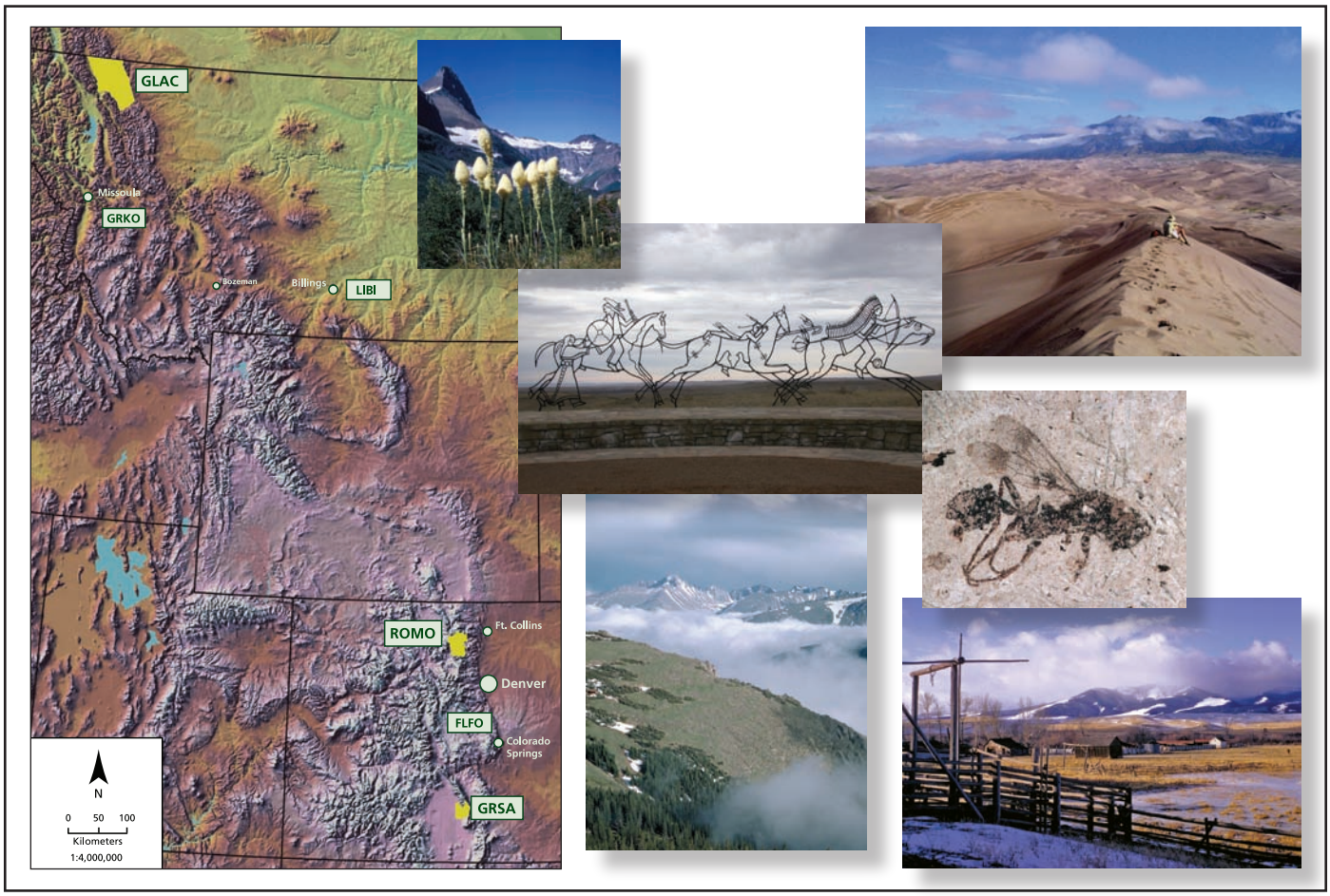
National Park Service
U.S. Department of the Interior

Natural Resource Program Center

Rocky Mountain Network
Data and Information Management Plan

September 20, 2007



ON THE COVER

Clockwise from top left: Beargrass (*Xerophyllum tenax*), with Mt. Grinnell in the background, Glacier National Park (National Park Service/J. Potter). Indian Memorial, Little Bighorn Battlefield National Monument (NPS). Sand dunes and hiker, Great Sand Dunes National Park and Preserve (NPS). Fossilized wasp, Florissant Fossil Beds National Monument (NPS). Grant-Kohrs Ranch National Historic Site (NPS). Rocky Mountain National Park (NPS).

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Data and Information Management Plan

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List of Standard Operating Procedures

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Data Management	Approving Information for Distribution
	Archive Format Standards
	Data Management Guidelines for Protocol Development
	Developing GPS Basemaps for Use in Garmin Units
	Digitizing Documents
	Directory Structure
	Documentation
	Establishing and Naming Sites and Markers
	Field Season Data Management
	File Naming Conventions
	Guidelines for Using and Updating NPSpecies
	Photograph Management
	Project Deliverables Specifications
	Project Manager Application
	Protecting Sensitive Resources While Conducting Fieldwork
	Quality Assurance and Control
	Requesting Park Research Permits
	Research Permitting and Reporting System Desktop Viewer
	Software Development
	Travel Time Cost Surface Model
	Using GPS-Photo Link to Georeference and Watermark Photographs
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Library	Using Procite to Manage Network References Locally
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Executive Summary

This Plan describes the process for generating, preserving, documenting, and transmitting the context that helps data become information and makes it valuable and interpretable. As such, this plan covers both data and information. This Plan applies to the Rocky Mountain Network (ROMN) which connects six park units: Glacier National Park (GLAC), Grant-Kohrs Ranch National Historic Site (GRKO), and Little Bighorn Battlefield National Monument (LIBI), Montana; and Florissant Fossil Beds National Monument (FLFO), Great Sand Dunes National Park and Preserve (GRSA), and Rocky Mountain National Park (ROMO), Colorado.

This Plan is organized into three levels (Figure ES.1). Level One is this Plan (this document), which contains the information management philosophy, regulations, guidelines, and general data management roles and responsibilities.

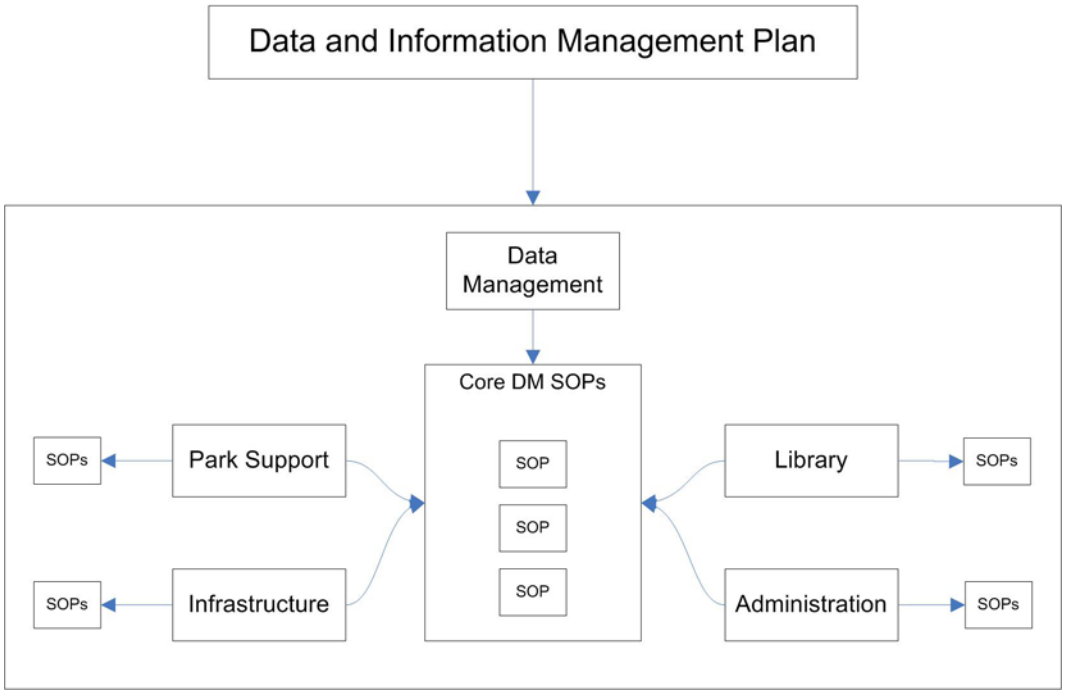


Figure ES.1. Hierarchy of Information Management Plan, Network Operations and Standard Operating Procedures

Level Two consists of the narratives describing the primary data-related operations within the Network:

- Data Management – Manages the Network's official and/or certified datasets and develops and maintains this Information Management Plan and the associated documents and standard operating procedures;

- Library – Oversees the digital and analog collection of documents used and/or generated by the Network;
- Park Support – Organizes the information related to other projects in support of park activities, including the natural resource inventories.
- Infrastructure – Manages the hardware, software, and local area network, and web pages that support the Network's activities including Intranet and Internet functionality; and
- Administration – Organizes the purchasing, travel, personnel management, and funding information.

Level Three is comprised of standard operating procedures (SOPs). They are detailed instructions for consistently accomplishing data- or information-related tasks.

The Plan and its related components are organized hierarchically and available via the Intranet as modules. This organization allows for the easy update of and access to sections, minimizes redundancy of content, avoids conflicting instructions, and accommodates both vision and detail in how information is managed.

The conceptual framework for managing data and information is described using four models. First, the Data Management Conceptual Model describes the seven steps for continually managing information:

- Acquire - Defines the scope of data and information to be acquired, generated and managed.
- Assure and Control for Quality – Develop procedures to prevent and check for errors;
- Document – Provide sufficient information about data (i.e., metadata) to ensure that others will understand how and why the data was created;
- Determine Sensitivity and Ownership/Responsibility – Determine who "owns" the data. That is, who has ultimate responsibility for maintaining and protecting sensitive and non-sensitive information and who is the legitimate source for access to the information;
- Archive – Securely store digital and hardcopy information;
- Catalog – Develop a working inventory of all information so it can be found by others;
- Analyze and Report– Provide the necessary information in the appropriate format to each defined audience.

These steps, which are not always in this exact order, are regularly guided by national and network regulations and policies.

The Project Life-Cycle Conceptual Model describes the general process for managing all projects:

- Initiate - Preliminary decisions regarding project scope and objectives.
- Plan - Details regarding data acquisition, processing, analysis and reporting.
- Execute - Implementation and/or fieldwork.
- Control - Modification of current practices.
- Close - Delivery of final products.

The Operation Life-Cycle model borrows its structure from the data management model and incorporates the project as the data-producing element to describe a system for continually and systematically processing, integrating and managing data. The network recognizes five distinct operations:

- Data Management – Management of network's official data;
- Library – Management of network's official documents;
- Park Support – network support of park activities;
- Infrastructure – Oversight of hardware, software and the local area network;
- Administration – Management of purchasing and payroll information.

Finally, the Enterprise Model of Data Integration describes how the network interfaces with other WASO data systems to serve multiple audiences requiring different format and various levels of synthesis.

This Plan and its related materials are continually changing through a process of analysis, evaluation, and updating to ensure the long-term success of data management within the network and its monitoring efforts for its member parks, the park service, and society as a whole.

1. Introduction

1.1. Purpose

Reliable data and information are essential to managing the national parks, and collecting natural resource information is the first step toward understanding national-park ecosystems. When collected using rigorous methods, maintained through sound management practices, and transmitted to park managers in a useable format, that information can also form the basis for sound management decisions.

Preserving information requires the establishment and maintenance of reliable data and information management practices. Without planning, data are easily corrupted, misplaced, or misunderstood, and information can be quickly lost through staff turnover, lack of effective communication, and changes in hardware, software, and data archive formats. Any good set of facts, whether collected last week or 20 years ago, must also provide enough information about itself to ensure its preservation and meaningful use.

1.2. Scope

This plan is not limited to facts or data contained in the tables, fields, and values that make up a dataset. Its larger purpose is to describe the process for generating, preserving, documenting, and transmitting the context that helps data become information and makes it valuable and interpretable. As such, this plan covers both data—commonly defined as “facts or pieces of information” in scientific or academic literature—and information, defined variously as “1. knowledge communicated or received concerning a particular fact or circumstance” to “7. computer data at any stage of processing, as input, output, storage, or transmission” (Merriam-Webster 2006). In other words, this plan is not just concerned with the management of data and facts; it also intends to ensure that facts become information (e.g., interpretation of the data via analyses and reports). Therefore, it addresses pieces of information, the processing and preservation of those pieces, and the communication of knowledge derived from those pieces.

This plan applies to the Rocky Mountain Network (ROMN), one of 32 NPS networks nationwide, which connects six park units: Glacier National Park (GLAC), Grant-Kohrs Ranch National Historic Site (GRKO), and Little Bighorn Battlefield National Monument (LIBI), Montana; and Florissant Fossil Beds National Monument (FLFO), Great Sand Dunes National Park and Preserve (GRSA), and Rocky Mountain National Park (ROMO), Colorado. The core network staff is located in Fort Collins and Estes Park,

Colorado. While the Internet and other modern telecommunication technologies have greatly facilitated contact between the multiple entities of the network, direct personal communication remains critical in establishing common goals, locating and resolving misunderstandings, and setting priorities. Figure 1.1 shows the physical relationship of the network office and the six parks and displays the major airports, roads, and geographic barriers that affect geographic connectivity among the network entities.

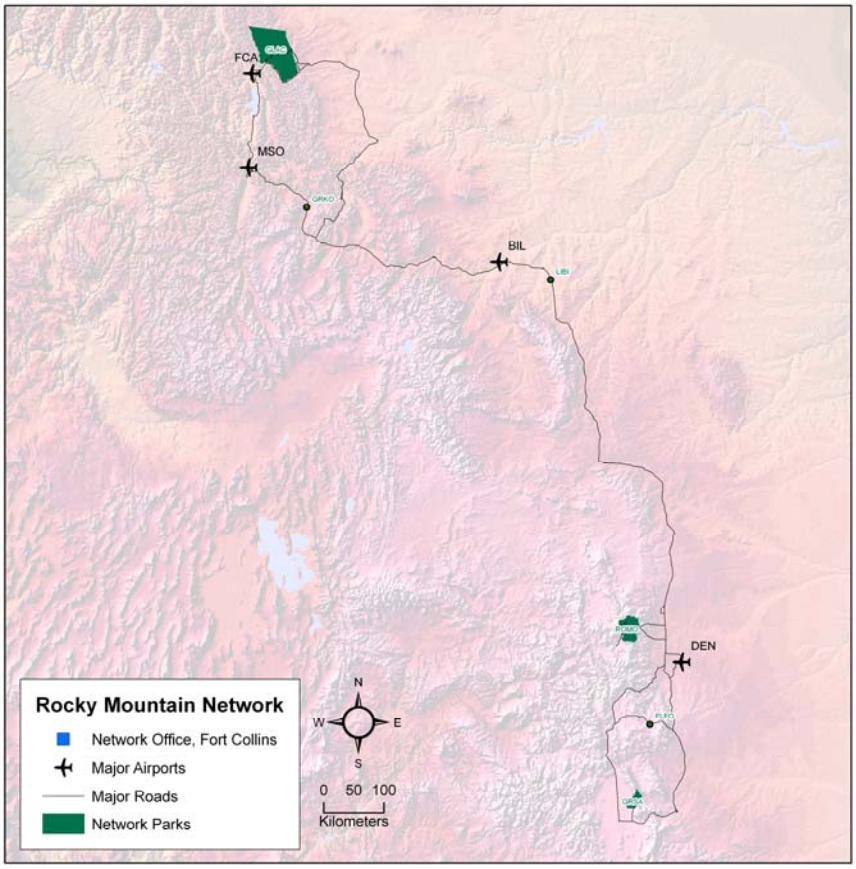


Figure 1.1. Location of Rocky Mountain Network Office Relative to Each of the Network Parks

The primary audience for this plan includes developers and users of network information. Developers include network staff, park professional staff, other NPS staff, and external collaborators. Users include network park managers and staff from all divisions, network staff, Intermountain Region managers and staff, Washington Area Service Office (WASO) managers and staff, and the public.

1.3. Goals and Objectives

The goals of our information management system are to ensure the quality, interpretability, security, longevity, and availability of ecological data and related information resulting from resource inventory and monitoring efforts.

Quality. The ROMN will take measures during all phases (project development, data acquisition, data handling, summary and analysis, reporting, and archiving) to guarantee the quality of the data. These measures will reflect current best practices and meet rigorous scientific standards.

Interpretability. A dataset is only useful if it can be readily understood and appropriately interpreted in the context of its original scope and intent. Data taken out of context can lead to misinterpretation, misunderstanding, and poor management decisions. Similarly, datasets that are obscure, complex, or poorly documented can be easily misused. Sufficient documentation (metadata) will accompany each dataset (and all reports and summaries derived from it) to ensure that users will have an informed appreciation of the dataset's applicability and limitations.

Security. The ROMN will maintain and archive datasets in an environment that provides appropriate levels of access. The network's data-management system will take advantage of existing systems for network security and systems backup, and augment these with specific measures aimed at ensuring the long-term security and integrity of the data.

Longevity. The longevity of a dataset is reliant on thorough documentation (metadata). Longevity is also realized through continued use, which requires that the data be maintained in an accessible and interpretable format.

Availability. Natural resource information can inform decisions only if it is available to managers at the right times and in appropriate forms. The ROMN will ensure that the products of inventory and monitoring efforts are created, documented, and maintained in a manner that is transparent to the potential users of these products.

The objectives that support these goals are as follows:

- To acquire and/or generate the data that the ROMN needs to achieve its goals;
- To compile that data into sets (information) and ensure its accuracy and logical consistency;
- To provide the documentation critical to maintaining the long-term interpretability of the acquired and compiled information;

- To determine the sensitivity level of the information;
- To properly archive the information;
- To properly catalogue the information and report it to the network parks and the public; and
- To provide information to the appropriate audiences in the correct format.

1.4. Organization

This plan and all of its related documents are organized hierarchically into three levels (Figure 1.2). Organizing the plan hierarchically and having it directly accessible to network staff via the web ensures that:

- The entire Data and Information Management Plan is broad in scope yet offers substantial detail to accomplish tasks consistently;
- Staff have direct, immediate access—from the office and on the road—to the documents they require, particularly the Standard Operating Procedures (SOPs);
- The plan, or any one of its components, can be updated as needed (those updates immediately affect the management of all network information);
- Updated schedules are accommodated by this plan, the operation narratives, and SOPs (while SOPs will regularly change, especially due to changes in hardware and software, the general framework for managing data will evolve more slowly); and
- If a printed copy is required, the very latest version is immediately and always available.

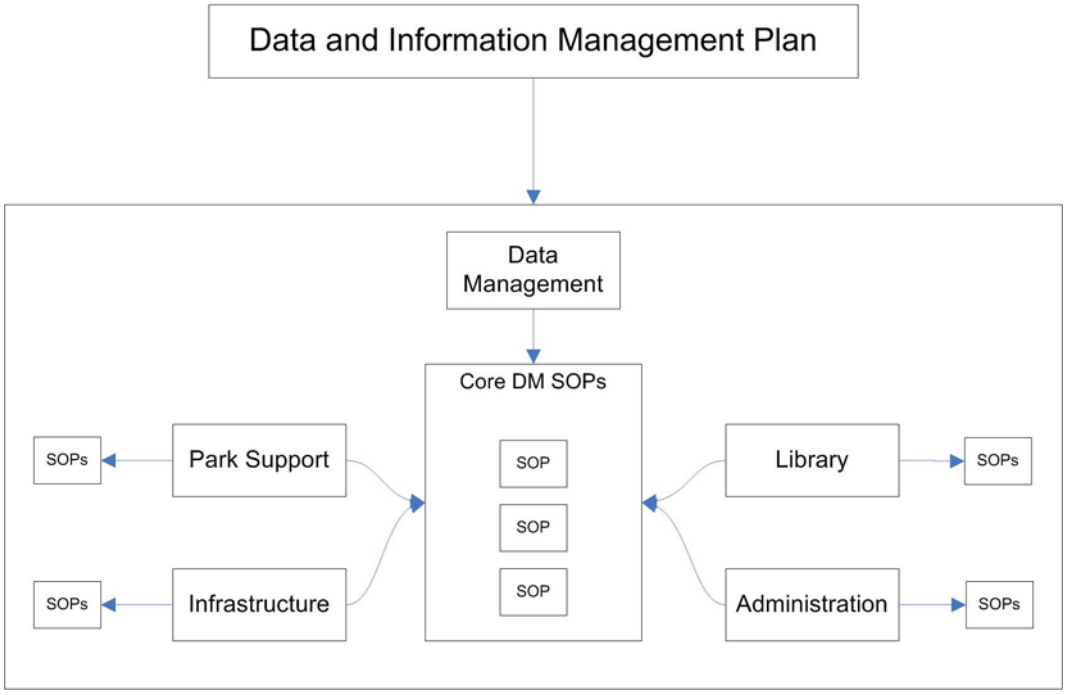


Figure 1.2. Hierarchy of Information Management Plan, Operations and SOPs

1.4.1. Level One

Level One is this plan, which contains the information management philosophy (models), regulations, guidelines, and general data-management roles and

responsibilities employed by the ROMN. This level is the most comprehensive, as it is applicable to all data-related actions within the network, but contains little detail regarding data management.

1.4.2. Level Two

Level Two consists of network operation narratives. Because the types of data and information, and the associated skills and personnel that manage that information, differ within the network, it is useful to divide the network into core operations relative to managing data and information (see Section 3). For instance, the software and skills used to manage payroll and travel information differ significantly from those used to manage grassland protocols and associated data. Each operation narrative describes the more specific and distinct data-related functions (i.e., unique software, hardware and process steps) performed by each operation. (The concept of an operation is further defined in Section 2, and Section 3 provides a brief description of the ROMN operations). The complete operation narratives are available at the network's Intranet site (NPS–ROMN 2007o).

1.4.3. Level Three

While operation narratives provide a framework for managing network information, specification of data-management steps is critical to ensuring that all tasks are performed consistently. Thus, the final level of organization is the standard operating procedures (SOPs) (Table 1.1). The SOPs describe the detailed steps necessary to accomplish a data- or information-related task. For example, an SOP may specify exactly how to digitize a document according to network specifications for resolution and color. SOPs can range in their level of detail, but will—when followed—produce consistent results. Finally, SOPs represent the implementation of the policies described in this plan, therefore enforcing these policies through action. All final SOPs are found at the network's Intranet site (NPS–ROMN 2007o).

Operation	Standard Operating Procedure
Data Management	Approving Information for Distribution
	Archive Format Standards
	Data Analysis
	Data Management Guidelines for Protocol Development
	Developing GPS Basemaps for Use in Garmin Units
	Digitizing Documents
	Directory Structure
	Documentation
	Establishing and Naming Sites and Markers
	Field Season Data Management
	File Naming Conventions
	Guidelines for Using and Updating NPSpecies
	Photograph Management
	Project Deliverables Specifications
	Project Manager Application
	Protecting Sensitive Resources While Conducting Fieldwork
	Quality Assurance and Control
	Requesting Park Research Permits
	Research Permitting and Reporting System Desktop Viewer
	Software Development
	Travel Time Cost Surface Model
	Using GPS-Photo Link to Georeference and Watermark Photographs
	Using the Garmin GPS 76csx
Library	Using Procite to Manage Network References Locally
Infrastructure	Backing Up the Network's Digital Information
	Rocky Mountain Network's Web Page
Administration	Obtaining Project Funding

Table 1.1. List of Current Operating Procedures Used by the Network

In some cases, SOPs are written for a particular network operation. For instance, an SOP for backing up the network's server is specific to the Infrastructure Operation; no other operations will refer to this SOP. In other cases, SOPs may apply to two or more operations. For instance, the SOP that defines digital file-naming conventions applies to all network operations. SOPs common to multiple operations are known as core SOPs, and are produced by the Data Management Operation (NPS–ROMN 2007e).

2. Conceptual Framework for Managing Data and Information

This chapter describes four models that represent the conceptual framework for managing all network information. The first model, a conceptual model for data management, describes the seven data-stewardship steps (Figure 2.1). Each step is integral to each phase of a project and operation. Beyond the network, Figure 2.1 provides a model for how information is ultimately integrated with other national systems.

2.1. Data Management Conceptual Model

Figure 3 shows a general model for data management. This model is a framework for regularly managing data at any point in time and with any task.

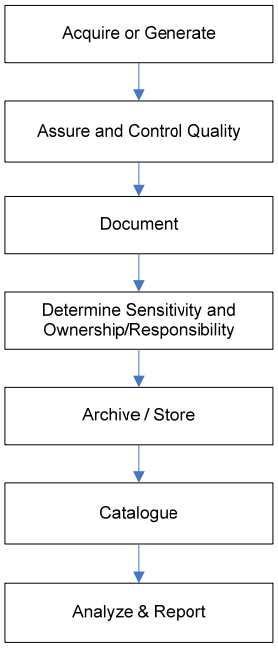


Figure 2.1. Data Life Cycle

These stewardship steps include:

Acquire and/or Generate. The scope of information to be acquired or created and maintained must be defined. Without a clear vision of scope, the network may be overloaded with unnecessary and/or irrelevant information or not collect critical information.

Assure and Control Quality. Quality assurance (QA) involves planning, monitoring, and evaluating the aspects of a project to ensure that standards of accuracy and

consistency are being met. Examples include limiting answers on a form to a pre-defined lookup list or designing field forms that are easy to read and help field crews to identify and record the observations that are needed. Quality control (QC) involves checking the data that has been collected for accuracy and completeness to minimize the risk of producing poor quality data. Examples include verifying that all temperatures were recorded in Celsius, that all field sheets are dated and properly completed, and that information entered into computerized forms matches the original field sheets. Data of inconsistent or poor quality can result in incorrect interpretations and conclusions.

Document. The careful documentation of datasets, the data source(s), and the methodology by which the data were collected or acquired is essential for preserving information over the long-term. Documentation also establishes the basis for the appropriate use of the data in resulting analysis and products. In many cases, documentation refers to metadata, which can be defined as information about the content, quality, condition, and other characteristics of data. However, documentation also applies to other types of information, including reports. For example, some final reports, particularly legacy reports, may have an incomplete title page, making it difficult to discern an author or year of publication. In this case, creation of a more complete title page would suffice for adequate documentation.

Determine Sensitivity and Ownership. While the free flow of information often benefits parks, there are cases in which information can be used to harm their natural resources or, in cases of distributing proprietary materials without permission, hurt the National Park Service. Sensitivity is defined according to whether the use of information by unauthorized individuals will threaten a park's natural and/or cultural resources, or legal obligations. Ownership can take on different meanings, depending on context. In some cases, ownership refers to proprietary or copyrighted information. In other cases, it elucidates whether the network or one of the parks is the ultimate authority over a dataset or information source. This includes not only the distinction between private and public information, but also whether the responsible party is the network, park or another entity.

Archive and Store. Archiving and storage refers to how information is physically organized. Where the information is physically housed depends on a number of factors, including its format, sensitivity, ownership, and content. Integral to properly housing the information are protections from disaster, malice, and degradation. Archiving and storage applies to hardcopy and digital information, drafts, and final versions. It should

be emphasized that archiving, in the context of this plan, is more generalized than the meaning associated with museum collections.

Catalog. Cataloging refers to how information—datasets, reports, maps, projects, ideas—is logically organized. Information may be stored and protected, but in the absence of a logical method for its discovery and retrieval, it may never be used. In some cases, cataloging may be directly connected to the documentation process (e.g., metadata), although cataloging may also be discrete.

Analyze and Report. Analysis involves the examination of information elements and their relations. Reporting involves the export of information, whether it is the analyzed product or original form.

It is important to note that these tasks are neither mandatory nor linear. During any type of data-management task, one or all could apply in any order. Nevertheless, there is a general logic to presenting these tasks in the order shown above.

2.2. Project Life-Cycle Conceptual Model

The data management model assists in building the foundation for a project, which is defined as a temporary endeavor undertaken to create a unique product (PMI 2004). Projects can be divided into five primary stages, each of which is characterized by some or all of the data-management components described above and implemented by staff involved in the project. Figure 2.2 outlines the conceptual model for the project life-cycle.

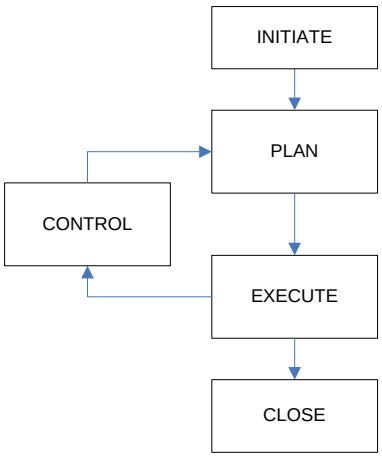


Figure 2.2. General Project Life Cycle

Initiate. This is when many of the preliminary decisions are made regarding project scope and objectives. In addition, funding sources, permits, and compliance are all addressed in this phase. Primary responsibility rests with project leaders and program administrators. Although this phase lacks specific data-management activities, it is important that data managers remain informed of projects at this phase. This is especially true as timelines for deliverables are finalized. All contracts, agreements, and permits should include standard language that describes the formats, specifications, and timelines for project deliverables.

Plan. During this phase, details are worked out regarding how data will be acquired, processed, analyzed, reported, and made available to others. The project leader is responsible for the development and testing of project methodology, or modifying existing methods to meet project objectives. It is critical that the project leader and the data manager work together throughout this phase. This dialogue will help to build and reinforce good data management throughout the project, especially during the crucial stages of data acquisition, processing, and retrieval. By beginning collaborative development as soon after project approval as possible, data integrity and quality can be assured most easily. An important part of this collaboration is the development of the data model (i.e., database structure) and data dictionary, where the specifics of database implementation and the parameters that will be collected are defined in detail. Devoting adequate attention to this aspect of the project is possibly the single most important part of assuring the quality, integrity and usability of the resulting data. Once the project methods, data design, and data dictionary have been developed and documented, a database can be constructed to meet project requirements.

Execute. During the project implementation phase, data are acquired, processed, error-checked and documented. This is also when products such as reports, maps, geospatial themes, and other products are developed and delivered. The project leader oversees all aspects of implementation, from logistics planning to data acquisition, report preparation, and final delivery. Throughout this phase, data-management staff functions primarily as facilitators, providing training and support for database applications, use of GIS and GPS software, and other data processing applications; facilitation of data summarization, validation, and analysis; and assistance with the technical aspects of documentation and product development.

Control. For short-term projects, change control will be built in to the project scope of work and will include SOPs for modifying project objectives, methodology, and products, as well as to document change. For long-term, multi-year projects, annual summary

reports will be produced to summarize results and document the work (including changes).

Close. Upon project closure, records are updated to reflect the status of the project and its associated deliverables in a network project-tracking application. For monitoring protocols, careful documentation of all changes is required. Changes to methods, SOPs, and other procedures are maintained in a tracking table associated with each document. Major revisions may require additional peer review. During this phase, data products, reports, and other deliverables are integrated into national and network databases, metadata records are finalized and posted in clearinghouses, and products are distributed or otherwise made available to their intended audience. Another aspect of integration is merging data from a working database to a master database maintained on the network server (e.g., NPS-ROMN 2007r). This occurs only after the annual working dataset has been certified for quality by the project leader. Certain projects may also have additional integration needs, such as when working jointly with other agencies for a common database.

Projects can vary in their length and complexity, which will affect the effort involved in managing data. Long-term projects will often require a higher level of documentation, peer review, and program support. From a data-management standpoint, a primary difference between short- and long-term projects is an increased need to control for change to ensure internal data compatibility over time.

Projects have particular relevance to the monitoring program because each field season of monitoring can be effectively treated as a project. Using the concepts of project management to coordinate field efforts will provide project managers with the tools and framework to ensure that a season's monitoring activities are well-organized and efficient in the generation of information.

2.3. Operation Life-Cycle

Following project close-out, data are managed under a broader framework: the operation, defined as ongoing and repetitive work with a primary objective of sustaining the business, or in this case, the network (PMI 2004).[†] Both the data management model (Figure 2.1) and project life-cycle model (Figure 2.2) inform how the data-management component of an operation can be conceptualized in the operation life-

[†] We chose to name these ongoing data management activities as "operations" instead of other terms (e.g., protocols, functions, tasks, programs) because the term is common to project management terminology, is not as easily confused with other definitions and uses within the NPS and the I&M program, but is still specific in meaning. Nevertheless, we recognize the limitations of this title.

cycle model (Figure 2.3). This model borrows its structure from the data management model and incorporates the project as the data-producing element. It describes a system for continually and systematically processing, integrating, and managing data during and following project termination. Just like the data life-cycle model, each step is neither mandatory nor linear; however, this model is generally applicable to all data-related operations defined by the network. This model also includes the infrastructure, or the physical medium—local area network, hardware and software—that makes the management of data and information possible.

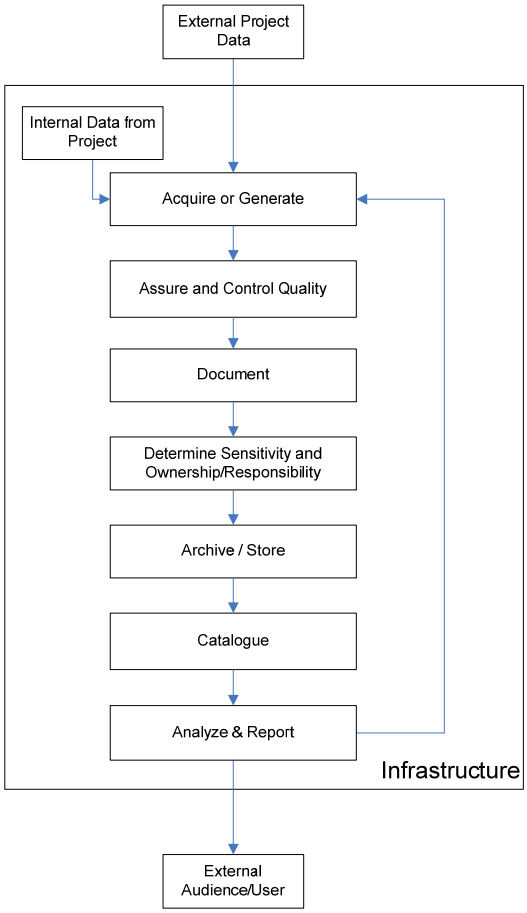


Figure 2.3. Operation Life-Cycle Model

The operation life-cycle model emphasizes a number of other key points beyond the integration of the data and project life-cycles. First, it shows that each operation is a self-contained system with distinct entry and exit points. This ensures that provisional data are not accidentally or inappropriately used by others; data are invisible to external users until they reach a defined process step. Additionally, it shows how reported data and information may feed back into the information system and ultimately require management. For instance, reports regarding the inventory of information are treated as another item to be inventoried. Monitoring reports must also relate back to the original

field information. Finally, the operation life-cycle model shows that information must be continually processed and managed for the network to function properly. Failure to incorporate any one of these steps, either individually or systematically, into an information management system, compromises both data and information over the long-term.

The operation concept has particular relevance to monitoring because each monitoring protocol, once implemented, should ultimately be treated as a unique operation. This model, therefore, provides a common framework for how all network protocols should function.

2.4. Integration of Network, Park and National Systems

Unfortunately, the current configuration of the WASO and regional systems creates some confusion in terms of ownership/responsibility and where official data and reports reside. The ROMN will make every effort to minimize replication of information, make all data available through one interface, and serve multiple audiences who require data in different formats and at various levels of synthesis. Figure 2.4 provides an enterprise-level model of how information generated within the network is ultimately shared with WASO, the parks, and other audiences. Because most of the information generated by the network will be from monitoring (and not other miscellaneous projects), the narrative is specific to monitoring data and information.

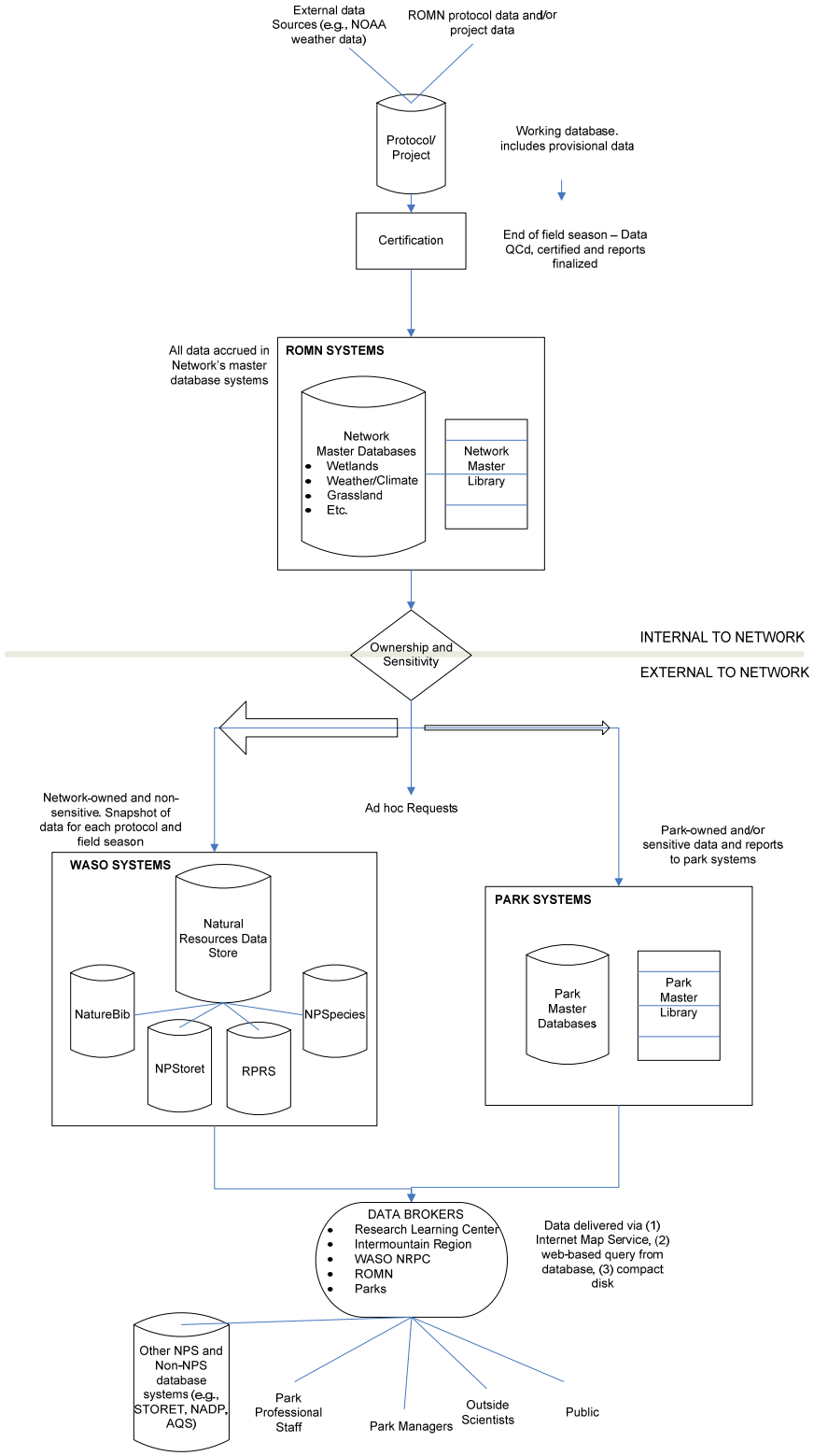


Figure 2.4. Enterprise-Level Integration of Network, Park and National Information Systems

Each field season of a monitoring protocol is treated as a project in which data are collected, managed, and tracked in a working database. During project close-out, or at

the end of the field season, the data are certified, or quality-controlled, and reports are created as a result of data analysis.

Annually, information is integrated into the larger operations. All certified data are integrated and accrued into the network's master vital signs datasets. At this point, the data are made available to the other network operations for integrative analysis.

External sharing of data depends on both ownership/responsibility and sensitivity. Non-sensitive data and reports owned by the network will be provided annually to the NPS national systems as a snapshot; data and the associated analyses will be delivered as a final product for that particular field season. Park-owned and/or sensitive data will be provided to the parks, whose managers have the ultimate responsibility to decide what action they will take regarding its distribution.

This data will be available to the parks and public through a number of avenues. Non-sensitive reports and datasets for a particular project or field season will be available through the NPS systems. These systems, in certain instances, will link to other federal database systems, including the Environmental Protection Agency's water quality database, STORET (EPA, 2006). Parks also have the option of serving their own data through their own web pages. Access to all of this information will also be facilitated by a number of data brokers, including the Research Learning Centers, which can provide context and meaningful links to the multiple systems which house data. The network will also honor all ad hoc requests for data.

3. Network Data Operations

This section describes the data operations integral to the support of the ROMN. The ROMN recognizes the following operations:

The **Data Management Operation** (NPS–ROMN 2007e) has two primary responsibilities. First, it is charged with the development, implementation, enforcement, and maintenance of this plan and its associated documents and standard operating procedures (see next section). It is also responsible for the management of the network's official and/or certified datasets. Official data includes general geospatial layers such as roads, trails, and park boundaries (which may come from other governmental or non-governmental agencies), as well as information and data derived from the other network operations (e.g., monitoring protocols). By providing an official and definitive data repository, it ensures that there is a single point for data requests and that consistency, quality, and accuracy are maintained among all network activities.

The **Library Operation** (NPS–ROMN 2007j) is responsible for maintaining the digital and analog collection of documents used and/or generated by the network. Documents are in final form and may include administrative records, reports, and scientific manuscripts or papers. This operation is similar to the Data Management Operation, in that it manages the master information for the network. However, because the processes and skills required for managing data and documents presently are so different, the two are split.

The **Park Support Operation** (NPS–ROMN 2007q) includes network support of park activities through the development and oversight of discrete projects. Many of the park-support projects are related to the mining of legacy information, resurrecting and documenting non-functional databases, and supporting the continuing natural resource inventories.

The **Infrastructure Operation** (NPS–ROMN 2007i) oversees the hardware, software, and local area network that support ROMN activities. This operation is also concerned with backing up the digital files found on the network's server. Finally, this operation is charged with the maintenance of the network's Internet and Intranet web pages and oversight of its Sharepoint space (when this becomes available).

The **Administrative Operation** (NPS–ROMN 2007a) includes the management of information related to purchasing, travel, personnel management, and funding sources.

As might be expected, the division among the operations is not entirely discrete. For instance, the Library and Data Management operations both are data and information repositories; the key differences are in how the information in the repository is formatted and used, and in the software catalog used to manage the repository. Nevertheless, classifying the network according to operations has helped to clarify systems for managing data and information that borrow from the data, project, and operation life-cycle models in Section 2. It has also enabled the ROMN to identify clear sets of processes that encapsulate the critical functionalities necessary for success.

The functions of the Library Operation serve to demonstrate how each operation implements the data management model (NPS–ROMN 2007j). Foremost, the library supports one of the fundamental needs of the network: access to final documents related to the network, its parks, or the National Park Service, as well as to natural resource information pertinent the network's vital signs.

In the Library Operation, information, including reports and books, are *acquired* if they fit in to the scope of the collection. The network may receive these reports from outside sources, including researchers, or from internal sources, including project funding by the NPS. Initially, network staff must determine the *quality* of the document and whether it is suitable for the library collection. Quality checking may include following established NPS procedures or just checking to ensure that the document is citable (e.g., author, year, title and publisher) and that none of the pages are missing. In cases where a suitable title page is missing or is vague, it may be necessary to add extra *documentation* to specify the title, author, or publication date. The network must in some way determine *sensitivity and ownership* of the document; this will determine whether the document is free for all to view or is located for privileged access only. Once *archived* either digitally or as a hard copy, the document must be *cataloged*, often through the use of such applications as NatureBib (NPS 2006e). Ultimately, the network will *report* on the collection, by distributing the document online or as a synthesized report such as a collections list. The operation's *infrastructure* is the medium (or context) within which information about the Library Operation flows, and includes the computer, hardware, software, local area network, file cabinets, and shelving.

4. Rocky Mountain Network Data Management Model

This section provides details about how the Rocky Mountain Network will implement the data management conceptual model (see Section 2.1).

4.1. Acquire and/or Generate

The purpose of this section is to define the scope of information the network will acquire and/or create. Both national and network policies affect the scope of collection. National policies are those that apply to all activities within the NPS, and may originate with the agency's director or other entities of the federal government, including Executive Orders. Network policies are those developed internally by the ROMN. A network policy should never conflict with a national policy and should be general enough to apply to all network operations.

4.1.1. National Guidance

National policies establish the scope of collection for all NPS activities, included those related to inventory and monitoring. Director's Order 19 (NPS 2001a) provides general guidance on the management of all NPS records; its Appendix B details what types of records should be maintained and for how long. Because administrative records are included in data and information that must be managed by this plan, the following sections of Appendix B (NPS 2001b), which specify which records are to be collected and managed, are particularly relevant:

- Natural resources records (Section N). Records and reports are considered permanent if they pertain to plant and animal life, the management of natural resources and their areas, research programs and partnerships, geologic features, pollution and environmental quality, weather and climate, pest and weed control, or soil.
- Fiscal records (Section F). Most fiscal records, including budgeting and payroll, are considered temporary and should be purged after three years.
- Personnel records (Section P). Records related to employees, including performance and work schedules are considered temporary and to be purged between two and three years.
- Property (Section S). Property and office supply records are temporary and should generally be removed after three years.

Another key policy is the Inventory & Monitoring Program Statement of Purpose (NPS 2006b). Appendix A of this document specifies the types of park-specific information to be acquired and managed, either directly or indirectly, by the networks:

- Legacy datasets and reports;
- Species information;
- Digital vegetation maps;

- Digital cartographic data;
- Digital soils maps;
- Digital geology maps;
- Water resources inventories;
- Water chemistry and flow information;
- Regional air quality monitoring stations, pollution sources, and data; and
- Precipitation and meteorological data.

4.1.2. Network Guidance

In addition to the national policies, the ROMN has defined its own set of policies applicable to all network operations. The guidelines that apply to information acquired from other sources state that the network will only acquire and manage information that:

- Directly or indirectly supports the defined vital signs and/or facilitates the inventorying of natural resources at or around the network parks;
- Either has basic documentation that identifies the meaning of the information, its source and quality (metadata), or those elements can be documented. The information source can be another document, individual, or agency, as long as it is possible to refer back to this source. Information may be unpublished or incomplete as long as its meaning is defined, its source is identified, and some measure of its quality (its reliability) can be assigned;
- Is one of the following information formats: book, report, gray literature, periodical, journal article, NPS reference material, dataset, or map; and
- Is not a voucher specimen collected at a network park, that is, the network will not house, manage, or curate specimens.

In summary, the network is unable to acquire and manage all types of information. Referring to national and network policies provides guidance as to the types of information, including content and format, on which the network will focus.

4.2. Quality Assurance and Control

Inaccurate, erroneous, or corrupt data or information can be worse than no information at all. Quality Assurance/Quality Control (QA/QC) mechanisms are designed to prevent error, which is the difference between an observed value, the recorded value, and the actual value. Inadequate QA/QC can result in three types of error. One type is commission, caused by data-entry or transcription errors, or malfunctioning equipment. These errors are common, generally identifiable, and can be effectively reduced with appropriate QA mechanisms built into the data-acquisition process, as well as QC procedures applied after the data have been acquired. Another type of error is omission, resulting from missing values or insufficient documentation of legitimate data values, which could affect the interpretation of those values. These errors can be resolved through QA procedures to identify missed values and QC procedures for documenting the steps of a data-collection process. Finally, errors of logical consistency refer to the

inconsistency of relationship among different features. Examples include trees that shrink through time, roads found on lakes, and other illogical measurements. These logical errors may result from inconsistencies in measurement and scale or differing definitions of the variables being measured. They can also be the result of errors of commission. Logical errors are the most difficult to detect because they are often context-sensitive and subtle. For instance, trees can shrink in size following a fire and roads can occasionally be found over lakes as bridges (and under lakes during unusually wet years!). Proper QC procedures will help identify measures that may be logically inconsistent.

4.2.1. National Guidance

National guidance related to information quality is found primarily in NPS Director's Order 11B (NPS 2002). This order specifies that data must be:

- Reliable. Information must be developed from reliable data sources and quality must be ensured at each stage of information development (NPS 2002);
- Accurate and timely. All information will be accurate, timely, and reflect the most current data available. All information sources will be documented (NPS 2002).

4.2.2. Network Guidance

In addition to the national guidance, the ROMN requires that data be:

- Verified to establish the truth, accuracy, or reality of data (e.g., data verification checks for errors of commission). Examples of this include development of database picklists that prevent transcription errors and cross-checking field forms with computer entries.
- Validated to check for errors of logical consistency. Validation is most easily accomplished by working with the protocols and projects to develop queries that test for illogical answers.
- Made decipherable so that it can be fully interpreted without ambiguity. This protects directly against errors of omission. Ensuring that data are easily interpreted and unambiguous is only possible if all supporting information (i.e., methods, codes, and data relationships) are clear and understandable.

Likewise, the network will assure and control quality through the implementation of the following SOPs:

- Standard file-naming conventions (NPS–ROMN 2007h): Provides consistent rules for how to name any digital file, accommodate data versions, and differentiate between draft and final;
- Standard directory structure (NPS–ROMN 2007f): Provides consistent rules for how the structure is to evolve through time;
- QA/QC Procedures (NPS–ROMN 2007k): Provides specific step-by-step guidance on how to effectively QA/QC network information.

4.3. Document

The careful documentation of datasets, the data source(s), and the methodology by which the data were collected or acquired is essential for preserving information over the long-term. Documentation also establishes the basis for the appropriate use of the data in resulting analysis and products.

4.3.1. National Guidance

Executive Order 12906 (EO 12906) mandates all federal agencies to:

- Fully document all new geospatial data collected or produced, either directly or indirectly, using Federal Geographic Data Committee standards (FGDC 2006);
- Document, to the best practical extent, all geospatial data previously collected. This policy applies to all legacy geospatial data.

The Federal Geographic Data Committee (FGDC 2006) provides guidance on a number of standards, including those specific to the information generated by the network:

- Content Standard for Digital Geospatial Metadata (CSDGM): The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. The standard establishes the names of data elements and compound elements (groups of data elements) to be used for these purposes, the definitions of these compound elements and data elements, and information about the values that are to be provided for the data elements.
- Federal Geographic Data Committee (FGDC) Biological Data Profile: The objective of the profile is to provide a common set of terminology and definitions for the documentation of biological data through the creation of extended elements and a profile of the FGDC Content Standard for Digital Geospatial Metadata.

A final requirement, from the NPS GIS Committee (NPS 2006d), requires that all GIS data layers be described using FGDC standards (FGDC 2006) and the NPS Metadata Profile (NPS 2006c).

4.3.2. Network Guidance

In addition to the national policies, the network will:

- Ensure that all documents, including reports, news articles, and letters, in final form (i.e., not draft) will have a cover page that clearly indicates the author(s), year of publication, title, and publisher;
- Document all tabular datasets, regardless of whether they meet the FGDC standards (FGDC 2006) for geospatial datasets;
- When possible, bundle all datasets, reports, protocols, metadata, and any other supporting documents as one archive;
- Use XML as the common documentation format; and
- Build documentation into all stages of a project life-cycle model.

These national and network policies are implemented through the following SOPs:

- Documentation (NPS–ROMN 2007g): Specifies how to document datasets, documents, and photographs, and how to bundle them together to preserve context and the supporting documentation necessary for the interpretation of the datasets.
- Project Manager (NPS–ROMN 2007m): Provides the means to keep notes of a project. Theses notes may contribute to the documentation of a dataset.
- Archive Format Standards (NPS–ROMN 2007c): Provides basic guidance for creating archives intended for long-term storage and distribution of network data.

4.4. Determine Sensitivity and Ownership

Network staff will need to regularly evaluate information for conflicts related to sensitivity and ownership.

4.4.1. National Guidance

At the national level the following rules and regulations apply to, and must be included in, all agreements with outside parties for research, monitoring, or protocol development. In short, these guidelines ensure that all data acquired via public funding belongs to the people of the United States. U.S. Office of Management and Budget (OMB 1999) guidance, particularly sections 36 “Intangible Property” and 48 “Contract Provisions”, mandates that the NPS:

- Reserve a royalty-free, nonexclusive and irrevocable right to reproduce, publish, or otherwise use the work for Federal purposes, and to authorize others to do so (Section 36);
- Has the right to obtain, reproduce, publish or otherwise use the data first produced under an award; and authorize others to receive, reproduce, publish, or otherwise use such data for Federal purposes (Section 36);
- Shall request, and the recipient shall provide, within a reasonable time, the research data (Section 36); and
- Shall include contract provisions or conditions that allow for administrative, contractual, or legal remedies in instances in which a contractor violates or breaches the contract terms in relation to data ownership (Section 48).

The Freedom of Information Act (FOIA; US-DOI 2006) restricts general public accessibility to:

- Geological and geophysical information and data concerning wells;
- The nature and specific location of (a) endangered, threatened, rare, or commercially valuable species, (b) minerals or paleontological objects, or (c) objects of cultural patrimony;
- The nature and location of any archaeological resource for which the excavation or removal requires a permit or other permission; and
- The specific location of any significant caves.

FOIA also specifies that all non-sensitive information be fully accessible to the public.

4.4.2. Network Guidance

At the network level, there is an additional level of policy with regard to the ownership and sensitivity of data. Determining whether data falls under the purview (ownership) of the network or of one of the member parks is essential because it determines which organization has the responsibility to make this information available to the public and who will respond to questions concerning its source, meaning, accuracy, and implications. To preserve ownership, the network will ensure that:

- Copyrighted documents (e.g., publications resulting from research in parks) will not be posted or distributed unless written permission is provided by the copyright holder;
- Data generated in a park, by park staff, or via park-funded research projects remains the property of the park. Use of the information will be granted to the network in cases where it supports resource inventory and monitoring; however, public release of the information will be reserved to the park;
- Data acquired or generated by the network outside of the member parks is the property of the network. These data will be available to park staffs via internet, intranet, and/or other means;
- Information developed from analysis and summarization by network staff or cooperators is the property of the network;
- The network will not distribute anything it does not own unless its dissemination has been previously approved by its constituent parks, and any other information owner or copyright holder;
- All cooperative or interagency work will be conducted as part of a signed collaborative agreement. Every cooperative or interagency agreement or contract involving the network will cite OMB Circular A-110 (OMB 1999) under the Reports and Deliverables Section of all agreements and contracts; and
- Cooperative or interagency agreements or contracts must include a clearly defined list of deliverables and products. Details on formatting and media types that will be required for final submission must be included. Typical products include, but are not limited to, field notebooks, photographs (hardcopy and digital), specimens, raw data, and reports. All reports and deliverables will follow the current version, at the time of the agreement, of the network specifications for project deliverables (NPS–ROMN 2007n).

The issue of sensitivity will be interpreted according to which organization will be most damaged by the accidental dissemination of sensitive information. To maintain sensitive information, the network will ensure that:

- Decisions involving the sensitivity of data (i.e., threatened, endangered, rare, or commercially valuable park resources) remain the responsibility of the relevant park;
- Reports, maps, analytical documents, or datasets will not be released by the network to the general public without approval by the relevant park's assigned agent; and
- Information to be used in pending litigation will be treated as sensitive.

Sensitivity and ownership policies are implemented through the Approving Information for Distribution (NPS–ROMN 2007b) standard operating procedure, which provides

decision points for whether data are sensitive and/or copyrighted and whether it is suitable for public distribution or available to select individuals only.

4.5. Archive and Store

The network will develop a storage system to accommodate a large volume of information. In most cases, the information will be in digital format, but analog copies—especially of historic documents—are sometimes the primary source of information. Where information is secured also depends on whether it relates to sensitive species and/or locations.

4.5.1. National Guidance

The NPS differentiates between records and mission-critical records. Records are all documentary materials, including books, electronic data, maps, moving images, papers, photographs, and sound recordings, made or received by the National Park Service during the transaction of public business (NPS 2001a).

- Mission-critical records are those records that are most necessary for fulfillment of the NPS mission (NPS 2001a). Mission-critical records are permanent records that will eventually become archival records. They should receive the highest priority in records-management activities, and resources and should receive archival care as soon as is practical in the life of the record. Mission critical records include:
- All records of natural and cultural resources and their management that contain information that affects the future management of the resource,
- General management plans and other major planning documents that record basic management philosophies and policies, or that direct park management and activities for long periods of time,
- All land records regarding legal title, rights, and usage of NPS lands; and
- Any records that directly support the specific legislated mission of a park unit in addition to, or distinct from, the overall NPS mission.

In addition, national guidance directs the NPS to:

- Follow the Records Retention Schedule. All NPS records must be retained for the amount of time specified by the NPS Records Retention Schedule. The schedule for all types of documents is covered in Director's Order 19-B (NPS 2001b);
- Store all records in areas that have the lowest possible risk of damage (NPS 2001a); and
- Permanently maintain original copies of natural resources information, including records related to animal and plant life. Document copies are to be held for 30 years and then transferred to the National Archives (NPS 2001b Section N).

4.5.2. Network Guidance

Network data maintenance, storage, and archiving procedures aim to ensure that data and related documents and materials (digital and analog) are protected against loss,

environmental hazards, catastrophe, and human malice; and archived in a manner that expedites recovery. Implementation instructions for the archiving policies are found in the following SOPs:

- Directory Structure (NPS–ROMN 2007f): Ensures that files are consistently, logically organized and easily accessible by all network staff.
- Network Backup (NPS–ROMN 2007d): Outlines steps to ensure that all digital information found on the network server is protected from accidental and deliberate loss.
- Photo Management (NPS–ROMN 2007l): Details how photographs are to be managed.
- Archive Format Standards (NPS–ROMN 2007c): Describes the steps for bundling data, photographs, and documents together into one zipped archive.

4.6. Catalog

Although there is not a single master cataloging system for data discovery, the network will use such systems when appropriate, with the goal of simplifying the search process.

4.6.1. National Guidance

National guidance directs the NPS to:

- File in a manner that is coherent, organized, and not random, haphazard, or handled solely by individual employees (NPS 2001b);
- Use NatureBib (NPS 2006e) to track natural resource bibliographic citations;
- Use NPSpecies (NPS-2006g) to track the scientific information on the biodiversity of all organisms in all national park units;
- Use the NPS Data Store (NPS-2006f) to catalog metadata and associated geospatial data; and
- Use ANCS+ (NPS-2006a) to catalog museum collections

4.6.2. Network Guidance

The network will:

- Keep up-to-date records such that the data can be easily accessed and their heritage and quality easily learned;
- Use Project Manager (NPS–ROMN 2007m) to track all network projects and their related files; and
- Use the FGDC-compliant metadata in xml format to track all datasets.

Further implementation of the network's cataloging policies are found in the following SOPs:

- Standard file-naming conventions (NPS–ROMN 2007h): Provides consistent rules for how to name any digital file, accommodate data versions, and differentiate between draft and final; and

- Standard directory structure (NPS–ROMN 2007f): Provides consistent rules for how the structure is to evolve through time.

4.7. Analyze and Report

Some common purposes of ROMN analysis include:

- Determining patterns/trends in status and trend;
- Discovering explanatory mechanisms, characteristics and correlations among information;
- Providing context or scale for a particular pattern or trend;
- Recommending changes to information management; and
- Presenting information in a manner that is readily communicated.

4.7.1. National Guidance

National guidance directs the NPS to:

- Report all non-sensitive geospatial metadata to the National Geospatial Data Clearinghouse (US-Gov 1994);
- Report all water quality data collected to NPSTORET (NPS 2006h), the NPS equivalent to EPA's STORET, according to the guidelines from the NPS Water Resources Division.

4.7.2. Network Guidance

The Network will:

- Use sound scientific analyses that are defensible in peer review and court. These must be definitive and defensible to shortstop public misperceptions and prevent or curtail costly interruptions to the Agency's management investments;
- Use the internet and intranet as the main mechanisms for distributing information;
- Promptly provide all reports to park natural resource managers, the Network's Technical Committee (TC), and Board of Directors;
- Prepare reports that are understandable and useful to its primary audience: park resource managers, administrators, facilities management, and interpreters and public affairs officers;
- Use graphical methods when possible that promote the understanding and interpretation of the information;
- Only release datasets and reports that have been subjected to full QA/QC;
- Distribute information with appropriate documentation that accurately and clearly defines the information and establishes the data as a product of the NPS I&M program.
- As much as possible, use presentations, posters, brochures, and for communication.

These guidelines are implemented through:

- Archive Format Standards (NPS-ROMN 2007c) – Specifies how information is to be bundled for distribution
- Quality Assurance and Control (NPS-ROMN 2007k)– Ensures that all information is checked for quality and accuracy

- Documentation (NPS-ROMN 2007g) – Details how to adequately document datasets, photographs and documents that are intended for distribution.

5. Rocky Mountain Network Project Life-Cycle Model

This section details the network's vision for project management, given a lack of national standards and policies (see Section 2.2). This section is written for all projects, recognizing that they can range in level of complexity, network input, and time. When possible and practical, it follows the Project Management Institute standards and terminology for project management, as articulated in the Project Management Body of Knowledge, PMBOK (PMI 2004). The steps and critical elements will aid in creating projects that successfully accomplish their goals, are realistically scheduled and budgeted, and are relatively easy to manage. These steps and elements will always be considered, and should be adopted at every possible opportunity.

5.1. Initiate

Projects exist to fulfill a need, for example: to create a database to contain the data collected during grassland monitoring, to plan for a season's field operations, to make more efficient use of office space, or to develop general and specific safety protocols for field crews. These needs can be developed from several sources—internally (vital signs monitoring), requested via the park support operation, or from other sources (WASO). In all cases, it is important to clearly identify the primary beneficiaries from the proposed project.

A network lead will be assigned to work with the beneficiaries in developing the background for the project and a general scope of work and objectives. The network lead will serve as the ROMN's primary representative and point of contact. In most cases, this person will also serve as the project manager. The general scope of work constitutes a statement of what is intended to be accomplished, a general budget for the project, and a simple description of what deliverables it will have. This will result in a descriptive document, or "charter," accepted by the parties involved.

The final phase of the initiation step involves competing for funding. The details of the various funding sources are included in respective SOPs for Administrative Operation. However, in a broader sense, every allocation of network resources, including personnel time and travel, will be included in the calculation. The competition for resources and funding will involve establishing priorities and taking the resulting list of projects in order.

5.2. Plan

The network differentiates between minor and major projects. Projects that involve significant allocation of either staff time or money will be considered major projects. If a major project is funded, a team will be created involving park contacts (if the project involves the parks) and third-party contacts (if they are involved either as working crew or beneficiaries). This team is responsible for producing a detailed scope of work and objectives, including a clear, concise statement of what is to be accomplished, detailed budgets, and a complete list of deliverables. In addition, any contracts, agreements, research permits, or permissions required by the project should be completed and signed.

Many kinds of projects may reach this stage. Those that are repetitive will be covered in individual SOPs, such as the Software Development SOP (NPS–ROMN 2007p) or annual field work for each protocol (Field Season Data Handling; NPS–ROMN 2007r). However, most projects, major or minor, require documents and resources developed in the planning process to be available during the implementation phase. If other, minor projects (such as database development) are created that must be completed before implementation of a major project, sufficient time must be allocated.

In every case, a schedule for the project will be created. Minor projects will only require a simple timeline. Major projects will benefit from a work breakdown structure (WBS), PERT (Program Evaluation and Review Technique) charts or Critical Path Method (CPM) plotting. These control techniques greatly aid in keeping projects on time and on target. Useful examples of these tools are found in the PMBOK (PMI 2004).

5.3. Implement

Project execution and control make up the implementation step. Execution consists of carrying out the tasks defined in the planning phase. Control consists of feedback to the schedule to account for variances from expected accomplishment goals as well as errors and omissions in the planning phase (e.g., the field team needs three tapes instead of one or there is no place to record water temperature in the field form). It will be necessary for the project manager to assess the feedback from the execution phase and make any necessary modifications to ensure project completion. In cases where significant variances exist and modifications are required, it will be necessary to document these changes.

5.4. Close

The following items, when available, are required at project close:

- Final reports
- Datasets and metadata
- Other defined project deliverables

5.5. Organization

To accommodate the project life-cycle model and clearly distinguish finalized information from planning and field work, all information for a particular project will be organized in a manner that clearly represents the various project phases, thereby preserving the temporal element to the creation of information and preventing planning/preliminary information from being confused with the final version.

6. Roles and Responsibilities

Data management is a process characterized as much by attitudes and habits as by infrastructure, standards, and procedures. Although primary responsibility resides with the data managers, good data stewardship cannot be accomplished by data managers alone; it is truly a collaborative endeavor that involves many people with a broad range of tasks and responsibilities. As such, a valid data-management system must be developed and continually modified to meet the needs of everyone with a role in coordinating, generating, maintaining, and using natural resource information in its many forms. This is a diverse group made up of network and park staff and other cooperators (Table 6.1). A successful data-management system is maintained by reinforcing communication, awareness, and acceptance among everyone with responsibilities related to the origin, quality, disposition, and use of the data.

Organization	*Position*	*Data Stewardship Responsibilities*
ROMN	Data Manager	Ensure inventory and monitoring data are organized, useful, compliant, safe, and available; development data management policies and procedures
ROMN	Ecologist	Oversee and direct certain protocols, analyze data, report results
ROMN	Program Manager	Coordinate and oversee all network activities, ensure adequate data management resources are available for network activities, enforce data management policies, report monitoring results,
ROMN cooperator or temp. staff	Field Crew Member	Collect, record, and verify data
ROMN cooperator or temp. staff	Ecologist/Crew Leader	Train and supervise crews in field data collection, organize and QA/QC field data, prepare summary statistics and reports for each field season
ROMN cooperator or temp. staff	Geospatial Analyst	Process and manage data
ROMN cooperator or temp. staff or ecologist	Protocol or Project Leader	Oversees and directs project, including data management
ROMN or ROMN cooperator	Database Application Developer	Know and use database software and database applications
Park	Natural Resource Managers and Specialists/Ecologists/Biologists/Hydrologists	Inform the scope and direction of science information needs and activities. Validate and make decisions about data. Integrate science in park and network activities.
Park	GIS Coordinator (or is this the geospatial analyst?)	Support park management objectives with GIS and resource information management
Park	Curator	Oversee all aspects of specimen acquisition, documentation, and preservation, and manage the park collections

Park	Park Research Coordinator	Facilitate data acquisition by external researchers. Communicate NPS requirements to permit holders.
Park	End Users (Superintendents, Resource Managers, Interpreters, Rangers, Facility Managers, etc.)	Inform the scope and direction of science information needs and activities. Interpret information and apply to decisions.
WASO	I&M Data Manager (National level)	Provide Service-wide database availability and support
WASO cooperator	NRPC Information Technology Specialist	Provide IT support for hardware, software, networking
Other agencies and academia	Scientists	Inform the scope and direction of science information needs and activities. Interpret results.
ROMN Tech. Comm.	Natural Resource Managers and Research Coordinators	Inform the scope and direction of science information needs and activities. Interpret results.
ROMN Board of Directors	Park Superintendents and Managers	Inform the scope and direction of science information needs and activities.
ROMN Science Panel	Scientists	Inform the scope and direction of science information needs and activities (during VS planning) in the context of current scientific research and knowledge of park ecosystems.

Table 6.1. Common Data Management Responsibilities by Position.

Although numerous positions share responsibility for data management, the chief personnel involved with data management include the network coordinator, project manager, and data manager. The network coordinator interacts with project leaders to ensure that timelines for data entry, validation, verification, summarization/analysis, and reporting are met. The project manager is responsible for the complete oversight of his/her respective project, including being involved in each step of the project and communicating with the data manager regarding network standards. The data manager is responsible for the development, maintenance, and enforcement of all data-management policies and procedures within the network, which requires being up-to-date with national policies and also understanding what is reasonable for network staff to follow. The data manager is also responsible for assisting and guiding the project manager during all stages of a project, from planning and database design to organizing and managing the project information, to reporting. Finally, the data manager is responsible for working with the network coordinator to ensure that adequate resources are made available for the management of all project- and network-level data.

7. Conclusion

The purpose of the ROMN Data and Information Management Plan is threefold. First, it provides a general framework and vision, articulated by the models described in Section 2. The plan further describes each of the data management model steps and any associated national and/or network policies. Finally, the plan provides a hierarchical structure that accommodates both vision and detail. The plan is general, theoretical and visionary, while each operation and its respective SOPs are practical and detailed.

7.1. Implementation

Because this plan reflects and formalizes the information management processes that have evolved in the network since its inception, implementation will be immediate. However, it will occur as an ongoing evolution as a product of learning, testing, refining, and technology changes. This plan is seen as a living, changing, tool to aid in preserving and protecting the information required for successful long-term monitoring of the network's constituent parks. Therefore, more SOPs, representing specific, data-related tasks, will be developed, tested, and adopted to reflect this evolution. We anticipate that there will be bottlenecks, the identification and elimination of which is an important element in the implementation of this plan.

Short-term (years 1–3) goals for implementation include:

- Ensuring that all network staff understand the core plan and operations,
- Empowering network staff to provide feedback, and
- Developing working SOPs that reflect the policies established in this plan.

Long-term (years 3+) goals for implementation include:

- Streamlining and standardizing the plan and SOPs within the network,
- Sharing SOPs and concepts among other networks, and
- Adapting the plan and SOPs to changing technologies and accepted practices.

7.2. Review and Revision

To determine whether these procedures are followed through time, the plan, operations, and SOPs have a periodic evaluation cycle. This plan, which describes the conceptual models, operations, and policies, will be slowest to change and, therefore, will require the least-frequent review. In contrast, SOPs, which are detailed and written to specific hardware, software, and data formats, will require frequent review and revision. How often the documents describing the network operations are modified falls somewhere in between.

During these evaluations, staff will review the documents for two qualities: adherence to the procedures and overall success of managing the information. Figure 7.1 provides a continuum of possible scenarios and actions following the review, in which the X-axis reflects how closely staff followed the policies and procedures and the Y-axis indicates the ultimate success of managing the information.

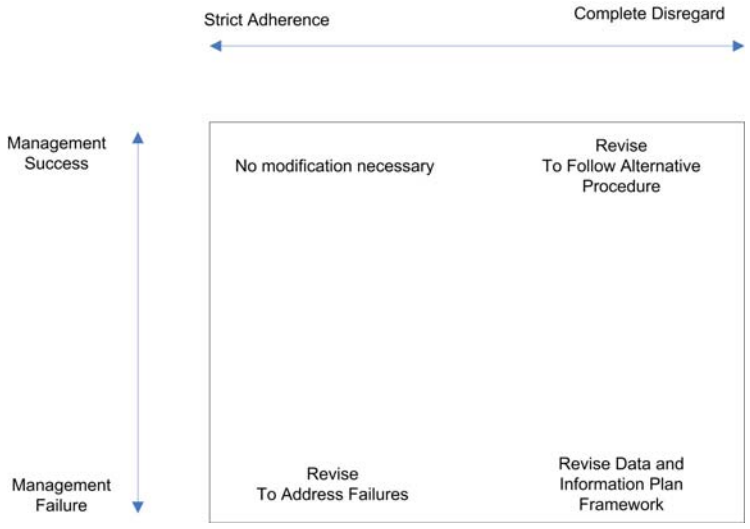


Figure 7.1. Continuum of Possible Outcomes to the Implementation of the Data and Information Management Plan, Operations, and SOPs

Because all of the network documents will be regularly updated, it will be essential to account for changes via versioning. Every document will contain a version number. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in process and/or changes affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7) when there are changes to grammar, spelling, or formatting, or minor changes in process that do not affect the interpretation of the data. In addition, each document will contain a modification date and "change log" table which tracks the following:

- Original Version Number: Indicates which version was modified;
- Date of Revision: The date the new revision is approved by network staff;
- Revised By: Primary author/contact;
- Changes: Description of changes, including how it will affect the interpretation of data;
- Justification: Why the change was necessary; and
- New Version #: Indicates the new version number (this ensures that there are not any gaps in notation between versions).

The change log for this document is found in Section 10.

7.3. Relationship with the Monitoring Plan

On a final note, this plan is intended to be a stand-alone document in support of the network, the monitoring plan, and each monitoring protocol the network produces. Chapter 6 of the network monitoring plan is a brief synopsis of data and information management. Each monitoring protocol will also include a data-management section detailing how to protect and preserve the pieces of information that are collected. As much as possible, these sections will reference the core data-management SOPs.

8. Definitions

- **Books** – Any bound publication with a designated library of congress number;
- **Data** –The original information collected from the field. When used with a plural verb indicates individual facts, statistics, or items of information. If used with a singular verb it means a collection of facts or particulars, information. Usage:

  > "Data are a plural of datum, originally a Latin noun meaning 'a thing given'. Today, Data are used in English both as a plural noun meaning 'facts or pieces of information' (*These data are described on page 8.*) and as a singular noun meaning 'information'." "It is almost always treated as a plural in scientific or academic writing, as a singular or plural elsewhere depending on the context." (Random House Webster's College Dictionary, 2nd Edition, 1997)

- **Decipher** - to make out the meaning of despite indistinctness or obscurity **b :** to interpret the meaning of
- **Error** - the difference between an observed or calculated value and a true value; specifically : variation in measurements, calculations, or observations of a quantity due to mistakes or to uncontrollable factors b : the amount of deviation from a standard or specification (Merriam Webster, 2006)
- **GIS Data** – Spatial and tabular information that is of a format that can be read and projected directly onto a digital map. Formats include, but are not necessarily limited to shapefiles, coverages, relational database tables, geodatabase feature classes and tables, tab-delimited text files, grids, geo-tifs, MrSid, and Imagine images.
- **Information** –

  > "1. knowledge communicated or received concerning a particular fact or circumstance." "7. computer data at any stage of processing, as input, output, storage, or transmission." (Random House Webster's College Dictionary, 2nd Edition, 1997)

- **Information Technology** – the infrastructure needed to move large quantities of digitized information in an efficient and secure manner from one place or person to another
- **Operation** – A system of related procedures that function to support the fundamental needs of the Network. An operation is implemented through a protocol or other document giving a general description of its elements and functions, linked to standard operating procedures (SOPs).
- **Protocol** –

  > "6. a plan for carrying out a scientific study or patient's treatment." "7. a set of rules governing the format of messages that are exchanged between computers." (Random House Webster's College Dictionary, 2nd Edition, 1997)

- **Quality** - degree of excellence; superiority in kind (Merriam Webster, 2006)
- **Quality Assurance** - a program for the systematic monitoring and evaluation of the various aspects of a project, service, or facility to ensure that standards of quality are being met (Merriam-Webster, 2006), generally used to refer to methods of ensuring quality during data generation and acquisition.
- **Quality Control** - an aggregate of activities (as design analysis and inspection for defects) designed to ensure adequate quality especially in manufactured products (Merriam-Webster, 2006), generally used to refer to checking acquired data for accuracy and completeness.
- **Reliable** - giving the same result on successive trials

- **Standard Operating Procedure (SOP)** – Detailed step-by-step methodology to accomplish a specific data management task.
- **Reports & Gray Literature** – Documents that summarize research or are completed to fulfill legal or procedural requirements (e.g., NEPA or planning documents);
- **Periodicals** – Published with a fixed interval between the issues that frequently have an editor and a series of reports/articles from separate authors. Falling under this category are NPS bulletins;
- **Journal Articles** – Peer-reviewed articles that are distributed through periodicals;
- **NPS Reference Materials** – Publications created by the NPS for general reference
- **Validate** - to support or corroborate on a sound or authoritative basis
- **Verify** - to establish the truth, accuracy, or reality of (Merriam Webster, 2006)

9. References

EPA (2006). STORET, environmental Protection Agency [http://www.epa.gov/STORET/], November 2006.

FGDC (2006). Standards Publications, Federal Geographic Data Committee [http://www.fgdc.gov/standards/standards_publications/index_html], November 2006.

Merriam-Webster (2006). Webster's Collegiate Dictionary, [http://www.m-w.com/], November 2006.

NPS (2001a). Directors Order #19: Records Management, National Park Service [http://www.nps.gov/refdesk/DOrders/DOrder19.html], November 2006.

NPS (2001b). Director's Order #19-B, Records Disposition Schedule, National Park Service, [http://data2.itc.nps.gov/wapc/records/nps19app-b.pdf], November 2006.

NPS (2006a). Automated National Catalog System (ANCS+), National Park Service [http://www.cr.nps.gov/museum/publications/ancs.html], November 2006.

NPS (2006b). I&M Statement of Purpose, NPS-75, National Park Service [http://www.nature.nps.gov/nps75/nps75.pdf], November 2006.

NPS (2006c). Metadata Tools and Editor, National Park Service, [http://science.nature.nps.gov/nrgis/tools/editor.cfm], November 2006.

NPS (2006d). Natural Resource GIS Standards, National Park Service, [http://science.nature.nps.gov/nrgis/standards/standards.cfm] November 2006.

NPS (2006e). NatureBib, National Park Service [https://science1.nature.nps.gov/naturebib/nb/simple/clean], November 2006.

NPS (2006f). NPS Data Store, National Park Service [http://science.nature.nps.gov/nrdata/], November 2006.

NPS (2006g). NPSpecies, National Park Service, [https://science1.nature.nps.gov/npspecies/web/main/start], November 2006.

NPS (2006h). Vital Signs Water Quality Data Management and Archiving - NPSTORET, National Park Service, [http://www.nature.nps.gov/water/infoanddata/index.cfm], November 2006.

NPS-ROMN (2007a). Administrative Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_AdministrativeOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007b). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_ApprovingInformationForDistribution], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007c). Archive Format Standards for Network Data, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_ArchiveFormatStandards.pdf], Fort Collins, Colorado.

NPS-ROMN (2007d). Backing Up the Network's Digital Information, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_IFO_NetworkBackup.pdf], Fort Collins, Colorado.

NPS-ROMN (2007e). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DataManagementOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007f). Directory Structure, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_DirectoryStructure.pdf], Fort Collins, Colorado.

NPS-ROMN (2007g). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_Documentation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007h). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_FileNamingConventionsSOP.pdf], Fort Collins, Colorado.

NPS-ROMN (2007i). Infrastructure Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_InfrastructureOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2006j). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_LibraryOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007k). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ ROMN_DMO_QAQC.pdf], Fort Collins, Colorado.

NPS-ROMN (2007l). Photograph Management, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DMO_PhotoManagement.pdf], Fort Collins, Colorado.

NPS-ROMN (2007m). Project Manager Application, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_PrjectManagerApplication.pdf], Fort Collins, Colorado.

NPS-ROMN (2007n). Project Deliverable Specifications, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_ProjectDeliverableSpecs.pdf], Fort Collins, Colorado.

NPS-ROMN (2007o). Rocky Mountain Network Intranet, National Park Service, [http://www1.nature.nps.gov/im/units/romn/index.cfm], November 2006.

NPS-ROMN (2007p). Software Development, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_SoftwareDevelopment.pdf], Fort Collins, Colorado.

NPS-ROMN (2007q). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_ParkSupportOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007r). Field Season Data Handling, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

OMB (1999). Uniform Administrative Requirements for Grants and Agreements With Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations, Circular A-110, Section 36-Intangible Property [http://www.whitehouse.gov/omb/circulars/a110/a110.html], November 2006.

PMI (2004). A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Third Edition, Project Management Institute, 388pp.

US-DOI (2006) Freedom of Information Act Program, US Department of the Interior [http://www.doi.gov/foia/], November 2006.

US-Gov (1994). Executive Order 12906-Coordinating Geography Data Acquisition and Access: The National Data Infrastructure, The White House [http://govinfo.library.unt.edu/npr/library/direct/orders/20fa.html]

10. Change History

Table 10.1 provides the ability to document change to the Plan. All documents, including those related to operations and specific SOPs, will contain this table.

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 10.1. Change History for the Network Information Management Plan

Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Data Management Operation (DMO)

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This narrative describes the procedures for managing the Network's core geospatial and tabular datasets.
Suggested Citation: NPS-ROMN (2007). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes the Data Management Operation (DMO), one of the five core operations of the network, as defined in the Data and Information Management Plan (DIMP; NPS-ROMN 2007b). This operation is guided by and conforms to the general data management framework, policies, and guidelines described by the DIMP, which apply generally to all other network operations. This operation has two primary and distinct functions. One is the development, maintenance and enforcement of the information management plan and its associated standard operating procedures (SOPs). Especially those common to at least two other Network operations, (Core SOPs), examples include:

- Directory structure (NPS-ROMN 2007d) defines functional requirements for the evolution of the network's directory structure and prescribes the root folders.
- File naming conventions (NPS-ROMN 2007f) details a process for naming any digital file, whether it is a dataset, report, or other, the network is managing on the server.
- Scanning and digitizing guidelines (NPS-ROMN 2007c) outlines the steps involved to digitize analog information using a photocopier or scanner.
- Quality assurance and control (NPS-ROMN 2007i) documents best practices for assuring good quality information.

A complete and up-to-date list of all SOPs is found at the Network Data and Information Management Plan and associated web page (NPS-ROMN 2007b).

The second function of this operation is the management of the "official network information", or core information. Core information includes official, documented, and finalized copies of all park-, Network-, state- and national-level datasets. Formats include GIS layers such as shapefiles, coverages, remotely sensed imagery, geodatabases, tabular data (e.g., relational datasets), digital and physical photography, and recordings. This operation does not manage reports and other synthesized products – those are maintained by the Library Operation (NPS-ROMN 2007g). Information not maintained by this operation or the Library Operation is considered to be provisional, a work-in-progress, unfinished, or unofficial.

2. The Plan and SOP Maintenance

All drafts and working documents related to the Plan and the SOPs are found in the Z:\DATAMAN\ folder (Figure 1). Subfolders for the respective operations and their

SOPs can be found in this location, versioned by date. PDFs of the most current completed versions are found on the Network's intranet web site.

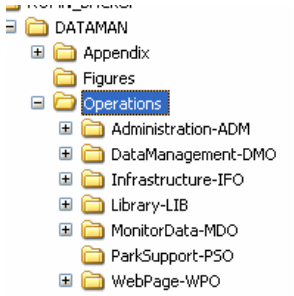


Figure 1. Organization of the Data and Information Management Plan Documents

3. Data Management

The remainder of this document is concerned with the maintenance of the Network's core datasets. Figure 2 provides a conceptual model of how information is managed. This model approximates the operation conceptual model articulated in chapter 2 of the Data and Information Management Plan (NPS-ROMN 2007b). The following sections provide more detailed descriptions for each of these steps.

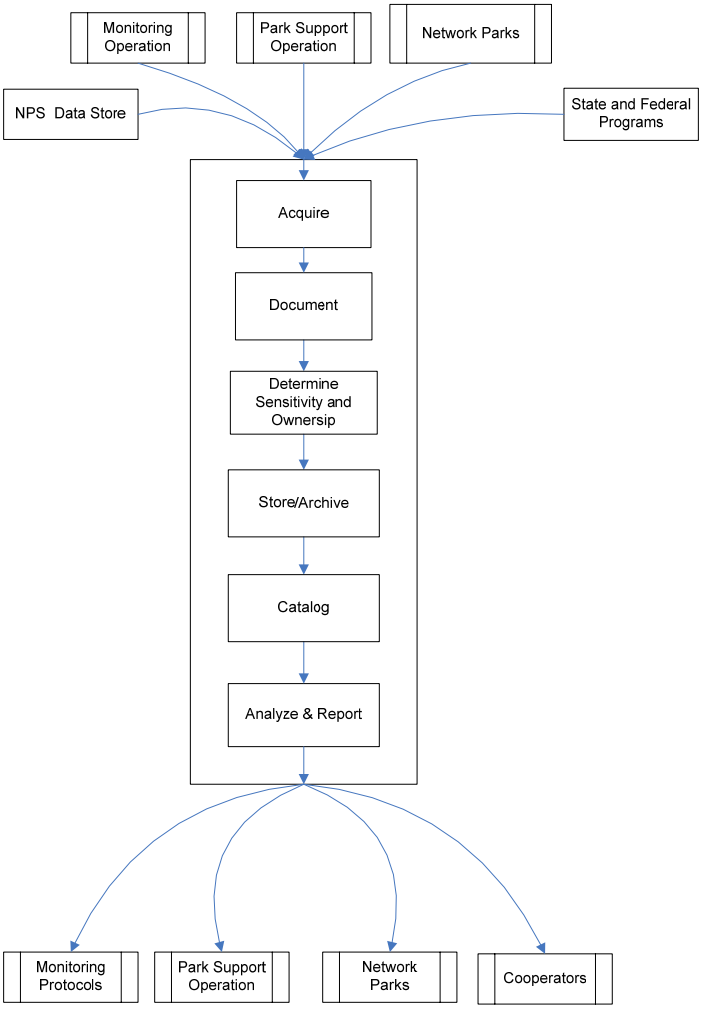


Figure 2. Conceptual Model of the Data Management Operation

3.1. Acquire

The acquisition step determines the scope of collection for this Operation. Information falls within the scope of this Operation, if it meets the following criteria:

- Relevant to Network Operations, the Network Vital Signs, or has been created or augmented by the Network.
- Original and not a by-product of existing data
- Up-to-date (i.e., not an older version of a dataset)
- Regularly used by at least one Network Operation
- Documented and of a known format, resolution, accuracy, and source.

Most often, information will come from one of the following sources:

- **NPS GIS Data Store** (NPS 2006a) – The Network will maintain local copies of relevant datasets on the NPS GIS Data Store. Synchronization will occur annually.
- **Monitoring Protocols** – Each of the network's monitoring protocols will update the "official" network database with certified data following the end of the field season. The precise date(s) for delivery are defined in each protocol.
- **Park Support Operation** (NPS-ROMN 2006h) – Data deliverables provided from short-term projects, including those related to natural resource inventories and the mining and cleanup of legacy data.
- **Network Parks** – The Network will occasionally receive information from the parks which was not posted on the GIS Data Store.
- **Miscellaneous State and Federal Agencies** – The Network will annually, update the following for the states of Colorado and Montana, unless otherwise noted:
  - National Hydrography Dataset (NHD 2006) for all HUC 8's that intersect park boundaries
  - NAIP imagery (NAIP 2006) or equivalent 1-m digital ortho-quadrangles for a 5-mile buffer of each park.
  - Digital Elevation Models (10 and 30 m; NED 2006) for all HUC 8's that intersect park boundaries
  - Official State Roads (MT-NRIS 2006; CDOT 2006)
  - Five-year census data (US-Census, 2006)
  - State and County Boundaries (National Atlas, 2006)
  - National Land Cover Dataset (NLCD 2006)
  - GAP Analysis (GAP 2006)
  - Governmental and private ownership boundaries for all counties that are within 5-miles of each park (MT-NRIS 2006; COMAP 2006)
  - Any free, non-proprietary and non-sensitive ortho-photography or satellite imagery that describes an area within the network parks.

Below are some of the recognized formats for datasets that will are appropriate for acquisition:

- Spatial Data – Formats native to ESRI software, including coverages and shapefiles, that represent points, lines and polygons
- Tabular Data – MS Access. Data stored in Excel Spreadsheets, Dbase tables, text files, or other non standard database formats will be converted on receipt.
- Raster Data – Image (*.img) is the preferred format. Also acceptable are ArcInfo Grids, geotiffs (*.tif), and MrSids (*.sid).
- Personal Geodatabase – An Access database that contains spatial and tabular, metadata and other miscellaneous information, including reports

Information within scope meets the basic criteria will be acquired and managed accordingly by this operation. The Data Manager is ultimately responsible for determining whether information falls within the scope of this Operation.

3.2. Confirm Documentation

All datasets generated by the network will meet the minimal requirement for documentation, as defined in the Documentation SOP (NPS-ROMN 2007e). All documentation will at least be in xml format and in other formats when appropriate.

Datasets from external sources - including WASO, the Intermountain Region, network parks, other state and federal agencies and researchers – should have minimum metadata, as defined in the Documentation SOP (NPS-ROMN 2007e). When they do not have sufficient metadata, the following decision points should help determine whether geospatial data is acceptable:

- Datasets are created and distributed by another government entity as official information
- The following minimum metadata fields are included:
  - Clear and standard projection and datum
  - Point of contact or author
  - Descriptive abstract
  - Title
  - How was it created
  - Date/time for which data is relevant
  - Date dataset was published
  - An indication of data accuracy (both spatial and attribute)

Additionally the following will be added for all information from external sources:

- A process step that indicates when the data was accepted in to the base-data collection, why it was added, and the person who accepted in the information
- Completion of the NPS metadata fields

3.3. Control for Quality

Even when data falls within the scope of this operation and is sufficiently documented, it may not necessarily meet the level of quality necessary for acceptance as core data. In general, the Quality Assurance and Control SOP (NPS-ROMN 2007i)covers useful techniques for controlling for quality. The following sections describe further steps for treating information from internal and external sources to the network.

3.3.1. Data from External Sources

It is generally impossible and often inappropriate for network staff to rigorously evaluate the quality of external data, particularly if the documentation ensures the data is of

sufficient quality. Nevertheless, the following simple checks will identify the most obvious errors:

- All geospatial datasets should have a projection that matches their documentation
- The data matches the documentation, particularly for dates (e.g., beginning and ending dates of data collection)
- The point of contact is still at the same location and can be reached
- In cases of relational databases, there is referential integrity among the core tables and all codes are described

3.3.2. Data Generated by the Network

Information generated by the Network includes that from using a GPS, on-screen digitization, analysis of existing datasets, or corresponding tabular information from hardcopy field sheets or electronic PDAs. All data development will follow the Network's Quality Assurance and Control (NPS-ROMN 2007i) guidelines.

In addition, for GPS data collection:

- Data will be collected in UTM NAD 83 Zone 12 or 13
- A GPS unit of sufficient accuracy and precision will be used to meet the information needs, as defined in the GPS Operation SOP (NPS-ROMN 2007i). All data will be differentially corrected.

For tabular data collection:

- Transcription errors (from hardcopy to digital) will be less than 5%. This will be confirmed by cross-checking at least 30 randomly-selected records

3.4. Determine Sensitivity and Ownership

In general, highly sensitive information is likely to remain within the possession of other Network operations. All data however, will be evaluated, flagged if sensitive, and documented according to the general guidelines established in Approving Information for Distribution SOP (NPS-ROMN 2007a).

3.5. Archive and Store

3.5.1. File Location

All non-sensitive geospatial data will be housed in the Z:/GEODATA/ folder. Folders are **read-only accessible to all Network staff**.

All data specific to a Park will be housed in the respective park folder. Information common to two or more parks will be found in the /ROMN folder/. Within each park, most information will fall into one of the following:

- \BOUNDARY\ - All boundary information,
- \DEM\ – Digital elevation models
- \FLORA\ – All vegetation-related information and land-cover classifications
- \FAUNA\ – All wildlife-related information
- \GEOL\ – All geologic information
- \HYDRO\ – All hydrologic information, including rivers, lakes, and water quantity and quality data
- \LANDCOVER\ - Raster and vector themes that represent natural and anthropogenic cover types. Sources will include GAP, NLCD, and vegetation maps
- \SOIL\ – All soil information
- \STRUCTURE\ – All structural information, including buildings
- \TRANS\ – All transportation-related information, including roads and trails
- \IMAGERY\ – All aerial orthophotography, digital ortho quadrangles, satellite imagery, and non-georeferenced photographs
- \UTIL\ – Utility-related information, including sewer and electrical
- \WETLAND\ - Wetland information, including the National Wetland Inventories

This directory structure is only approximate. Because many datasets do not fit cleanly into one of these categories, full prescription of a directory structure is counter-productive. Guidelines for developing the directory structure through time are found in the Directory Structure SOP (NPS-ROMN 2007d).

Note: To protect against information loss, the respective xml metadata record **will** be stored in the same folder and have the same name as the dataset.

3.5.2. Projections

The Network will prefer data in North American Datum 1983 (NAD83) as the standard datum (NPS ADP Standards Program, Sec V-1) and Universal Transverse Mercator (UTM) as the standard projection. Where appropriate, data will be converted and a process step will be recorded.

3.5.3. Data Aggregation and Versioning

This paragraph is an addendum to and explanation of the File Naming Convention SOP (NPS-ROMN 2007f); it is not a replacement. Information changes through time; having datasets that are up-to-date, complete, and not confused with older dataset versions, are important to maintaining a long-term record. When a dataset is complete and there are no plans for updates or modifications (as identified in the metadata record), the following naming convention will apply:

- DataSource_Title_DateOfIssue.xxx. This naming convention clearly shows when the final version of a database was completed. Because there will not be any further versions, a generic reference name – where the date of issue or version - is unnecessary.
- As much as possible, information will be aggregated into centralized datasets for the ease of management and updates through time. Datasets that are continually being updated will be named: DataSource_Title.xxx. To control for versioning, the following will be identified in the metadata record:
  - Citation Title – The version, identified by the date of issue, will trail the citation (e.g., GRKO Grassland Plot Data – August 26, 2006). The version date will be in Month DD, YYYY format.
  - Status – Status will be “In Progress”
  - Publication Date – The date will be identical to the date in the citation title but the format will be YYYYMMDD.

It is beyond the scope of the Network to be responsible for maintaining external datasets. Outdated versions of datasets will be discarded and replaced with the most recent version. At a minimum, external datasets will be evaluated every 5 years to determine whether the data are still valid or if a newer version exists.

3.5.4. Database Structure

All tabular datasets developed by the Network will be based on the NPS natural resource database template (NRDT) relational data structure (NPS 2007a).

When a database contains tabular and spatial data that must co-exist, the Network will use a geodatabase. Recommended specifications for the geodatabase model are found in the Geodatabase Specifications SOP [TBD].

External datasets, or those that contain legacy datasets, can reside in their native structure.

3.6. Catalogue

All geospatial datasets are cataloged using the NPS Metadata Catalog tool in ArcGIS. Use of this tool is found in NPS Metadata Catalog Toolset (NPS 2007a). This catalog includes read only metadata for all datasets, including those marked sensitive.

3.7. Report

Once a year the Network Data Manager will evaluate the data inventory to determine datasets that require acquisition, augmentation, or updating. Out-of-date datasets will be stored off line to CD and purged from the server.

The following utilize the information maintained by this Operation:

- **Other Network Operations** – All Operations rely on a common set of official park datasets, including administrative boundaries, aerial photographs, and digital raster graphics (DRGs). All network staff will have read-only access to all network data.
- **Cooperators** – Information will be provided upon request.
- **Network Parks** – Network information will be synchronized with each of the Network parks on an annual basis.

All reported information is subject to the provisions of the Approving Information for Distribution SOP (NPS 2007a).

4. Roles and Responsibilities

Role	Responsibility
Network Data Manager	• Has full responsibility for the oversight of this Operation. All decisions concerning policies, procedures, and responsibilities within this Operations must be approved by this position. Should this position be vacant, responsibility for this Operation falls to the acting Network Coordinator. • has the responsibility of maintaining the day-to-day tasks that maintain and support this Operation.
All network staff	• are responsible for following the policies and workflows established within this SOP.

Table 1. Roles and Responsibilities

5. References

CDOT (2006). Colorado Department of Transportation, Geographic Data [http://www.dot.state.co.us/], November, 2006.

COMAP (2006). Colorado Ownership Management and Protection, Natural Resource Ecology Lab (NREL), Colorado State University [http://www.nrel.colostate.edu/projects/comap/index.html], November, 2006.

GAP (2006). GAP Analysis Program, USGS [http://gapanalysis.nbii.gov/portal/server.pt], November, 2006.

National Atlas (2006). Map Layers, National Atlas [http://www.nationalatlas.gov/], November, 2006.

NAIP (2006). National Agricultural Inventory Program, Department of Agriculture [http://165.221.201.14/NAIP.html], November, 2006.

NED (2006). National Elevation Dataset, USGS, [http://ned.usgs.gov/], November, 2006.

NHD (2006). National Hydrography Dataset, USGS [http://nhd.usgs.gov/data.html], November, 2006.

NLCD (2006). National Land Cover Dataset, The USGS Land Cover Institute (LCI) [http://landcover.usgs.gov/natllandcover.php], November, 2006.

NPS (2006a). Metadata Tools and Editor, Version 1.1, National Park Service, [http://science.nature.nps.gov/nrdata/tools/], December 2006.

NPS (2006b). Natural Resource Database Template, National Park Service, [http://science.nature.nps.gov/im/apps/template/index.cfm], December, 2006.

NPS (2006c). NPS Data Store, National Park Service, [http://science.nature.nps.gov/nrdata/], December 2006.

NPS-ROMN (2007a). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_ApprovingInformationForDistribution], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007b). Data and Information Management Plan, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_IMP.pdf], Fort Collins, Colorado.

NPS-ROMN (2007c). Digitizing Documents, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_DigitizingDocuments.pdf], Fort Collins, Colorado.

NPS-ROMN (2007d). Directory Structure, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_DirectoryStructure.pdf], Fort Collins, Colorado.

NPS-ROMN (2007e). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_Documentation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007f). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service,

[http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_FileNamingConventionsSOP.pdf], Fort Collins, Colorado.

NPS-ROMN (2007g). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_LibraryOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007h). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_ParkSupportOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007i). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_QAQC.pdf], Fort Collins, Colorado.

NPS-ROMN (2007j). Using the Garmin GPS 76csx, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/DATAMAN/ROMN_DMO_UsingGarminGP76.pdf], Fort Collins, Colorado.

MT-NRIS (2006). Montana Natural Resources Information System, State of Montana [http://nris.state.mt.us/], November, 2006.

US-Census (2006). Census Data, US Census Bureau [http://www.census.gov/], November, 2006.

6. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Approving Information for Distribution

Data Management Operation
Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: September 4, 2007
Authors: David Pillmore, Mike Britten, Brent Frakes, Dan Manier
Abstract: This document describes the process for determining who owns the data, whether it is sensitive, and if it is proprietary. Based on these criteria, data is classified as one of three security levels which include “Public”, “Restricted-NPS Only” or “Sensitive.”
Suggested Citation: NPS-ROMN (2007). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This standard operating procedure outlines a strategy for approving data and information for release to the National Park Service, cooperators, and the public. This applies to all documents and datasets and their release in any form (via the web based internet or intranet, emailing electronic copies, providing printed materials, verbal descriptions, or any other form). Figure 1 provides the decision tree network staff will follow when evaluating information for ownership (both in terms of data stewardship obligation and when handling proprietary information) and sensitivity. Each of these steps and definitions are defined in section 2 of this document.

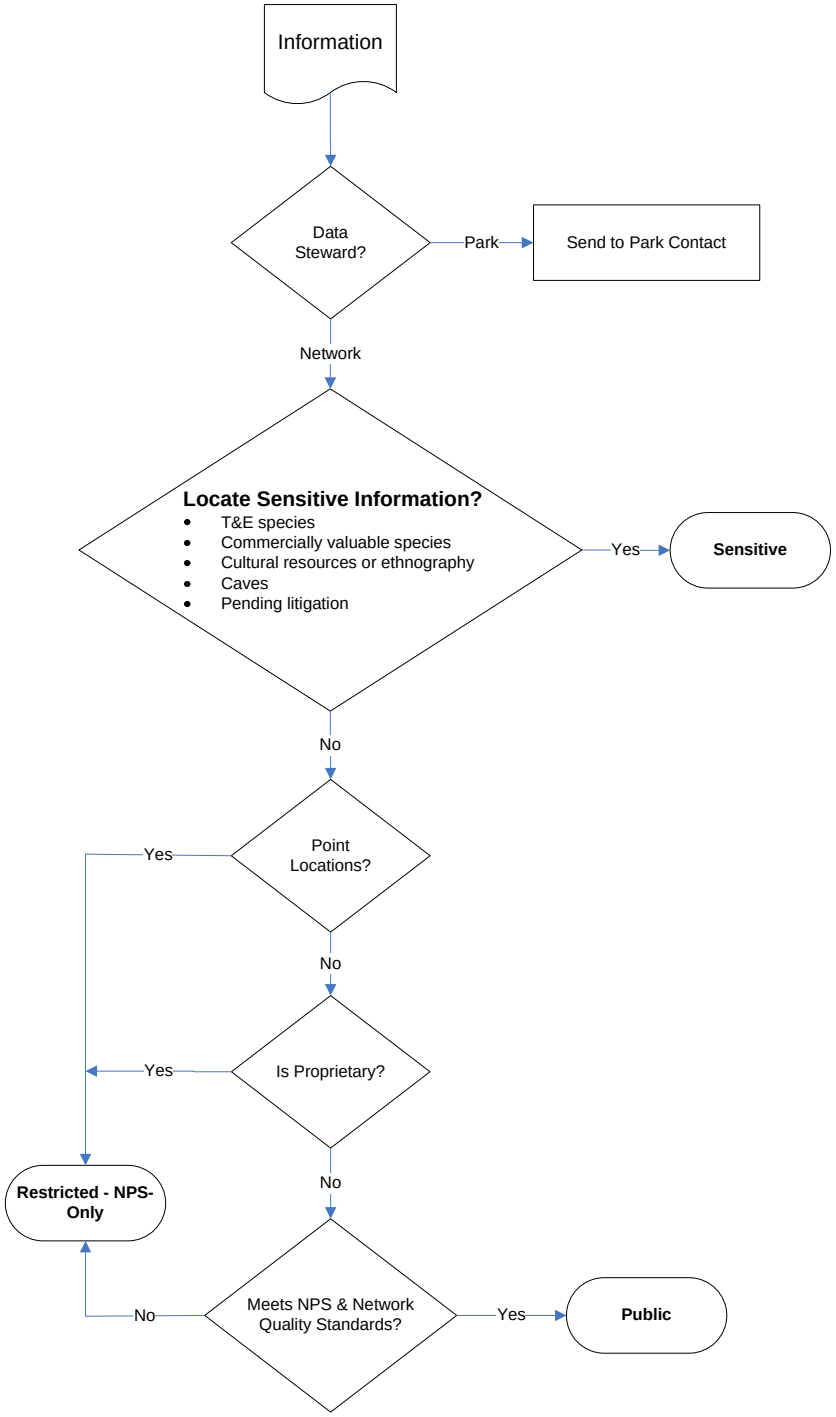


Figure 1. Data Release Approval Process

2. Procedural Descriptions

All data and associated information from I&M activities will regularly be assessed for sensitivity and ownership prior to, during, and following field work, as specified by the field protocols and/or data management guidelines (e.g., NPS-ROMN 2007b). Information types subject to review include, but are not limited to, reports, raw and

manipulated data, and maps. The network lead is responsible for communicating all potentially sensitive resources to principal investigators and clarifying park and network policies related to the handling of such information. If data, reports or analyses must contain sensitive material, then the network lead will develop procedures to identify and appropriately process all potentially sensitive resources in any products that come from the project.

2.1. Point-of-Contacts and Classifications

For each project or protocol, the network will identify the network lead. This person, who is typically the project leader, will be responsible for communicating with PIs, cooperators and park staff.

Each park will identify one point of contact. This individual will be the one to receive all information identified as belonging to the park (see Section 2.2) and will be responsible for determining who will ultimately receive that information within and external to the park. This person is also responsible for notifying the network if changes in park policies would affect the status of information.

For information that the network has responsibility for stewarding, information will be into one of three categories, depending on its sensitivity and ownership:

- **Public**: Approved for general release (Approved for Internet/Public posting). This information is not considered sensitive by national, network or park-level standards, is of high quality, fully documented, and non-proprietary. This information will be made available to all federal and non-federal entities and the general public.
- **Restricted, NPS-Only:** Only for release to the National Park Service (OK for Intranet posting). This information is not considered sensitive by national standards, but may reference specific point locations, be of questionable quality, proprietary, or intellectual property. All NPS staff, regardless of position and status, will have read-only access to this information. If information is requested by a federal or non-federal entity, or the public, it will only be released with the approval of the park contact.
- **Sensitive**: Not for release to the public or NPS. This information is considered sensitive by national or park level standards, and may also be of questionable quality or be proprietary. This data will not be accessible to a federal or non-federal entity, the general public, or NPS personnel unless approved by the park contact.

Data and information ultimately classified as **Sensitive** will be stored in a folder labeled /Sensitive/ on the network server, as specified by the directory structure SOP; NPS-ROMN 2007a). This information will only be made available to park and network staff on an individual basis, as approved by the project manager, network coordinator, or designated park point-of-contact. Details related to management of potentially sensitive

data that is collected or otherwise needed by non-NPS staff (e.g., cooperators, interns and student techs.) will be specified in the respective project or protocol. Approval for sharing this information will rest upon the network lead and the park contact.

2.2. Data Stewardship Responsibility

The first question to answer is who maintains the "official" copy of the data and is responsible for its upkeep. By clarifying this responsibly, confusion over versions will be minimized. In general any dataset consisting exclusively of information from a specific park will be the responsibility of that park and requests for that dataset will be routed through the park contact. Datasets which have been collected over several parks and surrounding areas to be used as the basis for vital sign monitoring activities are the responsibility of the Network and data requests will be handled by the Network.

The Network staff will evaluate information using the following questions:

- Is the dataset the result of vital sign monitoring operations?
- Does the natural resource material span multiple parks and surrounding areas?
- Has the park to which the information relates requested that the Network take responsibility for stewarding and distributing the material?

Answering "Yes" to any one of these questions places the responsibility of maintaining and distributing the data within the Network.

2.3. Sensitivity Evaluation

In cases where the Network has the stewardship responsibility, the Network staff will review material for sensitivity. Information is considered sensitive when it (1) describes the specific location, or (2) provides enough information to infer the specific location (e.g., a species is mentioned and there is only one location in the park where it could possibly exist) of the following:

- Wells,
- Endangered, threatened, rare, or commercially valuable species,
- Minerals,
- Paleontological objects,
- Objects of cultural patrimony,
- Archeological resources and/or artifacts,
- Ethnographic sites, and/or
- Caves.

The following questions aid in determining whether information is sensitive and should be protected (See US-DOI 2006 for further guidance):

- Has harm, theft, or destruction occurred to a similar resource on federal, state, or private lands?
- Has harm, theft, or destruction occurred to other types of resources of similar commercial value, cultural importance, rarity, or threatened or endangered status on federal, state, or private lands?
- Is information about locations of the resource in the park specific enough so that the park resource is likely to be found at these locations at predictable times now or in the future? (For example, raptor nests locations).
- Would information about the nature of the park resource, if available in conjunction with other public information, permit determining specific locations of the resource?
- Even if relatively out-dated, is there information that would reveal locations or characteristics of the park resource such that the information could be used to find the park resource as it exists now or is likely to exist in the future?
- Is the NPS unable to protect the park resource if the public knows or can infer its location?
- Is the information temporarily critical to some park's operations or negotiations (for a land purchase, water rights issue)?

An answer of “Yes” to any of these questions qualifies the information as being sensitive. If there is ambiguity as to whether information is sensitive (e.g., answers are indeterminate), it will be regarded as being sensitive.

Requests for access to all sensitive information, whether stewarded by the network or the park, will be routed to the respective park contact by the PI for approval. The park will have the ultimate say on how this information will be treated. These requests may occur when the network determines that cooperators will need this information to ensure they do not damage or interfere with sensitive resources. For instance, a cooperator may need to know the location of cultural sites during the protocol design stage to ensure that sampling points do not overlap. In other cases, a cooperator may be advised to avoid sensitive nesting locations or plants.

2.4. Point-Location Evaluation

Based on parks’ previous experience with monitoring plots, even if they do not pertain to sensitive species or artifacts, public curiosity may jeopardize the long-term quality of such sites if they were to be visited or vandalized. Therefore, the Network will not unilaterally release information to the public that describes, with a high degree of precision and accuracy, any location within a park. Data is considered to be too location-specific if both its precision and accuracy are within +/- 100 meters. Any data record that meets both criteria will be classified as “Restricted – NPS Only.” However, precise locations may be disclosed to active cooperators and contractors by the network to support specific monitoring purposes.

Meeting the +/- 100 meter accuracy and precision requirement can be addressed by one of the two following techniques:

- Round the UTM coordinates to the hundreds (e.g., 983667 to 983600 and 6689993 to 6689900)
- Add/subtract a random number between 1 and 100 to the UTM coordinates (e.g., 983667+43 and 6689900+23)

The one exception where the network will release non-sensitive point locations without first obtaining park permission is with network cooperators. However, collocation or overlap with sensitive resources (e.g., a rare species habitat, an important cultural site) would still only be disclosed with the prior approval of the park point-of-contact.

2.5. Proprietary/Ownership Evaluation

For this step, propriety refers to who holds, possesses or owns exclusive right to the data. Any copyrighted materials are assumed to be proprietary. Information is considered non-proprietary if it is publicly owned and distributed by any other governmental agency or if there is written permission by a private party that states that it foregoes any rights of ownership. The following questions apply when considering whether information is proprietary:

- Is it copyrighted?
- Are there other legal restrictions?
- Did the NPS or Network pay a third party for access to the data or does the third party normally sell this information?
- Has the data been collected by a non-NPS PI within the last two years and does this person plan to publish their results in a professional journal?

Answering “Yes” to any of the previous questions suggests the information is likely to be proprietary and/or intellectual property.

2.6. Quality Evaluation

Only information subjected to the network’s quality control procedures (See the Quality Assurance and Control SOP; NPS-ROMN 2007c) will be made freely available to the public. Products of incomplete, poor, or questionable quality (typically legacy data) may not be appropriate for release by the Network, yet still have NPS- , Network-, or park-level value because they may be the only source of information on the natural history of a park, may have been the basis for early management decisions, and/or may still be valuable as baseline information. Information of questionable quality will always be

accompanied by qualifying and explanatory documentation whenever it is published or used in reports or analyses.

2.7. Release

Datasets or other information will never be released before passing the classification procedure to ensure that sensitive or protected data are not made public. Investigators working on Network projects will:

- Submit all data and associated information to the network lead for the classification review process prior to release in any format.
- Ensure that any information classified other than “public” remains protected and not released to the public in any format.

When preparing or uploading information into any Network database, the Network staff will ensure that all protected information is properly identified and marked. The Network staff will work with the network lead to ensure that all references to protected information are removed or obscured in any reports, publications, maps, or other documents destined for a public forum.

Sensitive data will not be entered into any of the NPS I&M Program’s online web based applications; a metadata record, however, will be posted.

3. Roles and Responsibilities

Role	Responsibility
Network Lead (and Program Mgr.)	• Communicate all sensitivity and ownership policies to network staff, PIs, and cooperators. • Work with the park contact regarding any information identified as being restricted or sensitive
Park Contact	• Provide the Network Data Manager with any changes that would affect whether information is classified as being sensitive
Data Manager	• Maintain and updating this SOP
Cooperator	• Understand requirements of working with sensitive data (provided by NPS) and protect any sensitive information under their purview from unauthorized release.

Table 1. Roles and Responsibilities

4. References

NPS-ROMN (2007a). Directory Structure, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Protecting Sensitive Resources While Conducting Field Work, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

US-DOI (2006) Freedom of Information Act Program, US Department of the Interior [http://www.doi.gov/foia/], November 2006.

5. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Archive Format Standards for Network Data

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: September 4, 2007
Authors: David Pillmore, Brent Frakes
Abstract: This document describes the process and format for bundling related project information, including reports, datasets, and metadata.
Suggested Citation: NPS-ROMN (2007). Archive Format Standards for Network Data, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This SOP provides basic guidance for creating archives intended for long-term storage and distribution of network data.

Because there is not, at the present time, any way to effectively integrate data with associated reports and supporting information, it is necessary to bundle the information together into one archive. Figure 1 provides a graphical view of the general steps necessary to bundle datasets with other information.

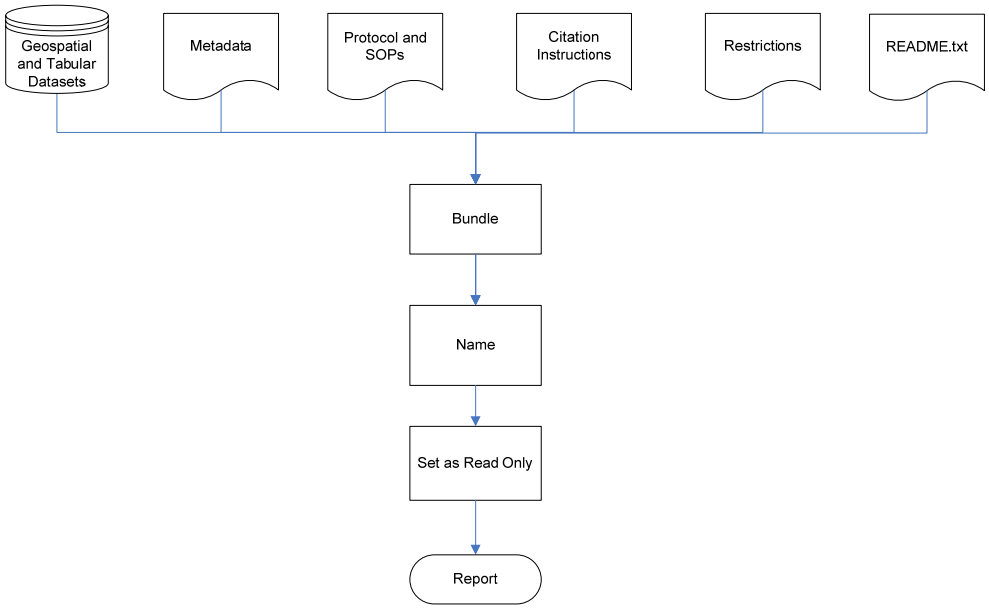


Figure 1. General Steps for Bundling Data Into a Zipped Archive

This SOP is written for Winzip Version 9.0

2. Required Elements

The following items will be bundled together:

- Relational databases will be housed in a Microsoft Access database and follow the current NRDT standards (NPS, 2007).
- An xml metadata record explaining data and the database structure in which it is stored;

- A complete copy of the Protocol and Standard Operating Procedures (SOP) which governed its collection;
- Instructions for citing the data in any publications;
- A document specifically detailing any restrictions on the use of the data based on the sensitivity or commercial value of the data when appropriate.
- "README.TXT" file describing each of the elements.

Optional items to be bundled are:

- Photographs – These should reside as a sub-folder or as a zipped file and if included will require their own xml metadata records.
- Digitized copies of field sheet - These should reside as a sub-folder or as a zipped file

3. Archive

The WinZip archiving program will be used to create a zipped archive file containing the documents mentioned. When creating the zipped archive (Figure 2), it is necessary that:

- The "Include Subfolders" will be toggled on if pictures are included
- Compression will be set to "Maximum (portable)"
- The Action will be "Add(and replace) files"

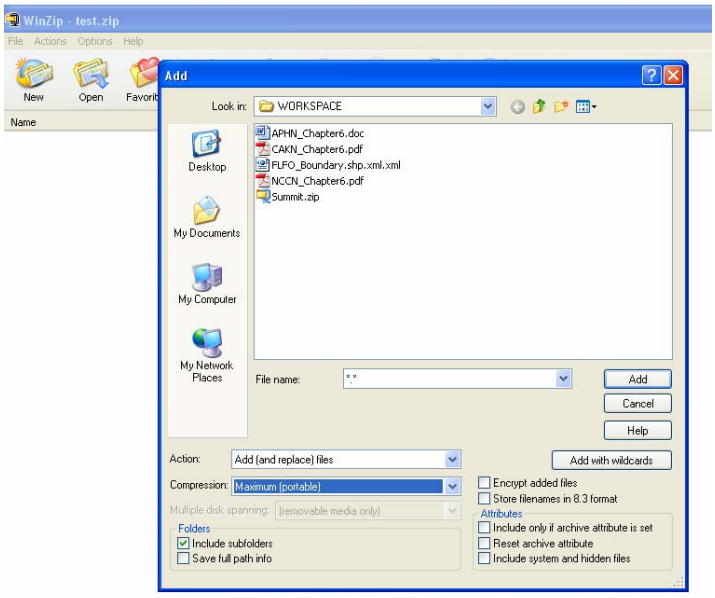


Figure 2. Winzip Archiving Options

Archive files will be named using the ROMN's file naming convention (See File Naming Conventions ;NPS-ROMN 2007) finalized documents and will therefore contain the date of their creation (e.g., ROMN_20060817_WaterQualityDataGRKO.zip).

It is advisable to use the "Make .Exe File" menu selection to create a self extracting archive file. This avoids the necessity of the recipient having extractive software. If used the file name should be exactly as mentioned above except that the file will end in ".exe".

Following creation of the zipped, or self extracting, file, it will be necessary to test for errors (Figure 3).

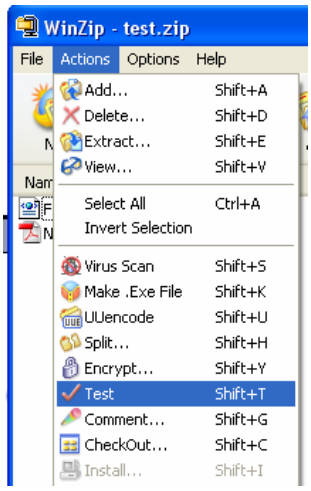


Figure 3. Testing a Zipped Archive

Once created, tested, and installed in the correct location, the archive will be set to read-only using windows explorer file properties.

4. References

NPS (2007). The Natural Resources Database Template, Version 3 [http://science.nature.nps.gov/im/apps/template/index.cfm], June, 2007.

NPS-ROMN (2007). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Data Management Guidelines for Protocol Development

Vital Sign Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, Dave Pillmore, Billy Schweiger, Dan Manier
Abstract: This document provides guidance to Protocol Developers to integrate effective data management techniques and procedures into network protocols.
Suggested Citation: NPS-ROMN (2007). Data Management Guidelines for Protocol Development, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document provides guidance to Protocol Developers to integrate effective data management techniques and procedures into network protocols. Data management requirements for monitoring protocols include explicit procedures to enter, edit, document, store and archive data according to the scope of each vital sign protocol. While this guideline does specify a set of minimum requirements, the Protocol Developer should also recognize that each protocol will have particular additions, revisions and omissions to those guidelines. Furthermore, the Developer is not expected to develop these guidelines separate from the Network; this is a cooperative endeavor to ensure the delivery of a quality protocol. To this end, the network will supply samples, templates, and technical assistance in support, but the project lead (Principal Investigator) retains primary responsibility for database content as well as meeting the minimum requirements outlined in this document.

2. Guidelines

A protocol should contain the following data management-related items

- Documentation procedures;
- Overview of database design;
- Data entry, verification, and editing;
- Data archival procedures;
- Recommended Analysis and Reporting;
- Workflow; and
- Roles and Responsibilities.

The following sections address each of these requirements in more detail and provide a list of **minimum** recommended requirements that must be addressed in the protocol. In general, these requirements do not specify exactly how something should be done, rather they indicate protocol components that should be explicitly addressed in the protocol document (i.e., focus on end result). It is hoped that these guidelines will standardize data management among monitoring projects, yet enable customization of the protocol that minimizes unnecessary work and realizes the most useful data products. Because we provide a set of minimum requirements, it is the responsibility of the Protocol Developer to address each bulleted point (in each category below). In cases where a requirement is unnecessary, incorrect, or problematic, the protocol should justify why the requirement was not followed. The goals and actualization of these guidelines often requires skills that not all principal investigators posses, (e.g.,

database design, metadata development, etc.), therefore collaboration between the data manager(s) and protocol developer(s) will be instrumental in realization of these guidelines (also see Section 3 Roles and Responsibilities, below).

In addition to these guidelines, Appendices A and B provide examples from other Networks on how data management is integrated into the protocol. As with theses guidelines, it is not expected that future protocols will precisely follow these examples, either in organization or content.

2.1. Documentation Procedures

Developing and maintaining complete and accurate documentation of data sets (metadata) is a fundamental requirement of the Program and the Network. Metadata establishes the basis for interpreting and appropriately using data in analyses and products by recording information about the data source(s), and the methodology by which the data were collected or acquired. The protocol should:

- Ensure metadata is compliant with current Federal Geographic Metadata Committee's (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) and the Biological Data Profile of the CSDGM (FGDC 2006);
- Schedule regular reviews and updates of metadata records
- Provide directions for developing the metadata in extensible markup language (xml) format using the NPS Metadata tool (NPS 2006a), ESRI ArcCatalog, or another comparable metadata tool

2.2. Overview of Database Design

Databases for monitoring protocols are designed to meet the data entry, quality assurance, and reporting or output requirements specified by the monitoring objective(s). Where possible, existing databases from other NPS units (e.g., the NPS Protocol Clearinghouse) or external sources will be adopted and adapted to promote consistency among data sets. For monitoring protocols without suitable or available database designs, the database should follow the NPS Natural Resource Database Template (NRDT; NPS 2006b) model for Microsoft Access and the ESRI Geodatabase model. The NRDT divides the data among three core areas that include the location and time the data was collected at as well as the observation itself. The protocol should:

- Ensure the database follows a related protocol or NPS NRDT structure (NPS 2006b)
- Graphically diagram the table relationships, showing the primary/foreign key linkages and relationships among tables
- Ensure the database contains appropriate look-up tables to support data entry

- Contain a complete data dictionary where the (1) attributes of each table are clearly identified and (2) their data type (e.g., integer, text, Boolean) and ranges are specified.

2.3. Data Entry, Verification and Editing

Up-front attention to data input minimizes the risk of entry errors, guards against information loss, and reduces the time spent correcting transcription errors. Data entry is conducted using several mediums (desktop forms, field sheets, PDAs, GPS, or Tablet PCs). Each has both unique and common requirements that must be accounted for in the Data Management process.

Regardless of medium, the protocol must ensure that:

- Forms are completed following strict 'penmanship' rules (e.g., sevens with slashes, zeros with lines, All/no caps, acronyms) that optimize the use of space and time and minimize confusion
- Forms are comparable, if not identical, if more than two mediums (e.g. digitals forms and paper backups/alternates) are used.
- Clear directions for transfer of data, if more than one medium is used to and from desktop database
- Hardcopy field sheets are used either as the primary medium for data entry or for backup (e.g. data collected in digital forms should be printed and filed)
- Minimal time spent completing data fields (e.g., favor the use picklists, use of stylus, etc.)

In addition, each medium also has its own set of requirements. For field sheets, the protocol should ensure they:

- Reflect (be prepared to receive) the information required in the protocol;
- Fit a common and accepted format (e.g., 8.5x11 inch);
- Provide space for the observer to record the name, version and date of the monitoring protocol used for data collection and processing;
- Are protected from inclement weather or other damages (e.g., "write-in-rain" paper)
- Mimic desktop forms;
- Have font sizes and formats that are legible in the field (e.g., not smaller than 8 points);
- Include sufficient space (i.e. empty rows/columns) to enter all data from a site on one form (e.g. don't provide too little space so data often ends up on the back of a sheet).

When a PDA is used, the protocol should:

- Contain clear directions for use based on the data collection needs;
- Contain provisions for battery backups and recharging;
- Discuss how and when backup field sheets are to be used, should the PDA fail;
- Address data transfer and backup when in the field and/or upon returning to the lab/office.

When a GPS is used, the protocol should:

- Have Clear directions for use of the GPS Unit based on the data collection needs;
- Contain provisions for battery backups and recharging;
- Specify consistent datums and projections;
- Provide the means for determining and recording the accuracy and precision of the GPS during data collection;
- Describe the method of data downloads and connecting GPS data with other tabular or database formats (when the GPS isn't integrated with a field computer).

When a field PC (e.g., tablet or toughbook) is used, the protocol should:

- Contain provisions for battery backups and recharging;
- Specify that forms function using the Microsoft Access application;
- Address data transfer and backup when in the field and/or upon returning to the lab/office;
- Discuss how and when backup field sheets are to be used, should the computer fail, or when carrying the computer into the backcountry is impractical.

Data Verification and Validation (QA/QC)

Quality assurance involves planning quality into the data while quality control consists of monitoring the system or appraising the product after the product is developed. QA/QC mechanisms are designed to prevent data contamination, which occurs when a process or event introduces fundamental types of error into a data set through one of three likely scenarios. (1) Errors of commission include those caused by data entry or transcription errors, or malfunctioning equipment. (2) Errors of omission often include insufficient documentation of legitimate data values, which could affect the interpretation of those values. (3) Errors of logical consistency refer to the inconsistency of relationship among different features. Examples include trees that shrink through time, roads found on lakes, etc. These may result from inconsistencies in measurement and scale or differing definitions of the variables being measured.

To provide for the highest level of quality, the protocol will:

- Ensure data is transferred from the field sheets to database in a timely manner.
- Specify that automated error checking features are built into the database, including auto-filled fields, range limits, pick lists, and spelling checks.
- Require the visual review of data during the entry in the field

- Contain a mechanism for randomly auditing for commission errors. In cases where errors are greater than 2%, a complete review (i.e., 100% re-evaluation) will occur.
- Contain complete descriptions of all data fields to minimize errors of omission.
- Contain a mechanism for auditing for logical consistency, (i.e., unlikely events and extreme measurements are located and checked).
- Contain steps to address and prevent future errors, should they be identified
- Contain a section for documenting changes to the Protocol (e.g., See Section 4 as an example), and include discussion of how changes may affect the data (interpretation, archiving, QA/QC, etc.)

Note: Examples of verification and validation techniques can be found in the Network's Quality Assurance and Control SOP (NPS-ROMN 2007).

2.4. Data Reporting Recommendations

Although it is beyond the scope of the data manager to determine whether an analysis is logically appropriate, the data manager will check for appropriate formatting and inclusion of all relevant reporting requirements:

- Routine data summaries
- Appropriate reporting schedule to (1) Network, (2) Parks, (3) WASO Enterprise databases in standard data formats
- Appropriate report format(s) with examples of summary tables and figures
- Guidelines for data export into appropriate format for use by other statistical packages

2.5. Sensitivity & Ownership

National guidance for sensitivity restricts general public accessibility to geological and geophysical information and data concerning wells; the nature and specific location of (a) endangered, threatened, rare, or commercially valuable species, (b) minerals or paleontological objects, or (c) objects of cultural patrimony; the nature and location of any archaeological resource for which the excavation or removal requires a permit or other permission; or the specific location of any significant caves (FOIA, 2002).

Therefore, the protocol will:

- Contain measures for identifying and flagging sensitive information
- In cases where sensitive information is intentionally or unintentionally located in the field, provide a means of collecting data that does not jeopardize the sensitive resources.

2.6. Data Archival/Storage Procedures

Storage and archiving procedures aim to ensure that data and related documents and materials, both digital and analog, are protected against loss, environmental hazards, catastrophe, and human malice, and are archived in a manner that expedites recovery. Therefore, the protocol will:

- Provide clear instructions for archiving physical and digital data during the field season
- Provide Clear instructions for archiving physical and digital data for the long-term
- Distinguish the management of the original field data from the finalized dataset
- Include procedures for managing different versions of the datasets, including a recommended naming convention.

2.7. Data Workflow

Workflow diagrams provide a useful means of summarizing complicated steps, highlight key decision points, represent the chronology, and facilitate understanding for graphically-inclined individuals. Where appropriate, the protocol should contain model workflows similar in nature the flowchart/conceptual model in Figure 1.

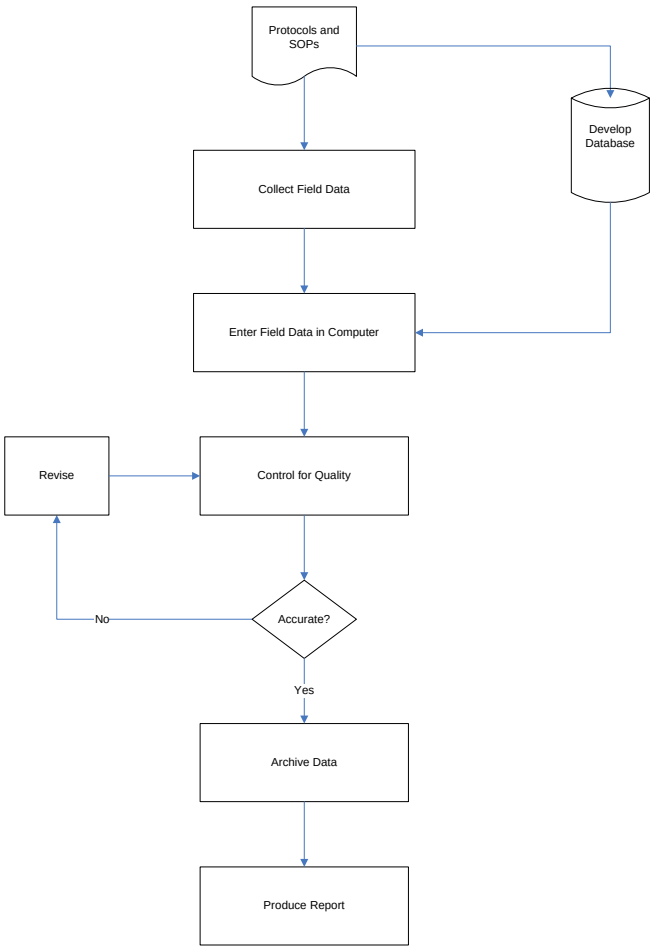


Figure 1. Example Data Flow Model for a Vital Sign Protocol

2.8. Change History

Because the protocols and associated documents will be periodically updated, it is essential to account for changes via versioning. Every document will contain a version number. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in process and/or changes affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor change in process that do not affect the interpretation of the data. In addition, each document will contain a modification date and "Change Log" table which tracks the following:

- Original Version Number – Indicates which version was modified
- Date of Revision – The date the new revision is approved by network staff
- Revised By – Primary author/contact
- Changes – Description of changes, including how it will affect the interpretation of data

- Justification – Why the change was necessary
- New Version # - Indicates the new version number (this ensures that there are not any gaps in notation between versions)

Section 4 is the change log for this document.

2.9. Roles and Responsibilities

Attaching responsibilities for managing the information minimizes confusion among cooperators, both in the field and office. Therefore, the protocol should specify who is responsible for each data management task. Section 3 of this document provides a working example of how the roles and responsibilities should be articulated.

3. Roles and Responsibilities

Role	Responsibility
Protocol Developer	• Ensuring that all data management requirements are explicitly identified in each monitoring protocol. In many cases, this responsibility means integrating requirements specified by the Network Data Manager. • Issuing responsibility for all data management-related steps within the data entry, data verification, and data requirements for entry to the analytical process in the protocol.
Network Data Management Staff	• Work with protocol authors wherever necessary to ensure each data management step and procedure meets NPS and ROMN data management requirements. These include, but are not limited to, database design and metadata development. • Review any draft Protocol • Review the final Protocol

Table 1. Roles and Responsibilities

4. References

FGDC (2006). Standards Publications, Federal Geographic Data Committee [http://www.fgdc.gov/standards/standards_publications/index_html], November 2006.

FOIA (2002). Freedom of Information Act Program, National Park Service [http://www.doi.gov/foia/], November 2006.

NPS (2006a). NPS Metadata Tools and Editor, National Park Service [http://science.nature.nps.gov/nrgis/tools/editor.cfm], November 2006.

NPS (2006b). NPS Natural Resource Database Template (NRDT), National Park Service [http://science.nature.nps.gov/im/apps/template/index.htm], November 2006.

NPS-ROMN (2007). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

5. Change History (For Network Staff only)

Every SOP and guideline developed by the Network contains a section documenting change (Table 1) and is intended for Network use only.

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History for the Data Management Guidelines for Protocol Development

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Developing GPS Basemaps for Use in Garmin Units

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore, Tim Smith
Abstract: This SOP details how custom basemaps can be created by shareware programs. These basemaps, which may utilize vector data, can be imported into any Garmin GPS unit.
Suggested Citation: NPS-ROMN (2007). Developing GPS Basemaps for Use in Garmin Units, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This Standard Operating Procedure presents a step-by-step process for creating and uploading basemaps into Garmin GPS units. Use of basemaps for field work is an effective quality assurance method because it helps reduce potential data collection errors resulting from improper navigation. Furthermore, use of created base maps takes advantage of the large data storage capacity for maps that many of the Garmin GPS units have, while leaving more space for the more limited number of waypoints they typically allow. Finally, it also allows the viewing of multiple map layers that can be turned on and off as needed.

Developing a custom basemap involves the coordination of multiple freeware and shareware programs. It program handles one of three distinct functions – create map, export to Garmin native graphic format (*.img), and upload to a Garmin GPS unit. Figure 1 shows the steps, while the remaining sections describe each of these steps in more detail.

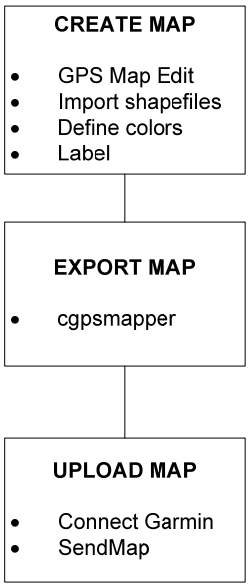


Figure 1. General Steps for Creating, Exporting and Uploading Custom Maps

This SOP does not replace a user manual for the details of using these programs; their manuals are more effective, current and complete. Furthermore, it does not describe the use of the Garmin units - the user should refer to the user's manual, Garmin's website or other SOPs for guidance. Instead, this SOP provides instruction in producing basemaps of consistent format and quality for loading into Garmin GPS units.

Examples provided in this SOP are from the following software versions: GPS Map Edit 1.0.36.0, cGPSmapper 0093, and Send Map 2.0.

2. Creating the Map: "GPS Map Edit"

GPS Map Edit is a shareware program that will import and overlay multiple shapefiles into one common map. It enables the user to import shapefiles, color each shapefile based on a pre-defined Garmin coloring scheme, and label them based on one of their attributes. GPS Map edit can be downloaded from Geopainting.Com (Geopainting, 2007). Once downloaded, the program must be located in the C:\Program Files\GPSMapEdit\ folder.

When using GPS Map edit for Network-related purposes, the following are important recommendations for developing useable and consistent basemaps that complement field work:

- The Start_Template.mp, which is provided with GPS Map edit, is a good working template for development of all maps. This template must be added before importing additional shapefiles.
- A unique eight-digit integer must be specified for each map (Figure 2) in the header tab of the map properties. This integer is what Garmin uses as its unique map identifier (i.e., primary key). Therefore, each map loaded on to the same GPS should have a different integer.

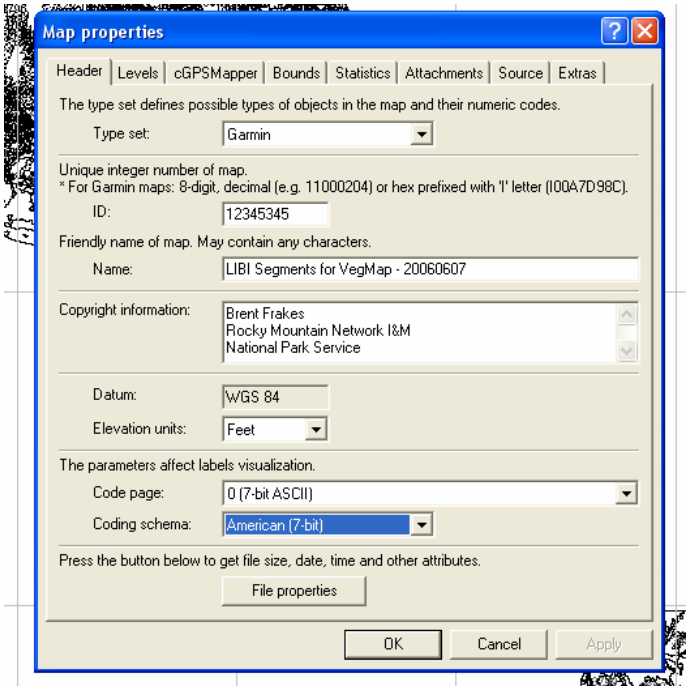


Figure 2. GPS Map Edit Form - Map Properties/Header Tab

- A title, creation date, and author/contact must be specified for each map (Figure 2).
- The coding schema should be set to “American (7-bit)” (Figure 2)
- The zoom level will be set to the maximum view required. In general, this is the scope of the study area
- When possible, it is preferable to store feature types as separate background maps (*.img’s). It gives the user more options for displaying certain features, just as if they were turning on/off GIS layers and labels in ArcMap.
- Polylines generally work better than polygons when it is necessary to navigate to areas. When in doubt, both should be created.

3. Exporting the Map: “cGPSMapper”

This program cGPSMapper (cGPSMapper, 2007) is freeware that allows constructing custom basemaps in a format that can be displayed on a Garmin GPS. To minimize confusion, cgpsmapper.exe should be placed in the same folder as the GPS Map Edit (C:\Program Files\GPSMapEdit\). It is called by GPS Map Edit during the export option (Figure 3). Under most situations little or no direct involvement with the program is necessary.

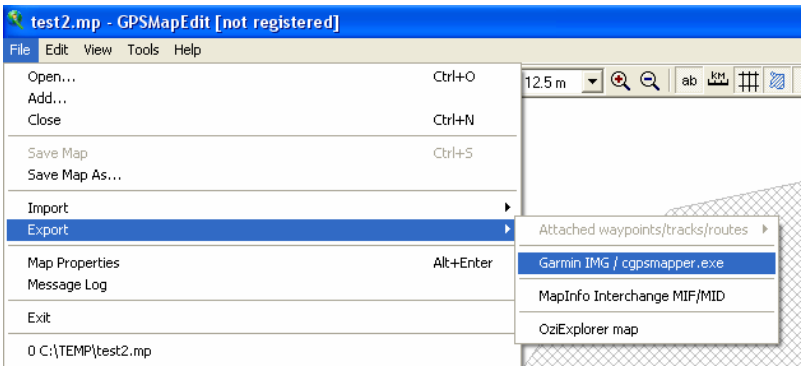


Figure 3. GPS Map Edit Form – Exporting to Garmin Format

The location of cgpsmapper must be specified, as shown in Figure 4.

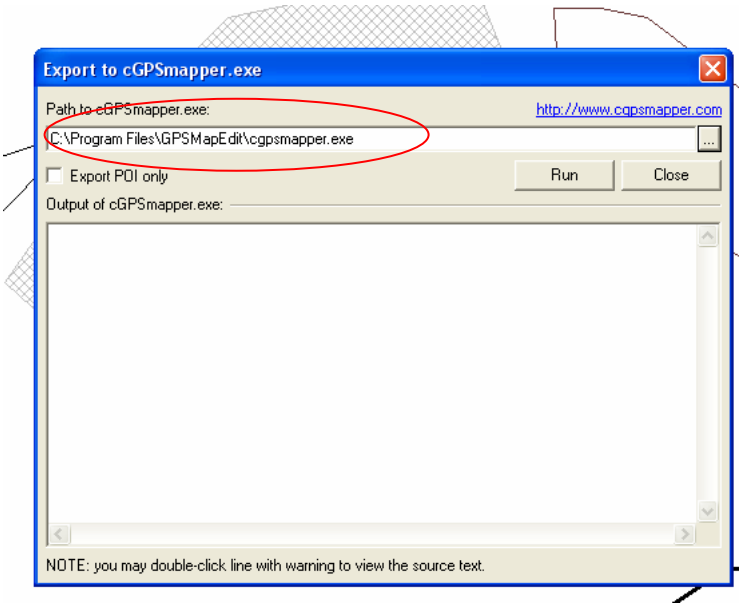


Figure 4. GPS Map Edit Form – Specifying the cgpsmapper file path

4. Uploading the Map to the GPS: “Send Map”

Send Map is a freeware program which can also be obtained at the cGPSMapper web site (cGPSMapper, 2007). This program enables the user to upload the compiled Garmin *.img maps into the Garmin GPS Unit (Figure 5).

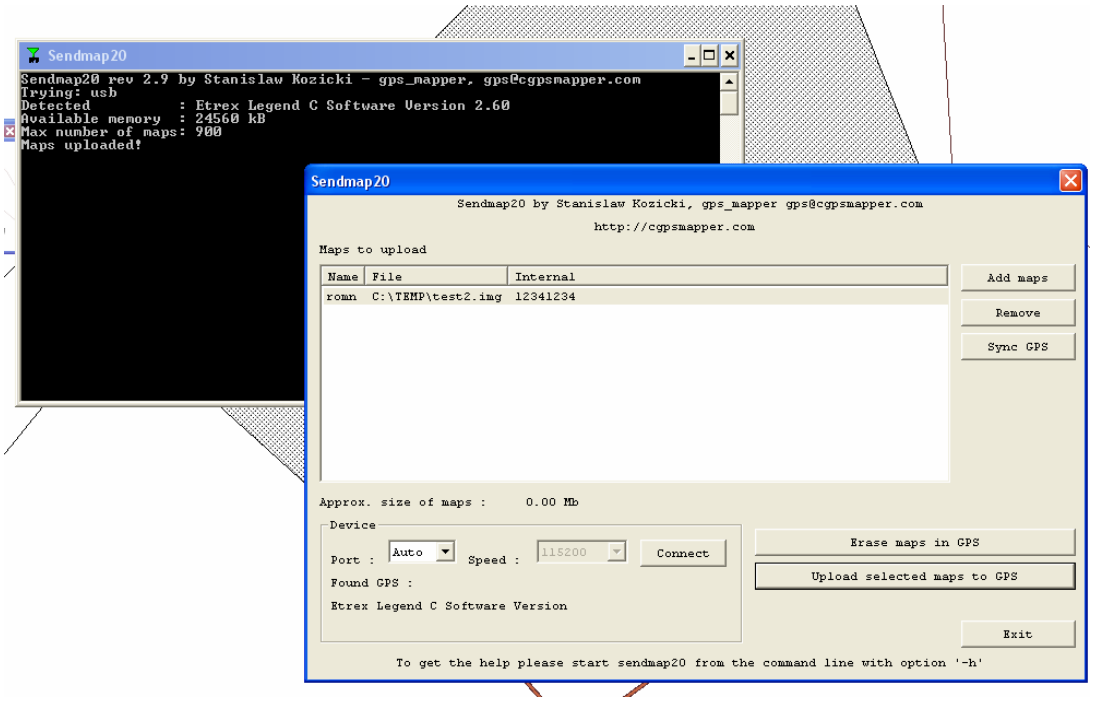


Figure 5. Send Map Form – Uploading to Garmin GPS Unit

To upload the map successfully, the Garmin unit will:

- Be turned on and connected to the computer
- Have the proper port specified
- Be configured to Garmin interface

5. References

Geopainting (2007). GPS Map Edit 1.0 (update 36), [http://www.geopainting.com/en/], June, 2007.

cGPSMapper (2007). cGpsMapper software, Version 93 [http://cgpsmapper.com/index.htm], June, 2007.

6. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Digitizing Documents

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes
Abstract: This document describes the steps for digitizing (scanning) documents
Suggested Citation: NPS-ROMN (2007). Digitizing Documents, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes the general steps involved in digitizing hardcopy documents. Figure 1 presents the general steps in relative order. The remaining sections provide further guidance for each of these steps.

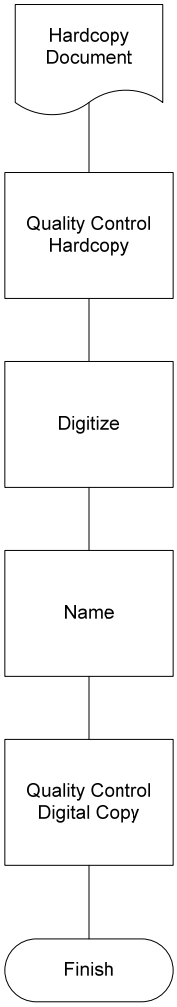


Figure 1. General Steps for Digitizing Documents

2. Quality Control Hardcopy

Digitizing a document without first checking for some basic quality can result in wasted time and useless digital documents. The following are minimum quality control measures:

- Confirm the (1) author(s), (2) year of publication and (3) title are discernable. If, not, it is questionably whether the document is ready for digitization.
- All pages must be present
- The document is in final form (i.e., not draft)

- First page will be title page. If a title page is not present, the Documentation SOP provides Network specifications for developing a title page.

Further guidance on quality control is found in the Quality Assurance and Control SOP (NPS-ROMN, 2007a).

3. Digitize

For most digitizing, use of the Canon ImageRunner Photocopier/Scanner will be the most efficient use of time. To set up the ImageRunner for scanning, follow the following steps:

1. Remove staples and other binders
2. Select Send
3. Select ROMN as the destination/mailbox
4. Scan to multi-page portable document format (PDF)
5. Specify single or double-sides
6. Specify image quality. Below are the recommended settings based on the type of document being scanned.
    - B&W text - 300 Dpi (Dots per inch) monochrome
    - General color artwork - 300 dpi color
    - Detailed color photographs and detailed artwork - 600 dpi color

Once the document is scanned, it will be placed in S:\ROMN\SCAN\ and be named according to the date and time of scanning. If the settings were correct, it will be saved as one complete PDF document.

3.1. Name

Documents will be named FirstAuthor_YearOfPublication_Title. This standard conforms to the Network File Naming Conventions (NPS-ROMN, 2007b) for all finalized documents.

3.2. Quality Control Digital Copy

Although the exact level of quality control depends on the ultimate use of the document, the following is a recommended list of criteria that are mandatory when applicable:

- Pages will be in correct order
- Crop pages - Cropping will occur when the whitespace or black lines occur consistently on each page. All pages will be cropped to the same dimension.

- All pages are aligned correctly (i.e., pages are not sideways)
- Pages are legible

Further guidance on quality control is found in the Quality Assurance and Control SOP (NPS-ROMN, 2007a).

4. References

NPS-ROMN (2007a). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

5. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Directory Structure

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document describes the functional requirements for how the server directory should be organized. It also specifies the root folders. Organization beyond the root level is not specified and depends, rather, on each operation's own direction.
Suggested Citation: NPS-ROMN (2007). Directory Structure, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

There are two components to the directory map. One is functional, which defines rules of organization that will help determine how the directory structure will evolve through time. The other is structural, which formalizes the structure of the root folders of the Network. This SOP does not go beyond defining the root folder (and first level beyond) because it is the responsibility of each of the Network's operations to further define their sub-directories.

2. Functional Requirements

Functional requirements define a thought process. Unlike structural rules, they do not define the directory structure *a priori,* but provide a framework for allowing the structure to evolve through time. When creating, expanding or modifying, every practical effort will be made to have a directory structure that:

- Provides a consistent and logically organized structure that complements the Network's day-to-day activities and functions.
- Minimizes confusion about where information is located.
- Allow for efficient, comprehensive, regular and secure means of backing up information.
- Accommodate various security settings for different types of users;
- Is hierarchical and minimize the ambiguity of where information should go. Ideally, the organization should be logical enough that one could navigate through the entire structure without ever requiring a map;
- Separates in-progress/draft/unofficial/in-progress files from final/official information;
- Is broad enough to clearly accommodate all types of information handled by the Network staff;
- Is simple, without sacrificing functionality;
- Minimize the number of sub-folder levels and also refrain from having more than 8-10 folders at any given level;
- Is organized thematically (e.g., hydrology, soil, etc.) or data- or project life cycle, and not by format (e.g., documents, GIS),
- Never arbitrarily divides information in a way that increases the possibility of corruption or loss (e.g., metadata should never be separated from the data)
- Conforms to other NPS and national directory structure standards, when possible, practical and appropriate

In addition, the following rules apply to the expansion of folders and directories:

- Fiscal Years will be represented by FY0x. Fiscal years begin October 1. Example: FY04.

- Subdirectories named “old” indicate older drafts of documents that are being temporarily archived. These folders are to be removed following final publication and archiving.
- Folder names will never have spaces or special characters (e.g., $%\&*).
- Folder names will be UPPERCASE if they are (1) primary folders, or those at the root level, (2) NPS Codes (e.g., WASO, ROMO), or (3) Titled SENSITIVE. Two words are separated by an underscore (e.g., FIRST_SECOND).
- All other folders not meeting the criteria of being UPPERCASE will follow the Proper Case naming convention (e.g., FirstSecondThird)
- Absolutely no modification to the primary or secondary levels of the directory structure will occur without approval by the Network Data Manager

3. Structural Requirements

The Z drive is the primary Network drive and contains all of the information related to administration, monitoring, projects, tools and web development. **All computers using this drive will map to it as the Z drive**.

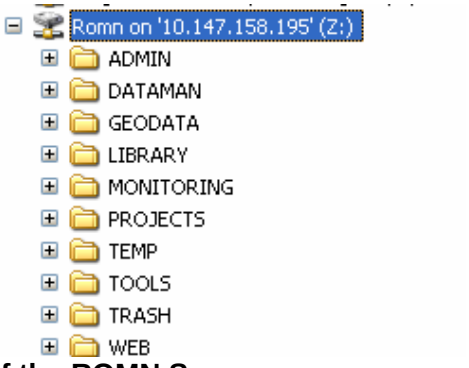


Figure 1. Root Folders of the ROMN Server

In general, the directory structure is set up to mimic the Network’s operations, with a few exceptions:

- **ADMIN** – Administrative Operation (NPS-2007a) - The administrative folder contains all administrative information handled by the Network, particularly by the coordinator and administrative assistant.
- **DATAMAN** – Data Management Operation (NPS-ROMN 2007b) - houses all information regarding the data management operation in regards to data management planning.
- **GEODATA** – Data Management Operation (NPS-ROMN 2007b) - houses all of the Network’s base information, both tabular datasets and native geospatial data (e.g., shapefiles and geodatabases) and the associated metadata. All Network staff have read-only access to this folder.
- **LIBRARY** – Library Operation (NPS-ROMN 2007d) - Houses all completed reports and reference materials used by Network staff

- **MONITORING** –This folder contains all information related to each of the monitoring protocols. Each protocol has its own folder.
- **PROJECTS** –Park Support Operation (NPS-ROMN 2007e) - Data and reports specific to various inventories and data mining projects. Each project has its own folder.
- **TEMP** -Intended as a temporary work area. Each staff has a folder over which they have complete ownership.
- **TOOLS** - This folder contains miscellaneous tools and applications used by the ROMN staff
- **TRASH** - a temporary location for documents that are set to be trashed. Files are removed daily
- **WEB** –contains all files used to maintain the ROMN Inter- (public) and Intra-net (private) web site. The web site is maintained by the Infrastructure Operation (NPS-2007c).

4. References

NPS-ROMN (2007a). Administrative Operation

NPS-ROMN (2007b). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Infrastructure Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007d). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007e). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

5. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Documentation

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This SOP describes the workflow for documenting documents, spatial and non-spatial datasets and photographs. It also provides guidance for documenting biological data.
Suggested Citation: NPS-ROMN (2007). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes the Network's procedures and decisions necessary for meeting the minimum standards for documenting data and information. Documentation, in this context, refers to the development of metadata, or data about data.

For something to be worthy of being documented, it will already have been evaluated and determined that it (1) fits into the scope of collection (i.e., deemed to be of use to the Network); and (2) meets a sufficient level of quality to warrant the effort. All datasets and other information produced or used by the network in its vital sign monitoring function will be documented.

All information, regardless of whether it is a dataset, publication, or photograph, requires basic metadata. This metadata should provide a brief synopsis of what it is, how to interpret it, how it was collected, how it should be cataloged, and whether it is related to other datasets and information. The degree of documentation depends on its source, format, and whether it is associated with other information elements that were co-produced as part of a project. Figure 1 provides a conceptual model of the general steps and decision points to follow when documenting data and information.

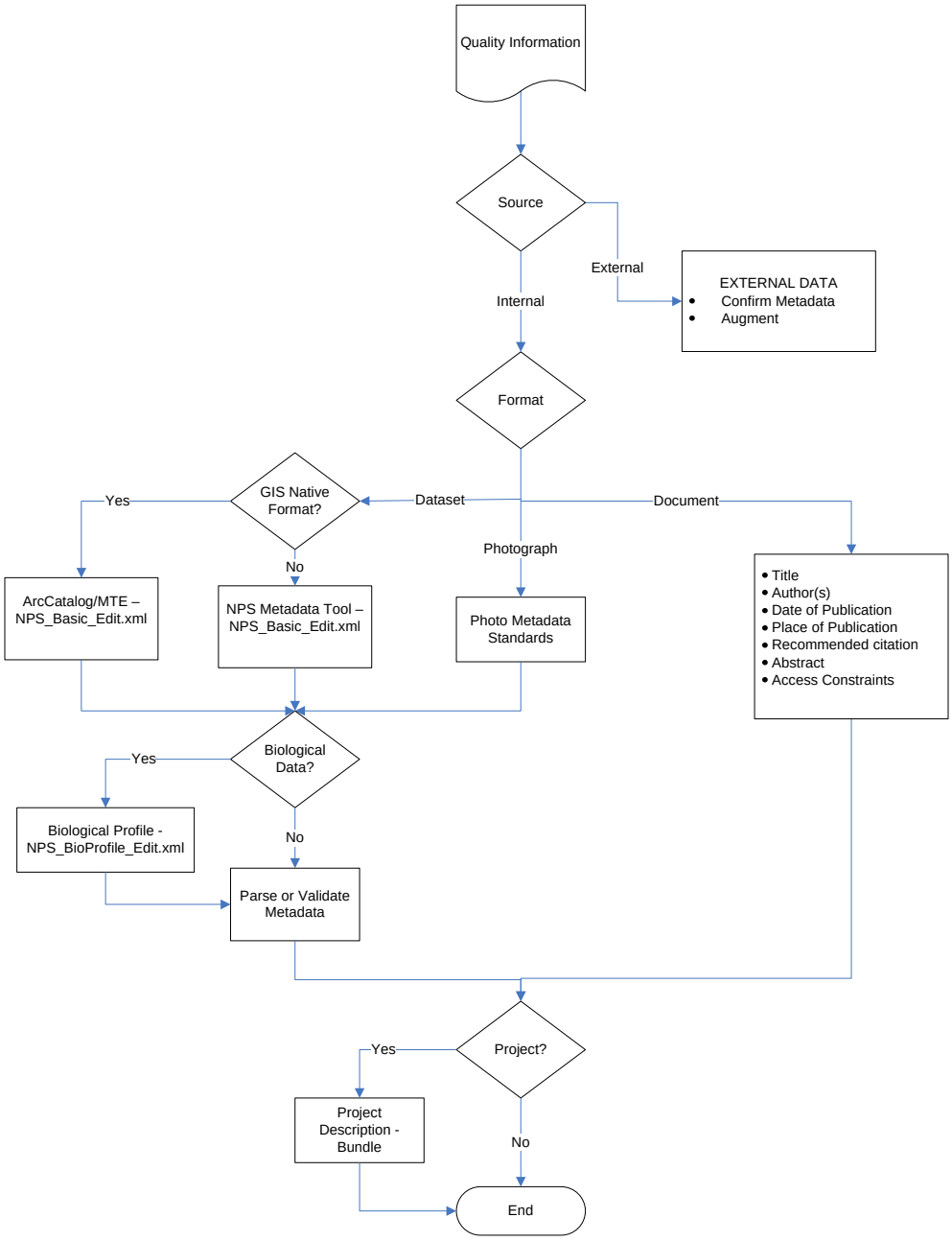


Figure 1. Conceptual Model For Determining Level and Type of Documentation

The source in Figure 1 refers to who created the information. Information generated by anyone other than the Network is considered to be external information. If an external dataset or document is modified in any way (e.g., data is clipped to the park boundary or a digital chapter removed from an edited book in portable document format), it will be considered internal data from that point forward. Anything the Network creates will be considered internal information.

The decision regarding format (Figure 1) refers to the native format of the information:

- A document refers to any report, letter, newspaper article, email message. Most often, documents are primarily text-based, contain complete sentences, are generated by a word processor or text-editor, and are in Microsoft Word, WordPerfect, text, rich text format, or portable document format (*.pdf). Documents are generally self-documenting, meaning they, to some degree, describe themselves via the interpretation of the text.
- A dataset is any collection of text and/or numbers organized in a table or group of tables where each column and row has a specific interpretation. Datasets are most often produced by Microsoft Excel, Microsoft Access, database or statistical software, and are managed as text, spreadsheet, or relational databases. A dataset can also be a collection or grouping of items that are difficult to document individually and yield a higher level of interpretation when maintained as an assemblage than when split out individually. A collection of photographs qualify as a dataset. While datasets may also be collections of field sheets and paper compilations of sample measures. These will be converted to digital datasets and fully documented if they are used and maintained by the network.
- Spatial datasets share many of the qualities of datasets, but have the additional properties of being natively read by mapping software. Spatial datasets are most often produced by mapping software, including those from ESRI (e.g., ArcMap and ArcInfo). Georeferenced imagery, including those in TIF, SID or Image format, or other gridded information is also considered a spatial dataset. Hardcopy aerial photographs, satellite imagery and maps also are considered to be spatial datasets. Microsoft databases that contain spatial feature classes, thereby making them geodatabases, also qualify
- Images include non-georeferenced imagery, including traditional pictures taken with a camera.

For all information types, it is assumed they are complete or as a new version – not draft or incomplete.

The following sections provide more detail and guidance outlined in Figure 1. Section 2 describes how external and internal information is to be handled. Section 3 describes the process for handling biological data.

2. Source

Because the Network has no control over externally-generated information, it is inappropriate for network staff to devote time to creating this documentation, particularly since the risk of misrepresentation is high. Thus, information acquired by the Network from external sources will not be subjected to the same metadata standards as information generated by the Network.

It is important to note that external information of any kind that does not have sufficient documentation provided by the originating source will neither be modified nor distributed by the Network.

2.1. External Information

For external information the Network plans to manage, it is still important to confirm the metadata is correct and sufficient for accurate interpretation. If necessary, augmenting the metadata may be necessary to ensure that network staff can trace the information back to the original source.

2.1.1. External Documents

When an external publication is received, the following are the minimum attributes to be confirmed as being correct and completed:

- Title
- Author(s)
- Year of Publication

In some cases, a document will be missing a title page or the title page does not accurately reflect the document (e.g., author names not present). In this case, it will be necessary to create a title page containing these minimum elements to ensure that the publication can be properly stored/archived and referred by the system cataloging it. In cases where an author or year of publication is impossible to discern, they will be labeled “No Author” or “No Date”, respectively. If a title is nonexistent, a descriptive title will be created; “No Title” is not acceptable since multiple NoAuthor-NoDate-NoTitle combinations are undistinguishable. In cases where a title page is created, a statement at the bottom of the page will state how the title page was created. One example might read:

> This page was inserted by Brent Frakes, Rocky Mountain Network Data Manager - National Park Service, on August 17, 2006 because a clear title page was missing from the source document. The title is based on the contents of the source document. The authors were inferred from page 36, which appears to list the contributing authors. The year of publication is estimated based on the dates found within the methods and results sections (pages 23 and 43) and the referenced materials found on page 38.

2.1.2. External Tabular Datasets

When an external dataset is received, the following will be confirmed to be correct and augmented as necessary:

Section 1- Identification Information

- Citation
  - Originator
  - Publication Date

  - Title
  - Online linkage
- Abstract
- Time Period of Information
- Point of contact
  - Name
  - Organization
  - Phone number
  - Email
- Status
- Progress
- Use Constraints – Set to “For Network Use Only – Not Intended for Distribution”

When these fields are incomplete or incorrect, it will be necessary to change them accordingly.

2.1.3. External Spatial Datasets

In addition to the fields defined for the tabular datasets, the following additional fields will also be required:

- Projection
- Datum

2.1.4. External Photographs

Externally-generated photographs that are used by the Network will at least have the following metadata fields:

- Date of photograph (year is acceptable)
- Photographer/contact
- Location of photograph

2.2. Internal Information

Much of the background information that will be needed for documentation will be accumulated during the development of the data and it is therefore important to retain all for preparation of the metadata.

2.2.1. Internal Documents

All documents generated by the Network will have a title page with the following information:

- Title
- Author(s)
- Date of Publication

- Place of Publication
- Recommended citation
- Abstract
- Access Constraints

2.2.2. Internal Datasets

All datasets produced and owned by the Network, or a modification of a dataset developed externally, will be documented using the NPS Metadata Tool and Editor (NPS 2006). This enables full editing in xml format, provides stylesheets specific to the National Park Service, and includes the metadata parser tool. The NPS Metadata Tools Help Page (NPS 2006) also provides detailed guidance for the development of metadata.

Any tabular data must include full data field definitions including data type, width, name, range of values, and relevance of values. For example; a numerical field, 12 bits wide with two decimal places, named “Specimen Height”, with a range from .5 to 12 meters, containing the height of trees in the study area. When data is in an Access database, the Metadata Exporter tool will be used to export table and attribute definitions.

At a minimum, all datasets will have minimum documentation, which closely approximates the NPS_Basic_Edit stylesheet. These requirements are detailed in the Creating Metadata (NPS 2006) Guidance document.

Fields that are automatically filled in are not discussed.

NOTE: The stylesheet has recently been updated so this section will need revision

Section 0 – National Park Service Only

- Metadata Purpose
  - OnlineData - if associated data exist on any accessible server
  - CSDGM - if the metadata is full or minimal Content Standard for Digital GeoSpatial Metadata
  - DataCat - if the metadata originated in the NPS Dataset Catalog desktop application
  - Other if the metadata does not fit in any of the other categories
- NPS_Unit_Information
  - NPS Unit Alpha Code – four letter code for park
  - NPS Unit Type - specifies whether it is a park or network
- Data Store Information
  - NPS Theme Category
  - Data Site
  - Data Steward

Section 1- Identification Information

- Citation
  - Originator
  - Publication Date
  - Title – The version of the dataset should be part of the title
  - Online linkage
- Abstract
- Purpose
- Time Period of Information
- Theme Keywords (minimum of two)
- Place Keywords (minimum of one)
- Access Constraints
- Use Constraints
- Point of contact
  - Name
  - Organization
  - Phone number
  - Email
- Status
- Progress

Section 6 - Distribution Information

- Contact Information
  - Name
  - Organization
  - Phone
  - Email
- Data Distribution Liability Statement

Section 7 – Metadata Reference Information

- Date Metadata was Created
- Metadata Contact

A template for sections 1, 6 and 7 is found at _____[TBD].

2.2.3. Internal Spatial Datasets

In addition to the fields required for internal tabular datasets (Section 3.1.2), the following fields are also required:

- Projection
- Datum
- Bounding Coordinates

2.2.4. Internal Photographs

In most cases, photographs will be treated as a collection of photos and will be documented as a dataset. It is only in cases were photos require individual documentation that the following standards apply. :

- **Title** - who or what is in the image
- **Image_Content_Place** – where the image was taken
- **Image_or_Set_Create_Date** – when the image was taken
- **NPS_Unit_Alpha_Code** – (e.g. Park code) used for managing or filtering groups of records and/or for linking systems
- **Metadata_Access_Constraints** – who may view the record/image (e.g. public, staff only)
- **Copyright_Information => Copyright_Description** – restrictions on using the image
- **Contact_Information => Contact Organization** – who to contact for further information

These seven fields are consistent with the [draft] NPS standards for photo documentation.

2.3. Biological Profile

The objective of the FGDC Biological Data Profile is to “provide a common set of terminology and definitions for the documentation of biological data” (FGDC, 1999). The purpose of this section is to provide an implementation of these standards.

Any dataset that contains references to biological data will have FGDC metadata extensions included in the biological profile completed. The NPS_BioProfile_Edit.xml stylesheet provides the appropriate fields for this extension.

Figure 2 provides the general decision steps for adding biological metadata. Key decision points include (1) whether the standard rectangular coordinates common to geospatial datasets are representative of the biological data collected, (2) the source of biological data (taxonomy, model analysis, or lab work), and (3) if the methodology is described elsewhere.

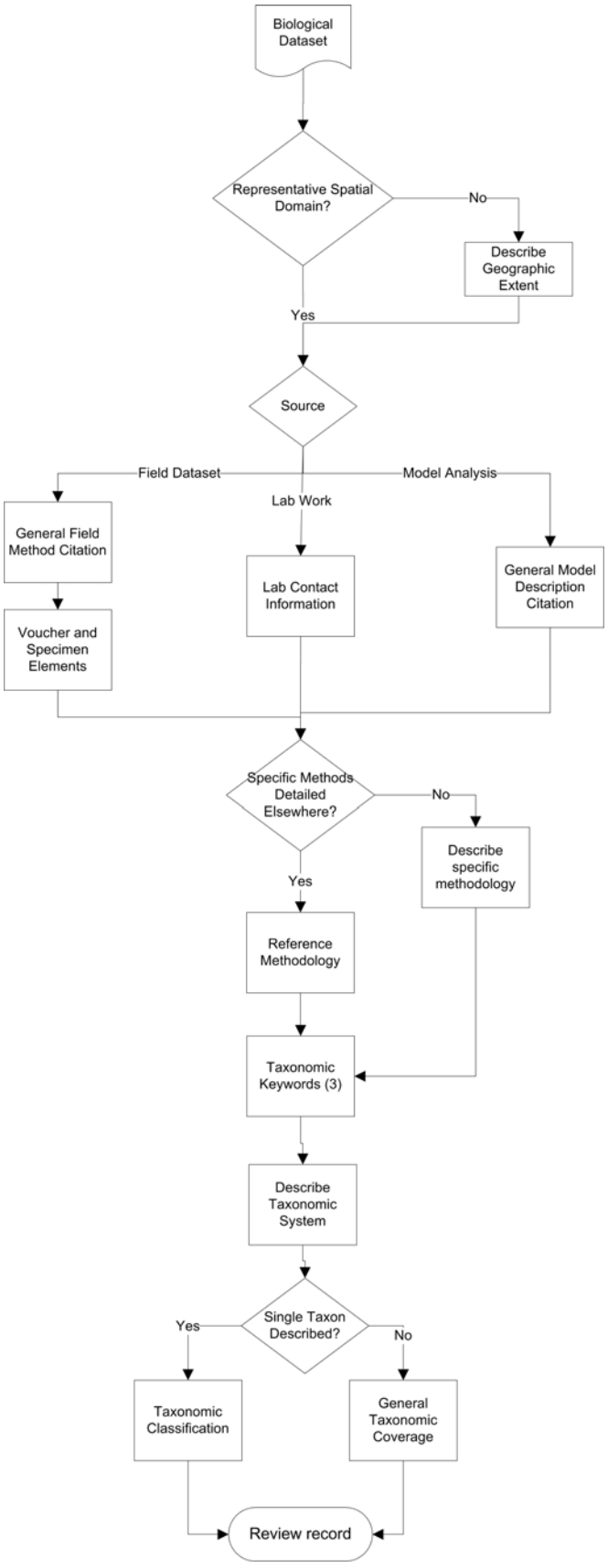


Figure 2. Biological Data Documentation Decisions

2.3.1. Representative Spatial Domain

In cases where the rectangular coordinates of the area of interest are not applicable or insufficient to adequately describe the dataset, the *Description of Geographic Extent* provides a short description of the geographic domain of the data set. Examples include, "Manistee River watershed", "extent of 7 ½ minute quads containing any property belonging to Rocky Mountain National Park", or "ponds and reservoirs larger than 2 acres in Larimer County, Colorado".

2.3.2. Data Sources

There are generally three sources of biological data, each of which requires different documentation. The three are field work, where a researcher collected biological data and possibly voucher information, the results of lab work involving biological specimen, or modeled data.

2.3.2.1. Field work

A general description of a publication containing such a description is required.

2.3.2.2. Lab Work

Datasets may include, or consist entirely of, the results from biological lab work. In this case, a brief description of what the lab work represents and the lab that completed the work will be provided.

2.3.2.3. Analytical Tools, Models, and Statistical Processes

Tools, models, or statistical procedures that the data set is intrinsically bound to and are available for use in analyzing the data set. Examples include reconstructions of phylogenies, population viability analyses, community ordinations, most atmospheric and hydrological transport analyses, and inferences on the effects of climate change on forest composition and productivity. In this case, the *analytical tool* will be described with enough information such that a potential data user can easily determine why they might wish to acquire the analytical tool, and the methodology to acquire it. The *tool contact* is the party from whom the tool, model, or statistical procedure may be obtained.

2.3.3. Methodology

The description of the specific methodology will only be required when not described elsewhere, as in a related report. Such reports must be cited and should be included with the documentation whenever possible.

Methodology is information about a single step of field and/or laboratory work. Each methodology will have a *methodology description*, which is equivalent to "Materials and Methods" in a journal article. It will be important to describe the physical methods used to gather data, the experimental design, sample frequency, treatments or strata, statistical and spatial design of the sampling, and sample completeness, representativeness, and biases. For example, in a bird survey, relevant elements would include the methods used to detect species occurrences (casual sightings, transects, focal point surveys, vocalizations, mist nets), whether or not evidence of breeding activity was required, descriptions of the habitat strata in a stratified design, and known biases (e.g., non-territorial birds were undersampled, and some juveniles could not be identified to species.)

2.3.4. Taxonomy

2.3.4.1. Taxonomic Keywords

Every biological dataset will be documented with at least three *taxonomic keywords*. Examples include "collection" "multiple species" "single species" "amphibians" "animals", "bacteria" "fungi" "invertebrates" "lichens" "mammals" "mosses" "plants" "protists" "reptiles" "vegetation" "vertebrates" "viruses". For each keyword, the *taxonomic keyword thesaurus* will be specified, which is a reference to a formally registered thesaurus or similar authoritative source of taxonomic keywords.

2.3.4.2. Taxonomic System

When used, the *taxonomic system* will be detailed. This involves describing the *classification system authority* and any supporting *classification system citations,* including monographs (e.g., a regional flora) or on-line data sets (e.g., the USDA PLANTS database), etc. When appropriate, the Integrated Taxonomic Information System (ITIS; USDA 2006) will be used. Any *modifications* to the classification system will also be noted. *Taxonomic procedures* describe the methods used for the taxonomic identification and may include specimen processing, comparison with museum materials, keys and key characters, chemical or genetic analyses, etc. *Taxonomic completeness* details information concerning the proportions and treatment of unidentified materials (i.e., materials sent to experts, and not yet determined); estimates

of the importance, and identities of misidentifications, uncertain determinations, synonyms or other incorrect usages; taxa not well treated or requiring further work; and expertise of field workers. If *vouchers* were collected, information regarding the *types of specimen*, the *repository*, and the *contact information* of the individuals who identified the vouchers will also be provided.

2.3.4.3. General Taxonomic Coverage

If the study is not specific to a particular taxon, but is more comprehensive (e.g., survey) the *general taxonomic coverage* describes the range of taxa addressed in the data set or collection. For example, “all vascular plants were identified to family or species, mosses and lichens were identified as moss or lichen.” This provides the capability to document the taxa addressed in the data set or collection via a free text description. This is especially important with data sets or collections which contain examples of a many taxonomic levels.

2.3.4.4. Taxonomic Classification

If the study and data refer to a specific taxon, the taxonomic classification will be identified. One will provide information starting from the taxonomic rank of kingdom to the most specific level which reflects the data set or collection being documented. The levels of Kingdom, Division/Phylum, Class, Order, Family, Genus, and Species will be included as appropriate.

3. Metadata Parser

The Metadata Parser program is used to validate metadata records by checking the syntax against the CSDGM and to generate compliant output files for posting to clearinghouses. It generates a textual report indicating errors in the metadata, primarily in the structure, but also in the values of some of the scalar elements where values are restricted by the standard.

To prevent erroneous parsing errors, the NPS Profile Metadata Parser configuration file (NPS 2006) must be used. The configuration file installs by default when the NPS Metadata Tools and Editor is installed in C:\Program Files\NPS\Metadata. Refer to the NR-GIS Metadata Parsing Guidance instructions (NPS 2006) and the NPS Metadata Tools and Editor documentation (NPS 2006) for details.

Once an XML is parsed and completed, it will be necessary to replace the original XML with the final.

4. Project Documentation

If data or information were created through a known project, the project will also require documentation. The following metadata is required:

- Project Identification – Unique project identification code. When possible, this will be the same as the code used to develop and/or manage the project (e.g., RPRS Project Code).
- Project Title
- Project Contact – Principal Investigator or other contact who was involved in the project or is familiar with the project
- Project Start Date – Date project was initiated. This date will be earlier than the date the information was generated/collected
- Project End Date – Date of final close-out for the project.
- Project Abstract – General description of the purpose and objectives of the project
- Project Products – Cross-reference to dataset, document, and image metadata records.
- Entity Identification and Description – Each element of the project archive will be listed as an entity and have a brief desription.

All data will also be physically bundled together according to the Archive Format Standards SOP (NPS-ROMN 2007).

5. ESRI ArcCatalog Setup Specifications

ESRI's ArcCatalog will require a few modifications to it default setting which will facilitate better metadata development.

First, it is imperative that the Automatically Update and Create Metadata options are turned off (Figure 3).

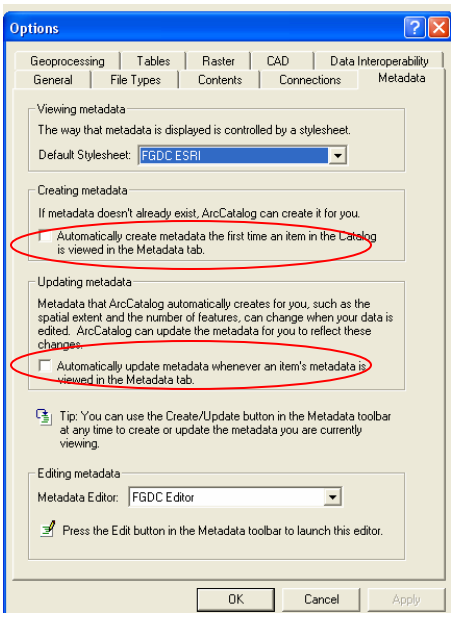


Figure 3. Metadata Options in ArcCatalog

Second, ArcCatalog does not natively recognize zipped files. Therefore, it is necessary to add the ZIP extension to the registry (Tools→Options→File Types). Likewise, ArcCatalog will give the ZIP extension a generic icon. Browsing to and selecting the Winzip executable will give all zipped files a more appropriate graphical representation in the ArcCatalog interface.

6. References

FGDC (1999). Biological Data Profile, Federal Geographic Data Committee Endorsed Standards, [http://www.fgdc.gov/standards/standards_publications/index_html], November, 2006.

NPS (2006). NPS Metadata Tools and Editor, National Park Service, Natural Resources GIS Program, [http://science.nature.nps.gov/nrgis/tools/editor.cfm], November, 2006.

NPS-ROMN (2007). Archive Format Standards for Network Data, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

USDA (2006). United States Department of Agriculture, Integrated Taxonomic Information System (ITIS) [http://www.itis.gov/], November, 2006.

7. Change History

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1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Establishing and Naming Sites and Markers

Monitoring Data Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: June 13, 2007
Authors: Brent Frakes, Dan Manier, David Pillmore, Mike Britten, Billy Schweiger
Abstract: This document describes the process for naming sites and their markers uniquely and establishes minimum documentation requirements.
Suggested Citation: NPS-ROMN (2007). Establishing and Naming Sites, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes the general steps involved in establishing and naming all markers associated with vital sign monitoring. Figure 1 shows the general steps involved.

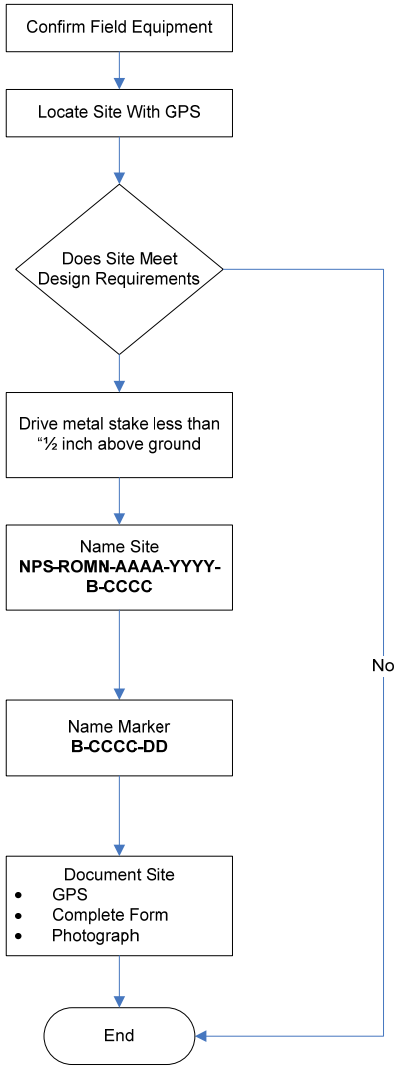


Figure 1. General Steps for Establishing and Naming a Site

2. Fieldwork

2.1. Confirm Field Equipment

The following equipment is necessary when establishing a site:

- GPS – (mapping grade preferred, post-processing correction accepted)

- Metal Stake (approx. 1.2 cm diameter by 50 cm long; See Specific Protocol for Quantity)
- Aluminum Survey Caps (2" diameter holds ~55 char/spaces and protects tip)
- Die set for marking tags – Site information may be done prior to the field visit
- Pliers
- Hammer / sledge hammer
- Digital camera
- Tripod
- White-board (with dark markers)
- Other equipment needed for a specific type of sampling are as specified in its protocol.

2.2. Naming Sites

This section pertains to how sites (plots) are named for all ROMN monitoring protocols. The entire name is not required on the tag, see below for tag details.

Each site will be named:

NPS-ROMN-AAAA-YYYY-B-CCCC

Where "A" is the park code (Table 1),

Park	"A" Park Code
Florissant Fossil Beds NM	FLFO
Glacier NP	GLAC
Grant-Kohrs NHS	GRKO
Great Sand Dunes NPP	GRSA
Little Bighorn NB	LIBI
Rocky Mountain NP	ROMO

Table 1. Park Codes Used in the Rocky Mountain Network

"YYYY" is the year of establishment, "B" is the protocol code (Table 2),

Field Protocol	"B" Protocol Code
Grassland/Shrubland Vegetation Composition, Structure and Soils	G
Wetland Ecological Integrity	W
Stream Ecological Integrity	S
Alpine Vegetation	A
Alpine Lake Ecological Integrity	L

Table 2. Protocol Codes Used in the Rocky Mountain Network

and "CCCC" is a numeric increment. In general, sites of the same protocol should begin at 0001 and increment by 1 (e.g., 0001, 0002, etc.) but must correspond to the codes generated by the study design (e.g., GRTS).

2.3. Naming Site Marker Caps

Ideally, site markers would match the site names. However, there a two related reasons why this is not possible. First, because the markers will be viewed by the public and other NPS personnel not familiar with I&M, it is important the markers contain enough information to minimize the chance that they will be removed or disturbed.

Therefore, markers will be named:

CCCC-DD

Where "C" is a numeric increment and "D" is a location in the design to be specified individually by each protocol.

The final cap will approximate Figure 2, where T1 refers to the grassland-specific design notation:

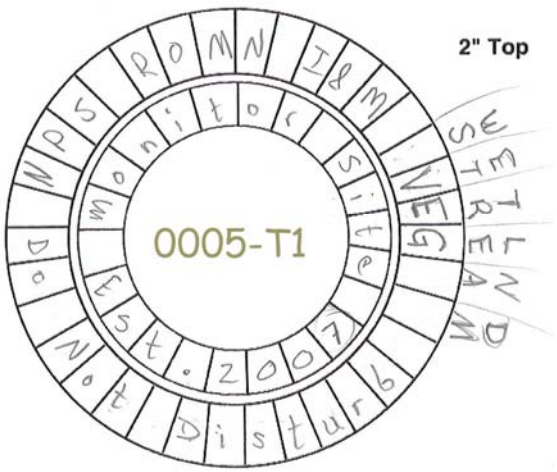


Figure 2. Example Marking Cap

2.4. Documentation

Once the site is established and markers established, the next task is to collect a GPS location (waypoint) for the new mark (minimum 120 points to calculate average). The following are the **minimum** fields are required in any Site Description Form:

- UTM Coordinates
- UTM Zone
- Datum
- Estimated Horizontal Accuracy
- Date Established
- Who Established

Network guidance on GPS use is provided in GPS SOP (NPS-ROMN 2007b).

At least one site overview photo will be taken following the installation of markers. The picture should capture the entire site (markers identified by colored flags to identify their location in the photo) and utilize distinct and permanent landmarks in the landscape that provide orientation (e.g., mountain peak). When capturing the picture, the camera will be held approximately 2.0 meters above the ground surface, with no more than ¼ sky in the picture. A white-board will be placed within the foreground of the image to record park, site, and sample unit information within the image (see details below). The board should be held to minimize glare and reflection (e.g., angle slightly downward) from the sun when necessary.

Camera setting requirements include:

- The automatic date/time stamp will be set to off;
- Images are set to the highest resolution and in “uncompressed” (‘tif’ or ‘raw’) format (except when memory is an issue);
- The flash is turned off;
- Photographs are in landscape format (wider than tall).
- The zoom view is to the widest angle.

Further guidance for photographs is found in the Network’s photo management SOP (NPS-ROMN, 2007a).

3. Roles and Responsibilities

Role	Responsibility
Project Lead	• Naming of all sites and markers • R2
Data Manager	• Confirming names are correct

Table 3. Roles and Responsibilities

4. References

NPS-ROMN (2007a). Photograph Management, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Using the Garmin GPS 76csx, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/ f], Fort Collins, Colorado.

5. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 4. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Field Season Data Management

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes; David Pillmore; Dan Manier
Abstract: This document describes the management of monitoring data during the field season through the final QC and certification for the season's dataset. A common framework for managing the protocol data on the network server is presented.
Suggested Citation: NPS-ROMN (2007). Field Season Data Handling, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document serves as the interface between ROMN Monitoring Plan (Britten et al. 2007), the specific field protocols, and the Data and Information Management Plan (DIMP). It describes the procedures for handling the data generated by monitoring protocol operations during the field season up through final quality control checking and certification for submission to the Data Management Operation. This operation is guided by and conforms to the general data management framework, policies, and guidelines described by the DIMP, which apply generally to all other network operations.

Digital information management is one source of continuity that links diverse objectives and methods across ROMN protocols. Effectively managing the monitoring data collected via one of the ten defined protocols, described in the ROMN Monitoring Plan (Britten et al. 2007) and specified in the field protocols and related SOPs, planned for implementation will be a challenge. In some cases, it may come from field efforts by network staff or cooperators. In other cases, the network will rely on sample measurements and processed information collected from stations administered by other agencies. These data and information will be arriving at different times and in various formats. Managing each protocol will depend on the different network leads and the specific protocols guided by the common framework contained in this document.

Although each protocol is unique, once the data and information is delivered from the field to the network or acquired from a third-party, the process for managing that information is similar. Codification of a common framework for managing both digital and analog information, on the network server and in the network office respectively, is critical for a number of reasons. Foremost, it ensures that the management of information will be similar among all protocols, which will enable the network staff to work interchangeably with minimal confusion. Second, this document provides a common reference for current protocol development and future data managers and project leaders. Finally, this common structure will support management, integration and analyses of all monitoring data for the short- and long-term across all protocols as they report to each vital sign. The purpose of this document is not to function as a “template” or chapter to be included verbatim in every protocol. Instead it is a vision of how the network data management and monitoring operations will work together to acquire, analyze, archive, and report its data; each protocol may implement the specifics slightly differently.

Data management for ROMN protocols reflects the integration of annual field/collection efforts, and associated data, files and analyses, with cumulative (master) data files. Data and information for each protocol will be organized into one of two complementary components on the network server. The annual component, largely detailed in each monitoring protocol and its related SOPs, represents an individual field season's data collection, administration, analyses, and reporting. The master component contains the data and information integrated across all field seasons as well as current and archived protocols. While each functions independently of the other, there must be a clear set of procedures for data sharing because annually accrued information will be used to update the master files.

Figure 1 shows a conceptual framework of the data management activities for each protocol. The annual monitoring component treats each field season as a discrete project. While the details of its data management are included in the specific protocol its deliverables – including datasets and reports for that particular season of data collection – will be available and reported to each of four clients. The parks and the respective WASO databases will receive a copy of each season's final products. Non-sensitive products will be available to the public. Most importantly, the deliverables feed into the master operation for the respective protocol, creating a cumulative value product beyond the annual events. The master operation manages the main long term database, analyzes the accumulated information, and produces the integrative reports and trend analyses. In summary, the annual monitoring efforts and the master operation, while part of the same general process, are discrete functions which require different strategies for effective management.

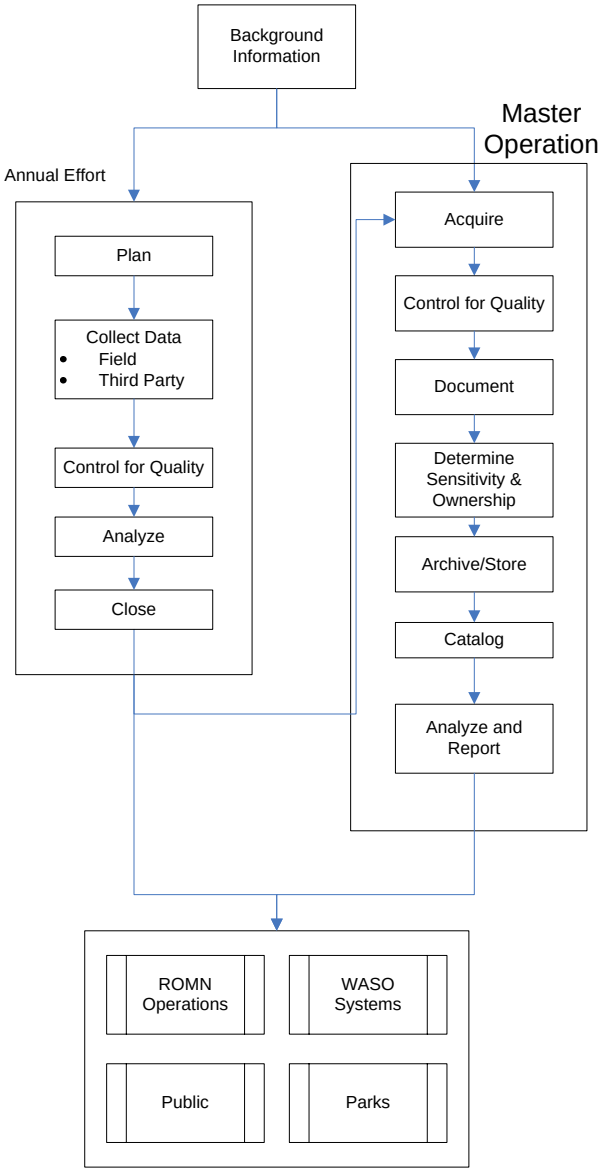


Figure 1. Monitoring Data Operation Overview

The remaining sections discuss each process and their interface in more detail. Section 2 outlines the steps involved in the annual monitoring component, from planning to reporting. Section 3 then describes the ongoing maintenance of the master component.

2. Annual Component

ROMN organizes the annual monitoring efforts, and the associated information products, according to four phases – plan, conduct field work, analyze, and close. These steps are comparable to the general project life cycle, although the specific steps (and any addition) will be customized to match the specific stages of each protocol. Steps are detailed in each protocol (or the respective SOPs) and need not be duplicated

here except for brief mention. The following diagram and description is provided as a general guide to elements that must be considered by protocol developers and field season planners.

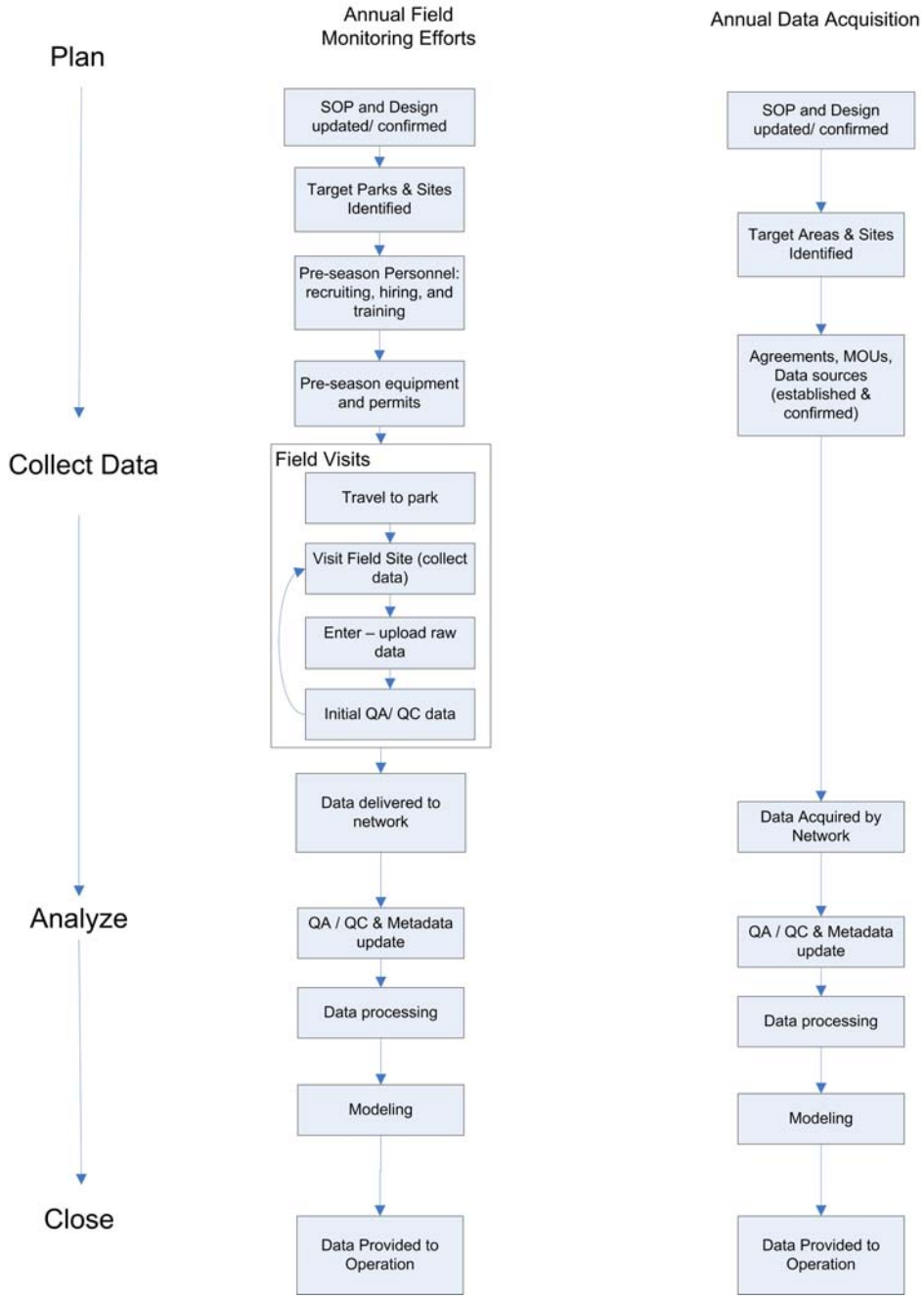


Figure 2. Conceptual Workflow for (a) Data Collected in the Field and (b) data Obtained by Sources External to the Network

2.1. Plan

The planning stage involves all of the background work necessary to accomplish the season's data collection. Steps include identifying shortcomings of previous year's planning efforts, protocols and SOPs; revising the datasets, field forms, protocols, and SOPs; and developing an annual work plan for each protocol including allocating necessary funding, target park and site identification, staffing, equipment, permits, and schedules. Each field trip requires developing a trip plan and organization. The Principle Investigator (PI) or Network Lead will generally be responsible for this stage of the annual effort.

2.2. Collect Data/Fieldwork

This is the stage where data are generated from field work or acquired from external sources by network staff or cooperators. The details of this process are expressed in the specific protocol involved. Quality assurance and initial quality control are performed during this stage (see the QA/QC SOP for more guidance, NPS-ROMN 2007g). The PI will generally be responsible for this stage of the annual effort.

Preservation of the field data in its original form and order of collection is essential to ensuring high quality information. At the end of each field day, or when returning to the office following a multi-day field effort, all digital data (databases, pictures, waypoints, etc.) will be downloaded to an agreed-upon primary fieldwork folder location on an office computer. This primary folder location will **not** be located under "My Documents".

All digital data will be placed in a subfolder titled by the current date (YYYYMMDD). In general, it is possible to place all information types (e.g., database, pictures, waypoints) in the same folder since the data formats are self-evident. However, when necessary, subfolders can be created to further split out the data by content. For example, a distinct folder for official plot photos and another for other photos may be required. Also, when data downloads from different data loggers are impossible to distinguish without reading the file contents, separate folders are also warranted.) When possible, all hardcopy/analog sheets will be digitized to 300dpi B&W PDFs and placed in the appropriate subfolder. Once all data are placed in the correct subfolder, the subfolder will be set to read-only. Figure 3 provides an example of how the folder organization might look.

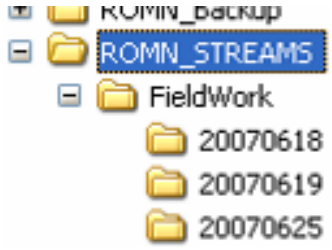


Figure 3. Example Organization of Fieldwork Folders for the Steam Protocol.

Some fieldwork may produce hardcopy/analog information, including field forms, which must be managed separately from the digital information. A clear folder location will be identified where these are to be kept. Separate folders, corresponding to each field trip, will be named identically to the digital sub-folders (i.e., YYYYMMDD).

2.3. Analyze

The analysis stage involves additional quality control, statistical analysis, and synthesis according to the detailed specifications included in the individual protocol specifications. The PI will generally work with the data management staff but will have the primary responsibility for this stage of the annual effort.

2.4. Close

The close-out stage includes development of all the final products, as specified by each protocol. This step serves the purpose of providing finished annual data to the Master Component (below) and preserving the finished annual data and information in a single archive primarily for future reference by ROMN staff. Data management staff will work closely with PIs and be jointly responsible for finalizing this step. Although the exact products may vary by protocol, the following are generally considered the standard items for closeout:

- Finalized and quality controlled relational field season database with a metadata record (*.mdb);
- A copy of the finalized relational database (line above) as individual pipe "|" delimited text files (*.txt). An image of the table relationships (*.jpg or *.pdf) will also be provided. Tables are exported to text in the off-chance that future users are unable to open the MS Access proprietary format.
- A copy of the protocol and all SOPs used to collect and manage the information for that field season (*.pdf);
- Blank field forms (if not fully described in the protocol; *.pdf)
- Final analyses and reports concerning that field season's data (*.pdf);
- Investigator's Annual Reports (*.pdf),
- Research Permits (*.pdf);
- Georeferenced and watermarked photographs (*.jpg; See NPS-ROMN 2007h);

- Native GIS data layers (specifically lines, polygons, and grids – points may be stored natively in tables) with metadata (*.shp).

2.5. Organization of Annual Projects

Figure 3 shows the “best practice “organization for how the annual information is will be stored on the network server.

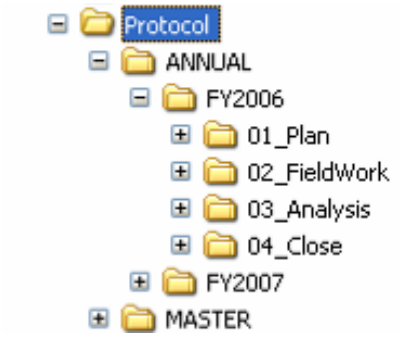


Figure 4. Main Sub-Folders for the Protocol as a Project

Within each protocol, the \ANNUAL\ folder for a specific year contains all of the data and information generated during a single field season. It is comprehensive, meaning that it includes the raw field data, quality controlled data, analyses, and final reports. Any and all changes to the published protocols must be documented in the annual folder. If the protocols changes are significant enough a new version of the protocols will be saved in the Master Folder (published) and referenced in a report in the annual folder. These steps are an attempt to ensure that future analyses will be able to reference exactly which protocols were in use in a given year. Preservation of the time element is essential, therefore, all folders will be organized accordingly. A “best practice” is to organize them by fiscal year (e.g., FY2006, FY2007, FY2008…) and then by a customization of the project life-cycle. The \01_Plan\ sub-folder contains all of the planning-related items, including scopes of work, cooperative agreements, and trip planning. The \02_FieldWork\ folder contains all of the unanalyzed, raw field data, including the field database, photographs, GPS waypoints, field notes, and any digitized field forms. None of this data is quality controlled, unless otherwise specified as part of the field protocol. The \03_Analysis\ folder includes final quality control checked datasets, synthetic datasets, spread sheets, statistical summary and analyses, and etc. The last folder, \04_Close\, contains the finalized data and information products specified by the protocol, including the finalized dataset(s), report(s), permits, photographs, field sheets, metadata, and protocols for that specific field season.

Because the annual folder reflects the chronological nature of information generation, there are a number of best practices which reinforce this. First, folders are cleaned up and organized once they are no longer in use. For instance, once planning is complete, removal of temporary files and the verification that file names are appropriate (See NPS-ROMN 2007d – File Naming Conventions) will aid in the long-term interpretation of this information. Second, folders are set to read only once they are cleaned up, organized and no longer being modified. This ensures that the data isn't accidentally corrupted. Finally, at the end of each reporting year, when the data is finalized and the annual reports are completed, all of the information found in the sub-folders is zipped (preserving the subfolder structure) as one archive. The zipped archive is named by the protocol, year the data was collected, and the date when the information was archived (as YYYYMMDD). This archive for each field season is stored in a secure area on the master server.

2.6. Integration with WASO Information Systems

In the interest of preserving the original data for each field season, the Network will update the national WASO systems annually. Because of issues relating to data sensitivty (see Approving Information for Distribution, NPS-ROMN 2007a), only a subset of the closeout information will be provided to the NPS Data Store (NPS 2006) as a bundled archive (see Archive Format Standards; ROMN 2007b). Although the exact products may vary, the following are generally considered the standard items for distribution to the NPS Data Store:

1. Finalized and quality controlled field season database with a metadata record (*.mdb) – point locations and sensitive records will be modified according to Approving Information for Distribution, NPS-ROMN 2007a;
2. A copy of the protocol and all SOPs used to collect and manage the information for that field season (*.pdf);
3. Blank field forms (if not fully described in the protocol; *.pdf)
4. Final analyses and reports concerning that field season's data (*.pdf) - point locations and sensitive records will be modified in according to Approving Information for Distribution, NPS-ROMN 2007a;
5. Native GIS data layers (specifically lines, polygons, and grids – points may be stored natively in tables) with metadata (*.shp) - point locations and sensitive records will be modified in according to Approving Information for Distribution, NPS-ROMN 2007a.

3. Master Component

This section describes the ongoing component of any protocol. Unlike the annual efforts, which have a distinct beginning and end, the master component is continuous and known as the Data Management Operation (NPS-ROMN 2007c). The following section touches only briefly on the major components of the DMO attempting to focus on those parts of most importance to the Protocol Leads and treats the annual effort as being entirely separate from the master component; this distinction has two advantages. First, it provides a clear demarcation of duties which prevents staff from confusing data management tasks and responsibilities; although annual data management is the responsibility of the Protocol lead/PI, due to staff limitations, the network data manager and other staff will often work collaboratively in multiple roles. Second, it provides an extra level of quality control since it does not assume that any of the annual deliverables are of sufficient quality to be integrated into the Master database until confirmed. In general, the data manager has complete responsibility for the oversight and management of this component.

3.1. Acquire/Generate

Information integrated in the master component will come primary from the annual protocol closeouts. The PI of each protocol will notify the data manager of the location of the annual component that has been organized into one archive.

3.2. Evaluate for Adequate Quality and Documentation

Upon receiving the zipped archive, the data manager will check for the following:

- The annual component is named properly;
- There is a logical folder structure which preserves the temporal component of the annual planning, fieldwork, analysis, and closeout;
- The close-out folder is clearly labeled and contains all relevant products;
- Metadata and file names are sufficient to understand each information element

In cases where the data manager determines any one of these to be insufficient, the PI will be notified. It is the responsibility of both the PI and data manager to rectify the problems.

3.3. Sensitivity & Ownership

Datasets, especially raw datasets may easily contain sensitive information such as the location of commercially valuable species or cultural artifacts. The sensitivity and

ownership of collected data is articulated in the Approving Information for Distribution SOP (NPS-ROMN 2007a).

The data manager will review the final products for sensitivity and ownership conflicts. In cases where products were not originally flagged as being sensitive, the data manager will consult with the PI regarding their status.

3.4. Archive/Store

All information related to the master component is stored in its respective /MASTER/ folder

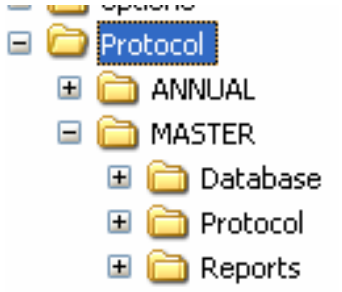


Figure 5. Main Sub-Folders for the Protocol as an Operation

The \MASTER\ folder represents the integration of the ongoing operation and is organized into three sections. The \Database\ folder houses the master database for that respective protocol. This is the official copy of all protocol data which contains all years of data collection. The \Protocol\ folder contains the current protocol, related SOPs, and an archive of previous versions. Finally, the \Reports\ folder contains the integrative/synthetic reports where protocols are analyzed for all years of data collection. By maintaining all of this information together, it would be possible to distribute the master database, protocols, and reports as one archive.

3.5. Report

The NPS does not currently have enterprise-level systems capable of managing and dissemination protocol data. However, the NPS Data Store (NPS 2006b) does function as a metadata repository that is publicly accessible. Therefore, the network will post metadata records regarding the availability of the dataset. Upon request, the Data Manager will distribute this information externally to cooperators and/or the public via CD, file transfer, or hardcopy (see ROMN Phase III and specific SOP for Analysis and Reporting plans; Britten et al., 2007).

Copies of all reports, presentations, journal articles, fact sheets, etc. will be provided to the network Library (NPS-ROMN 2007e) within 10 days of completion.

4. Roles and Responsibilities

Role	Responsibility
Project Leader	• Ultimate responsibility for ensuring that this SOP is followed for their particular protocol • Collection, quality control, analysis and reporting
Network Staff	• Understanding and adhering to this SOP
Network Data Manager	• Updating this SOP • Assisting project leader in management of information • Archiving, posting, updating, distribution gatekeeper

Table 1. Roles and Responsibilities

5. References

Britten, M., E. W. Schweiger, B. Frakes, D. Manier, and D. Pillmore. 2007. Rocky Mountain Network Vital Signs Monitoring Plan. Fort Collins, Colo.: National Park Service, U.S. Department of the Interior.

NPS (2006). NPS Data Store, National Park Service [http://science.nature.nps.gov/nrdata/], November 2006.

NPS-ROMN (2007a). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007b). Archive Format Standards for Network Data, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007d). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007e). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007f). Project Deliverable Specifications, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007g). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007h). Using GPS-Photo Link to Georeference and Watermark Photographs, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

6. Change History

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1.0					

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

File Naming Conventions

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document describes the logic and process for naming all digital files managed by the Network. It accommodates draft and final versions and also geospatial information.
Suggested Citation: NPS-ROMN (2007). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This SOP provides guidance for the naming of all digital files used by the Network staff. Consistent naming conventions are an effective means of quality assurance because it minimizes confusion over file versions and purpose.

There are two considerations when outlining the guidance. First, it is recognized that file naming conventions will change through time as staff, NPS and Network Policies, technology, formats, and the uses of the information change. Therefore, the first part of this SOP addresses the goals that any naming convention should meet. The second part of this documents the current standards.

2. Functional Requirements

As naming conventions change and are updated, the file naming conventions will:

- Clearly distinguish between final and in-progress documents;
- Minimize confusion over file versions;
- Ensure the file names are unique;
- Accommodate all types of information used by the Network;
- Be consistent with other NPS and Federal Standards when files are shared externally.

3. Standards

3.1. General

The following general standards apply to all files:

- File names will be no less than 8 and generally not be greater than 30 characters in length. They must never have spaces or special characters (e.g., $%@!)
- Author names will only be the first author. Acronyms are only acceptable for state and federal agencies. Except when necessary, the author of all network publications will be the network code. Unknown authors will be referred to as “NoAuthor”
- Dates will be one of the three following formats. YYYYMMDD, YYYYMM or YYYY. Unknown dates will be referred to as “0000”
- Titles will be as descriptive as possible. Titles will follow the proper case (e.g., FirstSecondThird). An underscore is optional following an acronym (e.g., ROMN_BugReport). In cases where the file already has a title page, metadata record, or is catalogued, the filename title should be close, if not identical to the prescribed title. In cases where the file does not have a title page, metadata record, or is not catalogued, the file title will be [SpatialScope][Description] (e.g., ROMO_VegetationMap, ColoradoRoads, US_Airports). All references will have a title. “NoTitle” is not allowed.
- Long file name may not be possible for some file formats (i.e., ESRI coverages and grids). In this case, the file names will only be the Title. Further information will be provided in the associated metadata record.

Specific standards depend on three additional criteria – status, whether a file is linked (referenced) by another, and its format. Figure 1 provides a decision tree based on these criteria while the remaining sections provide more guidance and naming examples.

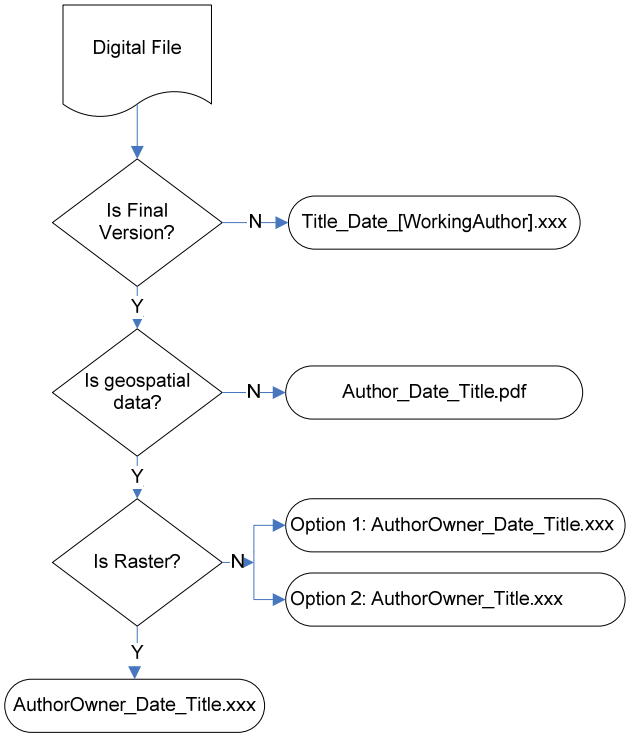


Figure 1. Decision Tree For Naming Digital Files

3.2. Status: In Progress or Final

Status refers to where a file is in its life cycle. Files ***in progress*** are those that are draft, incomplete, currently being edited, or have not been evaluated for quality. In contrast, files are ***final*** when they are complete for their respective version, finished, and have been evaluated for quality.

In progress documents will be named:

Title_Date_[WorkingAuthor].xxx

The Working Author [WorkingAuthor] applies when two or more staff are working on the same draft. For example, the AARWP2005_20051021.doc may be the primary working document while AARWP2005_20051021_Frakes.doc and AARWP2005_20051021_Pillmore.doc are modifications of that draft by those

respective authors. Ultimately, modifications by those authors will be integrated into a draft with a different date (e.g., AARWP2005_20051029.doc)

When practical, each time a document is edited, the draft should be incremented by the date of edit, where date is represented by YYYYMMDD. In cases where two different drafts are created on the same date, the file should be incremented by letter of the alphabet after the date (e.g., 20060512a, 20060512b).

Document format (xxx) is specified by the appropriate 3-letter extension (e.g., doc, xls, txt).

Examples of in-progress files include:

- GLACWatershedCondition_20060621.doc
- LIBI_BatInventory_2004.mdb
- GLACParkBoundary_20060412.shp

3.3. Geospatial Data or Document

Files that are in final version must be further evaluated to determine whether they are geospatial information. Geospatial files are always ***linked*** because they are called by mapping software, including ArcMap, and can be projected onto a map. Examples of geospatial data are all ESRI compatible formats that include: delimited text files, spreadsheets, raster, vector, geo-databases, and relational Access databases containing records attributed by a location. In addition, photographs are included in this category because they also have a location where the photograph was taken (the precision of this location may vary, however).

It is important to note that in rare cases, some files may be non-geospatial but still be linked. One case where this occurs is when documents are linked by a generic URL (e.g., <Click Here for the Current Calendar>) which only occurs when documents reside as a mirror copy to a web server. Furthermore, it is also possible to link other documents, including Visio documents, although this practice is discouraged.

Final non-geospatial files are most often reports, letters, graphics, and other word-processed documents. The naming standard for these is:

Author_Date_Title.pdf

PDF is the preferred extension because it is the Network policy that all final non-geospatial documents be in portable document format (pdf). Example names of final, non-geospatial files are:

- Smith_2006_WaterQualityAssessment.pdf
- ROMN_2005_PhaseIIMonitoringPlan.pdf

3.4. Geospatial Data Format: Raster or Other

The name of a final geospatial file depends on whether its format is ***raster*** or ***non-raster***. Raster files include digital photographs from handheld cameras, satellite imagery, digitized aerial photographs, digital raster graphics (DRGs) and grids (e.g., digital elevation models). File extensions frequently associated with these formats are (*.jpg, *.tif, *sid, *.img).

The naming standard for final raster files is:

AuthorOwner_Date[Time]_Title_[SequentialNumber].xxx

In this case, date refers to the date the photograph represents on the ground (which may be different than the date is what published). Time, as HHMM using 24 hour time, is optional. In cases where there are multiple photographs with the same author, title and date, each photograph should be numbered sequentially by number or flight line.

Frequently, the primary owner of the data will be synonymous with the author. For instance, all datasets produced by the Network will have the network code, and not the name individual who created the dataset. Datasets produced by other federal agencies will have their respective acronyms.

Examples of final, linked, raster file names are:

- NASA_20060421_GLACLandsatTM7.tif
- USGS_2002_ColoradoNLCD.img
- Frakes_200606251034_ROMOFallRiverRoad_02.jpg

Non-raster refers to any geospatial file that is not a raster. To accommodate data versions, there are two possible naming options. In Option #1, the current version will be named

AuthorOwner_Title.xxx,

while older, outdated versions will be named

AuthorOwner_Date_Title_.xxx

where date is the date the version became obsolete or was replaced by a newer version.

In Option #2, legacy and outdated information will be stored as a distinct feature class within a geodatabase or as its own record within a shapefile or coverage. For instance, instead of having five distinct files representing older versions of a Park's boundary, there will be one shapefile with five records, four of which are attributed as being out-of-date. For option #2, the naming convention is

AuthorOwner_Title.xxx

Examples of final, linked, non-raster file names include:

- ROMO_ROMOBoundary.shp
- Bock_LIBIVegetationSurvey.mdb
- ParkCode_DescriptionOrLocation_YYYYMMDD_SequentialNumber.xxx

4. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Guidelines for Maintaining and Using NPSpecies

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: David Pillmore, Brent Frakes, Mike Britten
Abstract: This document describes the requirements for adding records to NPSpecies and the process for uploading them to NPSpecies.
Suggested Citation: NPS-ROMN (2007). Guidelines for Maintaining and Using NPSpecies, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This is a general guideline for updating and managing the information in NPSpecies. Detailed instructions in the programs operations are covered on the web. For a description of its options Please See:
http://science.nature.nps.gov/im/apps/npspp/NPSpeciesMainMenu.htm

NPSpecies is a dynamic database that will only have long-term value to the parks, Network, or the Service through a continued commitment to keeping it accurate and current. Not only will updates to the vertebrate animal and the vascular plant records be necessary, but as species lists and vouchers become available for a wider range of taxa (for example, invertebrates and non-vascular plants), NPSpecies should be updated with this information as well.

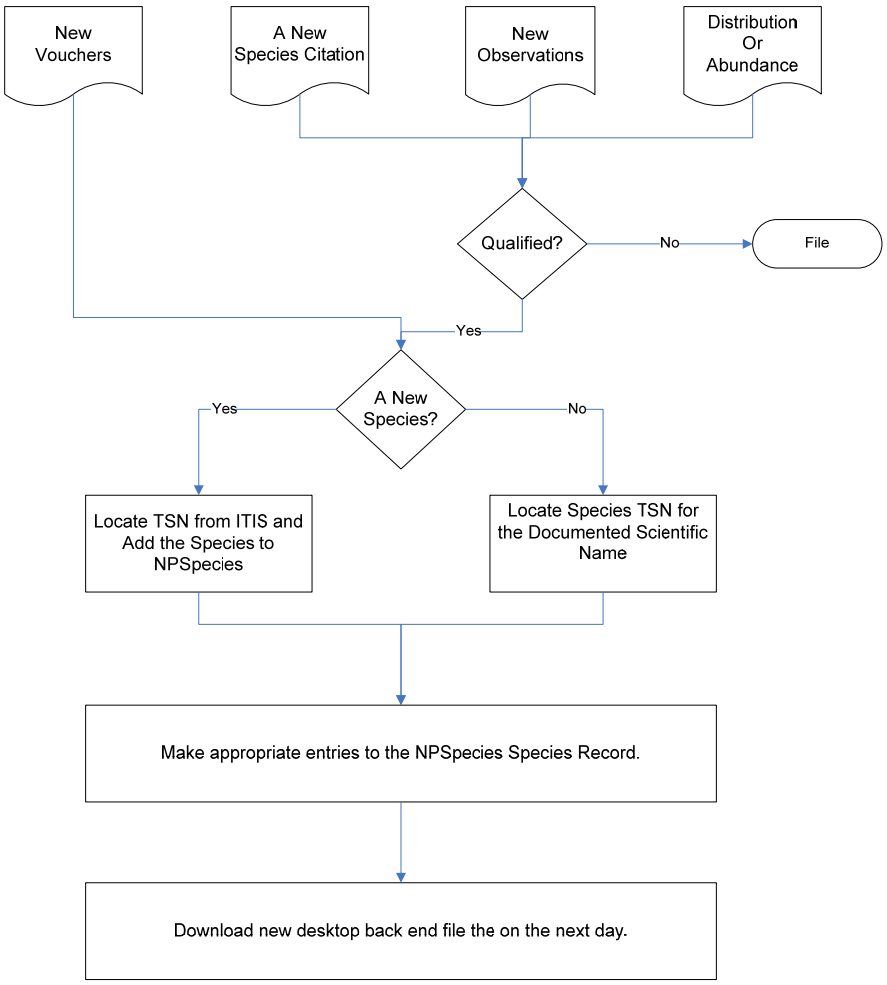


Figure 1. Steps for Adding or Editing NPSpecies Records

2. Qualified Data Sources

NPSpecies is the National Park Service database to store, manage and disseminate scientific information on the biodiversity of organisms in National Park Service units throughout the United States and its territories. Data may come from park research or operations, from permitted research by science partners, from the NPS I&M program, or from observations by qualified observers which have been verified by recognized experts.

Criteria for adding to NPSpecies include:

- New vouchers
- A new species is documented by research or operations
- New qualified and verified observations accepted by park
- New information for the “Park Status”, “Abundance”, “Residency”, or “Nativity” fields

New species-related information is only acceptable for entry into NPSpecies when it is well documented. Although it is impossible to define a completely objective means for determining qualification, the following cases meet the standard.

- A properly documented voucher. In some cases a photographic voucher is acceptable when properly verified.
- A citation for species information from a peer reviewed scientific publication.
- Species data from vegetation plots and transects usually qualify to expand the scope of the information contained in NPSpecies but not to add a new species to the system.
- Rare animal observation forms containing documentation of qualified and verified observations that have been accepted by the park may be added. Observations need to be carefully reviewed as to their source and repeatability before being entered into NPSpecies.

Species information will be entered into NPSpecies and given a “Park Status” under the following conditions:

- A “Park Status” of “**Present**” or “**Probably Present**” requires proper documentation and the instruction of the proper park representative.
- A “Park Status” of “**Historical**” requires either published records or vouchers to be included.
- A “Park Status” of “**Encroaching**” (as in exotic species) requires proper documentation by external sources and acceptance by the proper park representative.
- A “Park Status” of “**Unconfirmed**” may be assigned to records that are uncertain but otherwise possible valueable.

- Entries in NPSpecies that are found to be incorrect may be given a "Park Status" of "**False Report**" if there is reason for maintaining the entry (for example, it is cited by a published scientific article or report).

3. Data Entry

If the new entries are relatively few in number (i.e., 10 or less) they will be entered into the online version of NPSpecies directly. Cross-referencing NPSpecies records to NatureBib citations will be done online:

https://science1.nature.nps.gov/npspecies/web/main/start

4. Batch Processing

If a group of vouchers or observations are to be entered, and they are in electronic format (i.e., Spreadsheet or Database) then they can be entered into the desktop version of NPSpecies as a batch process (Figure 2). It is also useful in some cases to add or edit large numbers of NPSpecies records, (species, vouchers, or observations). This is done offline using the desktop version.

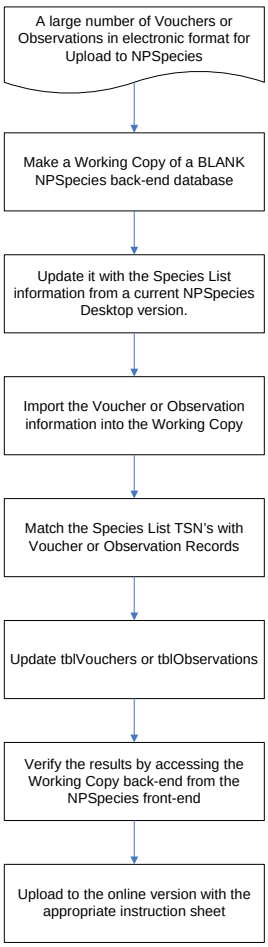


Figure 2. Steps for Batch Updating of NPSpecies Records

The desktop version and species lists are located at:

https://science1.nature.nps.gov/npspecies/web/main/start

Details on using the desktop application are found at:

http://science.nature.nps.gov/im/apps/npspp/Discover.htm

5. References

NPS-WASO (2006). , National Park Service NPSpecies Home Page, [http://science.nature.nps.gov/im/apps/npspp/index.htm], December 2006.

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1.0					

Table 1. Change History

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7. Appendix – Example Forms and Reports

Rocky Mountain National Park
Rare Bird Report

Species: Barrow's Goldeneye

Plumage: breeding, non-breeding, imm. (First winter male)

Date: 5/6/07 Observer: Scott and Julie Roederer Phone/email: 586-8812

Location of sighting: Sprague Lake

Field marks noted: This bird was obviously a goldeneye based on the shape of the head, its petite bill, and general body shape. It was diving. It had a blackish head, a light breast, and an entirely black bill, making it a male, but it was not in full adult plumage. The sides were streaked with gray, and the back was a dark gray lacking the definite white markings of either goldeneye adult male. What did show were the beginnings of the adult markings, a thin, elliptical, whitish area behind the bill and an almost clean white slash on the flank. Those two marks indicated Barrow's rather than Common Goldeneye. A careful study of the head shape showed it to be large and blockish with a decidedly straight top and a sharp, almost vertical drop to the bill. The bill was disproportionately small.

Similar species considered: Common Goldeneye, first winter male. The whitish spot behind the bill is more limited and rounder, not elliptical. The head is smaller, lacks the squared top, and has a much less acute angle from crown to bill in the front. The bill is larger.

Reason for report (e.g. rare bird, out-of-season, nesting): This species is not on the current Rocky Mountain National Park checklist. Previous sightings have been outside Park boundaries.

Viewing conditions/equipment: Midday. Overcast with intermittent snow but light was adequate. Bird observed at distances of 40 m. to 100 m. with Leica 8x42 binoculars for a half hour or longer.

Other notes: Gary Matthews confirmed the identification independently within an hour, using a scope.

Thank you for filing a report.

Colorado Field Ornithologists Sight Record Form

(Please print or type. Attach photographs and additional pages if necessary.)

Each table cell will automatically enlarge as you type!

CBRC FILE #:		
RESULTS:		
Species: (Common Name)	(Scientific Name)	
Date(s) of occurrence:		
Number of birds seen:	Sex:	Plumage:
Exact location:		
County:	Nearest town:	Elevation:
Length of observation:	Time(s) of observation:	
Other observers who saw the bird(s) with you:		
Other observers who independently saw the bird(s):		
Light conditions (quality; direction relative to bird(s) and observers position:		
Optical equipment used:		
Distance to bird(s) (estimated, unless otherwise noted):		
Was (Were) bird(s) photographed?	If so, are you submitting photos?	
Who took the photograph(s)?		
Describe the general and specific habitats in which the bird(s) occurred:		
Describe the bird's (birds') behaviors, particularly behaviors that were used in supporting the identification, e.g., flying, feeding, habits:		
DESCRIPTION -- **This is the most important part of this report.** Include in these details the overall size and shape of the bird and give as many plumage details as possible, even including those that you feel might not have relevance to the specific identification. Please fill out this portion even if photos are accompanying your report.		
Describe the bird's (birds') call(s) and/or song(s), if noted:		
SIMILAR SPECIES – **This is another critical part of your report.** Please discuss how you eliminated similar species from consideration:		
What is your prior experience with this and similarly appearing species?		
List books, guides, recordings, or other sources consulted and how these influenced your identification (during and after observation):		
This report was made from (check one) ___ notes made during observation ___ notes made after observation ___ later from memory.		
Date and time of written report:		
Reporting observer:	Signature:	
Reporting observer's address:		
City:	State:	Zip:

Send report to:
Colorado Bird Records Committee
Larry Semo
9054 Dover Street
Westminster, CO 80021

MONTANA RARE BIRD REPORT FORM

Species:

Date observed:

Observer:
Address:
Phone:
E-mail:

Photo taken/enclosed?:

Specimen taken?:

Other observers:

QLL: **Status (B, b, W, w, t):**

Nearest town:

Specific location:

Lat/Long:

Describe the habitat:

Plumage:

Sex/age:

Optics used:

Quality and direction of light (if applicable):

Distance from bird:

Duration of observation:

Previous experience with species:

This report was written (from memory, field notes, at time of sighting, etc.):

Notes:

Describe the bird. Record only field marks and behaviors you actually saw. State size (compared with other nearby known or common birds). Record relevant information such as color, body shape, bill, legs, voice, behavior, number of individuals, sex:

Discuss how similar species were eliminated:

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Photograph Management

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore, Dorothy Mortenson et al. (SWAN)
Abstract: This SOP describes the entire working process for managing photographs. It specifies appropriate formats, organization, and sensitivity issues related to photographs.
Suggested Citation: NPS-ROMN (2007). Photograph Management, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes a management strategy to preserve, organize, store, name and retrieve photographs in electronic format. The intent is to centralize processing and storage, preserve digital metadata from the camera, reduce wasted disk space, and make photos readily accessible.

Figure 1 provides a graphical view of the general steps involved in managing photographs. The remaining sections provide more discussion of each of these steps.

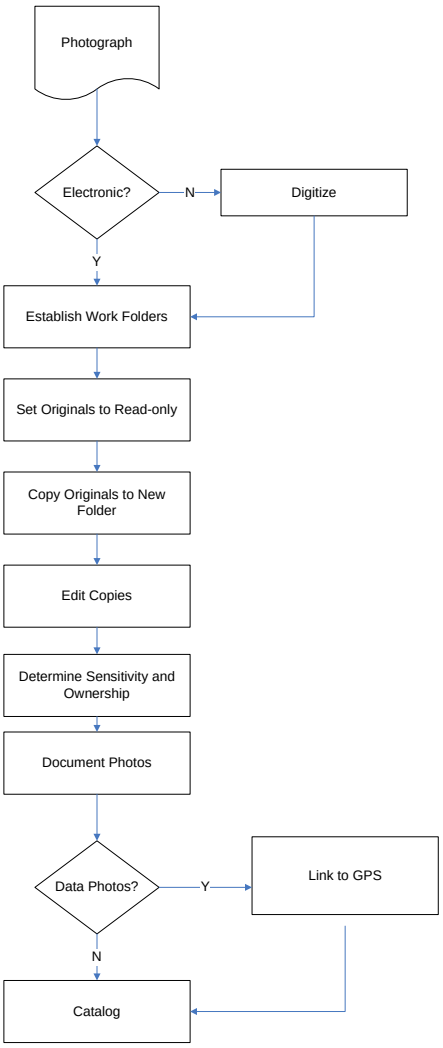


Figure 1. General Steps for Photograph Management

2. Acquiring Photos

Digital cameras will be set at a resolution appropriate for the highest level use to which a photo may be used. Publication quality photos will be taken at a minimum of 4 megapixels. If the camera will allow, the resolution will be set at 1760 x 1168 or higher. The quality will be set for “super fine” or “high”.

Photographs formats will be either jpg (Joint Photographic Experts Group standardized format) or tif (Tag Image File Format).

Because the destination of a photo is unknown at the time it is taken, it is recommended all photos be taken with this resolution or for lower resolution cameras, the highest resolution possible. It is best to decrease the resolution for web use or thumbnails in the office using software.

Most digital cameras can digitally imprint the date and time onto the photo image. In general, it is recommended that this feature not be used. Date and time data are embedded in the exif data area by most digital cameras. If the image is being cataloged and documented it has value – imprinting the image reduces the image quality and hence the image value. The exception may be for projects collecting massive numbers of photos – imprinted dates and time could facilitate data linking.

Digital camera internal clocks are subject to minor cumulative errors. Accurate camera date and time is important to maintain, it is recorded as the file creation date for each photo and for jpg formats it is embedded in the photo itself. It is best to frequently sync a camera time to an active GPS or to the network time. Beware of time zone changes where appropriate.

Different brands of digital cameras name photos differently. Typically the camera will have several file naming options. These may include:

- Sequential numbering which resets each time a memory card is formatted or a new card is put in.
- Sequential numbering which loops from 0001 to 9999.
- Numbering based on date-photo sequence.

As a general rule, the most useful setting is a date-photo sequence, then the 0001-9999 loop and the least useful the card based sequence. Projects must carefully review the naming options of the project cameras for the most useful convention. Projects must also ensure the same convention is used by all cameras collecting data photos.

The following items/settings will be confirmed prior to acquiring photographs in the field:

- All old photographs are removed
- Camera is functioning properly
- Date and time set correctly
- Batteries charged with an extra set
- Photo resolution is set to maximum
- Photographs format is set to JPG (or TIF)
- Date/Time photo imprint is set to OFF
- Clean rag for cleaning lens
- Waterproof pouch is in sound shape

3. Digitizing Photos

Below are the minimum recommended scan resolutions for different formats. Higher resolution scans will yield larger and better quality images.

3.1. 35mm color slide or negative

- Scanner will be set up to scan transparent materials - both hardware and software
- Choose source size of approx. 1.3 x .85 inches (software will auto-detect this exact dimensions)
- Choose target size same as original
- Choose resolution 2400 dpi, 24 bit color (do NOT use 32 or 48 bit color)
- Save as uncompressed TIF file
- Scan to yield file size approximately: yields file size approximately 3120 x 2040 pixels, file size 15-20MB

3.2. 3 1/2" x 5" color photograph

- Choose source size 3.5 inch x 5.0 inch (software will auto-detect the exact size)
- Choose target size the same as the original
- For color photo, choose resolution 600-700 dpi, 24 bit color (do NOT use 32 or 48 bit color)
- For black & white photo, choose resolution 600-700 dpi, 8 bit grayscale (do NOT use 16 bit grayscale)
- Save as uncompressed TIF file
- Scan to yield file size approximately: yields file size approximately 3000 x 2100 pixels, file size 15-20MB

3.3. 4" x 6" color OR black & white photograph

- Choose source size 4.0 inch x 6.0 inch (software will auto-detect the exact size)
- Choose target size the same as the original
- For color photo, choose resolution 600 dpi, 24 bit color (do NOT use 32 or 48 bit color)
- For black & white photo, choose resolution 600 dpi, 8 bit grayscale (do NOT use 16bit grayscale)
- Save as uncompressed TIF file

- Scan to yield file size approximately: yields file size approximately 3600 x 2400 pixels, file size 15-20MB

3.4. 5" x 7" color OR black & white photograph

- Choose source size 5.0 inch x 7.0 inch (software will auto-detect the exact size)
- Choose target size the same as the original
- For color photo, choose resolution 600 (450 if controls allow it) dpi, 24 bit color (do NOT use 32 or 48 bit color)
- For black & white photo, choose resolution 600 (450 if controls allow it) dpi, 8 bit grayscale (do NOT use 16bit grayscale)
- Save as uncompressed TIF file
- Scan to yield file size approximately: yields file size approximately 4200 x 3000 pixels, file size 20-25MB for color

3.5. 8" x 10" color OR black & white photograph

- Choose source size 8.0 inch x 10.0 inch (software will autodetect the exact size)
- Choose target size the same as the original
- For color photo, choose resolution 300 dpi, 24 bit color (do NOT use 32 or 48 bit color)
- For black & white photo, choose resolution 300 dpi, 8 bit grayscale (do NOT use 16bit grayscale)
- Save as uncompressed TIF file
- Scan to yield file size approximately: yields file size approximately 4200 x 3000 pixels, file size 20-25MB for color

3.6. 8 1/2" x 11" typewritten/printed paper

- Scan at resolution 300 dpi or 400 dpi if the text has very small print
- Save as uncompressed TIF file

3.7. 9" x 9" aerial photograph

- If possible scan from diapositive transparencies rather than prints
- Scan at resolution 1200 dpi or as high as possible/feasible
- Scan with sharpness set to extreme
- Save as uncompressed TIF file

4. Data Photos

Data photos are photos collected as part of a documented data collection protocol. The project's data processing protocol will contain a detailed section on processing data photos. This protocol will include information, such as:

- File folder structure conducive to data entry and linking.
- Photo naming standard conducive to data entry and linking.
- Field collection method for uniquely linking each photo to its related field data sheet/record.
- Consistent photo database that facilitates linking of photos to the projects data.
- Step-by-step procedural documentation.

5. Establish Working Folders

Unaltered photos, downloaded directly from the camera, will be carefully preserved. Since many photo editors will automatically destroy the photographic metadata imprinted into the picture file by the camera it is extremely important that no changes to these photographs will be made. The names of folders containing original photos will clearly indicate that the folder contents are unedited originals. Original photo folders may include multiple photos of the same subject, blurry pictures, or other less desirable photos. This original set of photos will be preserved as is. Copies of original photos will be saved in clearly named folders for review and editing. For example:

/Subject_A

/Originals – original, downloaded photos, including poor photos

/Edited –photos which have been processed: renamed and edited.

After downloading or scanning photos to the /Originals directory, this directory will be set to “read-only” permissions to prevent inadvertent edits. Permanent backup copies will be made periodically.

6. Edit Copies

It is unlikely that a photo will go directly from the scanner or camera exit port to the library photo folder or to the project data repository where it will live forever. Photos need to be processed before they are ready to be used.

The renaming of the copied files will follow the Network File Naming Conventions SOP (NPS-ROMN 2007a) for photographs, or AuthorOwner_Date_Title.xxx.

7. Document

All photos will be documented according to the guidelines in the Network’s Documentation SOP (NPS-ROMN 2007b). In addition, digital photos capture some metadata and will hold this information in an EXIF data section of the photograph file (jpg, tif, etc) that stays with the photograph unless the photograph is carelessly modified. These include:

- File name
- Aperture
- Date Digitized

- Date Taken
- Exposure Bias
- Exposure Time
- F-Number
- Flash (yes, no)
- Focal Length
- ISO Speed
- Light source
- Metering Mode
- Shutter Speed

Additional Attributes may include (IPTC standards):

- Special instructions for how the photo was taken
- Subject distance
- Caption writer
- City, State, Country
- Equipment make
- Equipment model
- Object name

These additional metadata will be preserved in their original EXIF form by making the original image read-only at the time of download.

If the image is processed, for example cropped or modified, the following attributes will be documented:

- Height
- Width
- Artist
- Artist Copyright
- Creating Software
- Date
- Model of printer intended

Appropriate photo-editing software that will preserve the EXIF metadata includes:

- Adobe Photoshop
- IrfanView

8. Determine Sensitivity & Ownership

In addition to the general sensitivity and ownership guidelines specified in the Network's Data and Information Management Plan, when taking a photo of a person, the subject's

right to privacy may come into play. Photos with the following criteria will seek a model waiver form:

- The person is recognizable, is not a government employee (on-duty), and the photo will be used for profit to the photographer.

OR

- Any photos of a minor, where the minor is recognizable.

Photos with the following criteria do not need a model waiver form:

- Photos are public domain (unless protected by law)
- Photos are not for profit
- If photos are used for profit, such as in a magazine, it is not NPS who profits

In the case of NPS, it is rarely the case where a model waiver form is needed. Typically these photos are used for education and editorial purposes, where photos of subjects are acceptable.

Other violations of privacy may include:

- The photographer intruded on the person's seclusion to take the photo
- Private information about the person is now made public
- When the photo causes the average, reasonable person to believe something about them that isn't true.

These instances will not occur within the scope of government work. NPS and contracting photographers will exercise the following guidelines when photographing people:

- Avoid photos of minors.
- Intentionally do not identify the non-government people pictured, providing one less invasion of privacy.

9. Link to GPS and tabular datasets

Georeferencing of photos will follow the Network's SOP for Using GPS Photolink (NPS-ROMN 2007c).

10. Catalog

All photographs will be catalogued using ArcCatalog with the NPS Metadata tools and editor (NPS 2006).

11. References

NPS (2006). NPS Metadata Tools and Editor, National Park Service, Natural Resources GIS Program, [http://science.nature.nps.gov/nrgis/tools/editor.cfm], November, 2006.

NPS-ROMN (2007a). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Using GPS-Photo Link to Georeference and Watermark Photographs, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/, Fort Collins, Colorado.

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Project Deliverable Specifications

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document provides details of data products required at Project Close Out whether from third party contractors or network staff.
Suggested Citation: NPS-ROMN (2007). Project Deliverable Specifications, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes the specifications for the products that cooperators and contractors deliver to the Network. These specifications provide cooperators and contractors with a concise list of deliverables that should minimize confusion among all parties. These deliverables are required at the completion of any project, whether through a contract or cooperative agreement, unless otherwise amended.

Common deliverable types include:

- Raw Data
- Datasets
- Documentation, including metadata
- Specimens
- Reports, including progress, interim, draft and final

2. Guidelines

2.1. Network Points-Of-Contact

All deliverables will be provided to, and all decisions will be made in conjunction with, the identified network point-of-contact. Unless specified otherwise, the point-of-contact will be the network's lead on the project.

2.2. Original Data

Copies of all original data, including hand-written field forms and electronic databases/spreadsheets will be provided. Depending on the specifications of the particular project, raw data may be delivered progressively at defined intervals throughout the course of the project, or, if not specifically addressed, during project close-out. Data, as discussed in this section applies without exception to all forms of data, including (but not limited to): field sheets, species observation data, GPS and other spatial data; tabular data and photographs.

2.3. Datasets

Preferably, all databases will:

- Follow NPS database standards, as defined by the Natural Resources Database Template specifications (NPS 2006), and
- Be pre-approved by the Network Data Manager

Spreadsheets are generally not acceptable, but may be used on a project-specific basis **if** approved by the Network Contact (and Network Data Manager).

Datasets designed by the Network Data Manager for a particular project will be not be modified for any reason other than data entry and editing, **unless** approved by the Network Contact (and Data Manager).

All datasets, both spatial and tabular, will be described following the Network's Documentation SOP (NPS-ROMN 2007).

2.4. Supporting Documentation

Supporting documentation is often just as important as the main deliverables. Documentation can take the form of flowcharts and diagrams that define the major stages of a project, it can include the development of project-specific Standard Operating Procedure (SOP) manuals, and/or it may consist of detailed protocols.

2.5. Specimens

Voucher specimens will be obtained in accordance with the guidelines contained in the Network Scope of Collection Statement [TBD]. A decision about obtaining voucher specimens will be established prior to collecting any specimens. All specimens, regardless of their repository will remain the property of the National Park Service and are assumed to be on long-term loan to the housing institution/collection if they are stored outside of a Park Service facility. Voucher specimens will be appropriately recorded in NPSpecies, and will be entered into the Automated National Catalog System (ANCS+) in accordance with procedures established by the curatorial facility handling the collection.

2.6. Reports

All reports, unless otherwise specified, will be in portable document format (*.pdf) and include the recommended organizational structure.

2.6.1. Progress

Interim and/or progress reports (henceforth referred to as progress reports) will be submitted on regular and predetermined intervals. Unless otherwise specified, annual progress reports are due no later than September 15 of every year during the project.

Progress reports will be organized into the following sections:

- Project Goals
- Notable Results
- Next Year's Plans
- Requests for Modification to Contract or Agreement

2.6.2. Draft and Final

Draft and final reports will be submitted to the Network Contact and related parks. The draft and subsequent final report will be organized into the following sections:

- Introduction;
- Methodology;
- Results;
- Analysis and Discussion;
- Conclusion; and
- Citations.

Modification from this outline will require approval from the Network Contact.

2.7. Project Close-Out

All digital deliverables will be submitted on CD to the Network Contact. The Network will compile all distribution materials (i.e., raw data, final data, report, GIS layers, etc.) and will coordinate product delivery to all parks involved with the project. All CD's submitted will contain a "Readme.txt" file, in ASCII text format, providing a list of all files contained on that CD as well as a brief description of each of those files in accordance with the database documentation elements.

Data formats that are acceptable as deliverables include, but are not limited to the following:

- Native ESRI ArcGIS 9 formats with a projection file (*.prj)
- Digital imagery (e.g., scanned aerial photographs) as tagged image files (.tiff) files with the proper header file or world file for geo-referencing purposes;
- GeoTiff v1.0 (raster format with geo-referencing stored in the header of the file);
- Tiff with world file (tiff files shall be geo-referenced and include the world file .tfw);
- MrSID File (raster file format that may be used natively as an Arc View theme).

For digital Photographs, the following apply:

- Digital cameras will be at least 4 megapixels of resolution and set to the largest image size.
- The date and time will NOT be imprinted on the photo image.

- Original images will immediately be set to read-only to preserve the metadata embedded within the image.
- The NPS Focus digital library has provided guidelines for image quality and digital camera capacity that may be useful when determining file sizes to store if the high resolution 600 dpi high resolution format is not required. Copies of files will be reformatted to .jpg format to save space and increase loading time when high resolution is not required

3. References

NPS (2006). Natural Resources Database Template Specifications, National Park Service [http://science.nature.nps.gov/im/apps/template/index.cfm], November 2006.

NPS-ROMN (2007). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

4. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Project Manager Application

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes
Abstract: This document describes the MS Access desktop application developed to track all projects managed by the Network.
Suggested Citation: NPS-ROMN (2007). Project Manager Application, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This SOP provides an overview of the Network Project Manager application. This application should be used for tracking all Network projects. Most of the projects will be associated with either the Park Support Operation (NPS-ROMN 2007b) or for specific monitoring protocols. Figure 1 shows the general steps involved in managing project information.

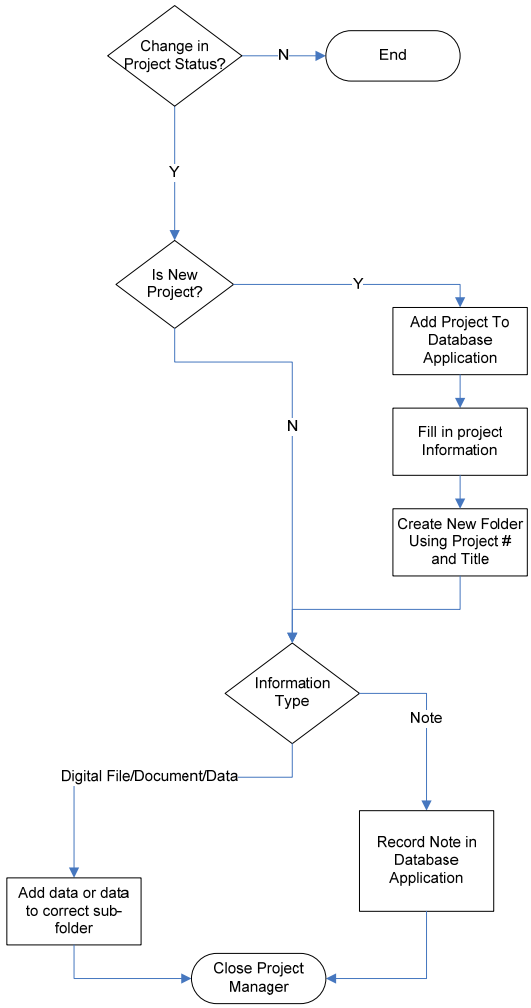


Figure 1. Project Manager Workflow

2. New Projects

New projects will be added to project manager when:

- The project is affected by the actions of the Network and/or involves Network time; and
- The project is related to ROMN Park's Natural resources

When adding a new project, one will follow these steps:

1. Open Project Manager and Create New Project
2. Fill in main form including title, project lead
3. Note project number
4. Create a new folder. The folder name should begin with the assigned project number.
5. Add necessary subfolders based on the appropriate template

3. Database Application

The database application is found in Z:PROJECTS\.

3.1. Searching

The database includes the ability to search for projects and track general project information (Figure 2).

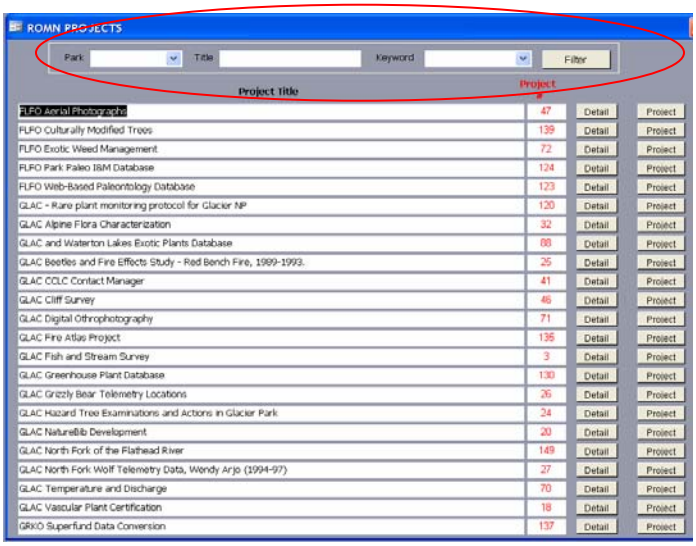


Figure 2. Search Options from the Main Form

3.2. Managing Project Information

The application can be used to track five different categories of information. All actions during a project's lifetime should be entered in the database. Actions include any change in status, including project initiation, progress reports, and any interactions among staff members and cooperators.

The **General** tab pertains to the primary contacts – PI, park contact, and network contact – priority level, status, which parks it applies to, general abstract and keywords (Figure 3).

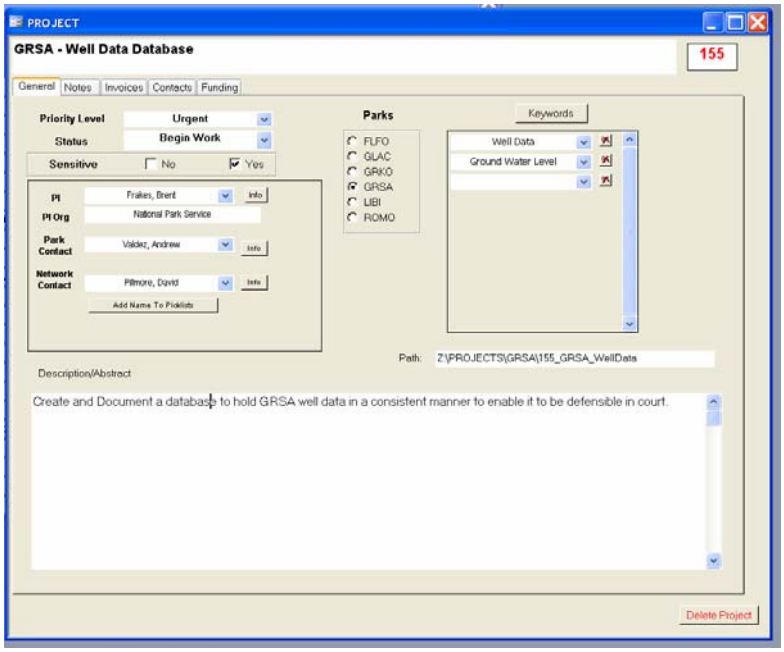


Figure 3. General Project Information Tab

The notes tab (Figure 4) provides the ability to manage notes as the project progresses. Each note has a date, staff name who recorded the note, a general action item category which thematically organizes the notes, and a note text box.

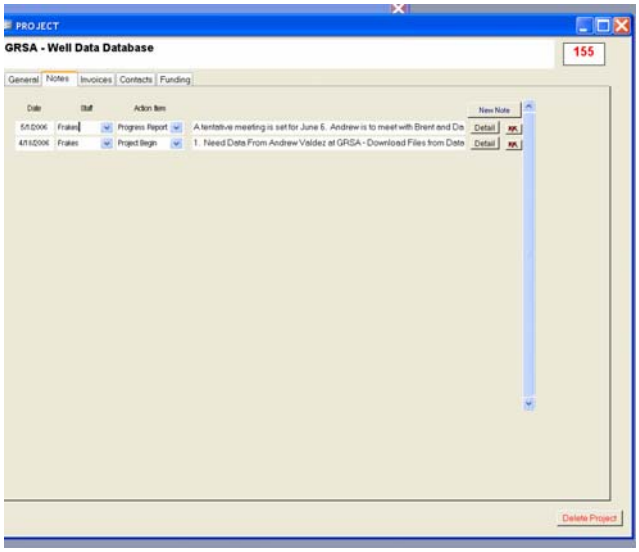


Figure 4. Notes Tab

In cases where budget tracking is necessary, the Invoices tab enables efficient tracking of all invoices (Figure 5). These invoices are counted against the project budget.

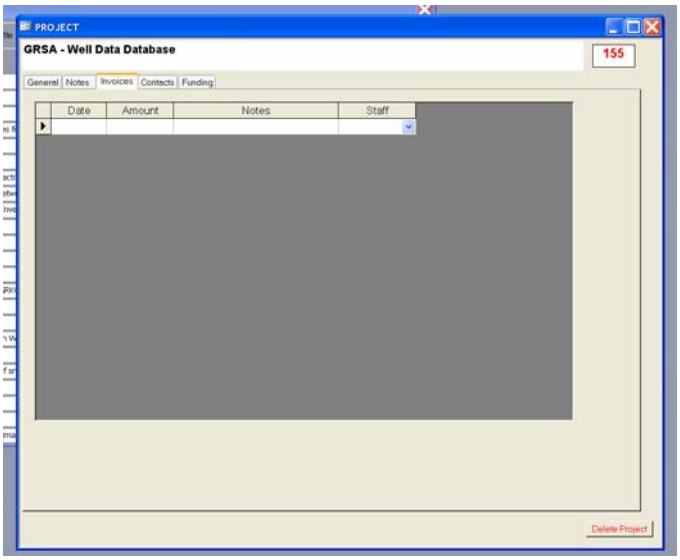


Figure 5. Invoices Tab

Because many projects have multiple contacts, the Contacts tab (Figure 6) provides the ability to track all parties.

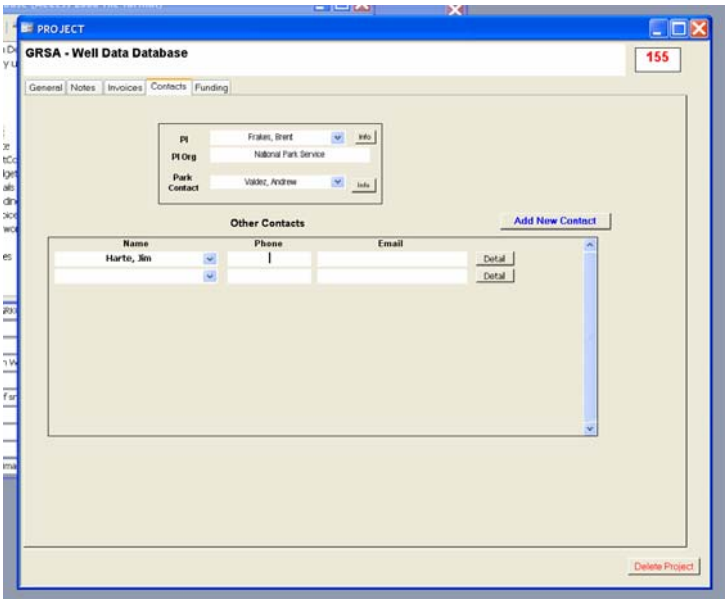


Figure 6. Contacts Tab

The funding tab (Figure 6) permits the tracking of all budget information, including invoices.

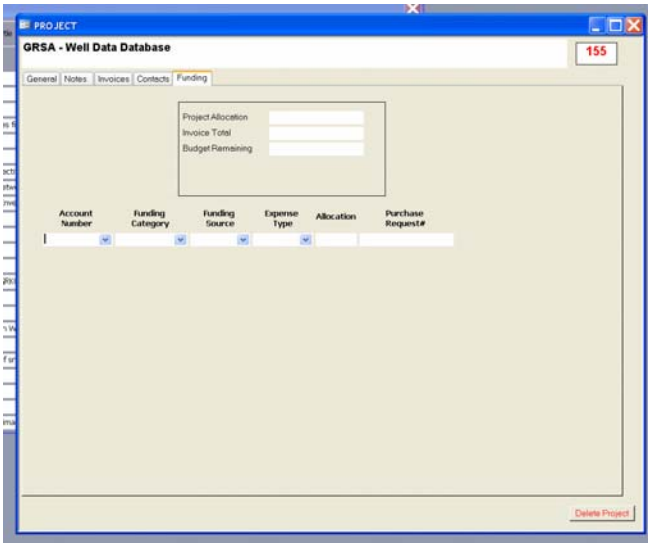


Figure 7. Funding Tab

3.3. Application Back-End

The database application is only a front end. The data tables are housed in the Z:/TOOLS/ROMN_DATABASE/ folder. The front-end relies most on the following three core tables found in Figure 8.

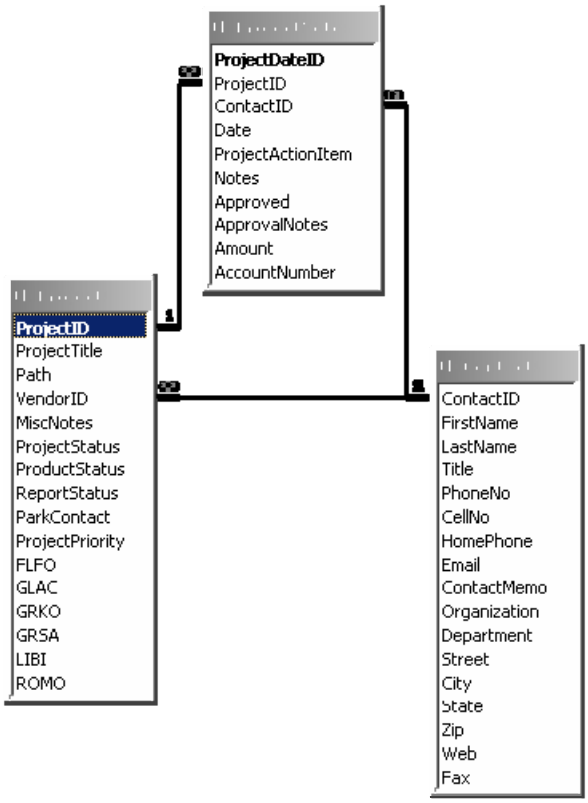


Figure 8. Project Database Relationship Diagram

4. Directory Structure

A standard directory structure is critical for managing the project's information and for its long-term accessibility. The functional requirement for directory structure are found in the directory structure SOP (NPS-ROMN 2007a), while the specified structure for the vital sign and park research operation in specified in the respective operation descriptions. It is expected that staff follow this structure except in rare instances. Any deviations from the suggested folder structure should be communicated to the Network Data Manager.

5. Roles and Responsibilities

Role	Responsibility
Network Data Manager	• Keeping the database application in working order • Modifying the database to meet the needs of Network staff • Managing and updating the recommended directory structure folder to reflect the most common folders in use by the network projectsR2
Project Lead	• Ensuring the project information is accurate and up-to-date • Adding new projects to the database and directory structure
Network Staff	• Notifying the Data Manager when the database application is not working properly • Adding the necessary information to the application and directory structure during the project. • Notifying the data manager when non-standard folders are added to a project's folder.

Table 1. Roles and Responsibilities

6. References

NPS-ROMN (2007a). Directory Structure, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

7. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Protecting Sensitive Resources While Conducting Field Work

Data Management Operation

Data and Information Management Plan

Version*: 1.1
Status: Final
Revision Date: September 4, 2007
Authors: Brent Frakes, Dan Manier
Abstract: This document describes the steps staff will take while conducting research at Network parks to protect sensitive information, and includes procedures leading to, during and following field work.
Suggested Citation: NPS-ROMN (2007). Protecting Sensitive Resources While Conducting Field Work, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

Sensitive Resources exist and may be encountered in any of the ROMN member parks. Cultural resource need special attention and prior study. While the bullets, tools, weapons, or human remains that may be encountered at Little Bighorn Battlefield National Monument (LIBI) may seem obvious, any rock that exists on the Sand Sheet west of the dunes at Great Sand Dunes National Park and Preserve was carried there by a human and may be indicative of more important cultural resources in the area. Also important are the sensitive natural resources (i.e. Threatened, Endangered, or Rare Species) and paleontological resources (i.e. Fossils) that also exist, or may exist, at any of the Network's parks.

This document is a general template of an SOP to be developed and included in each protocol that addresses specific resource concerns and ROMN strategies for limiting and/or mitigating potential impacts. ROMN will work with specific parks to comply with laws, regulations, and policies for minimizing impacts to park resources via the NPS and IMR environmental compliance process for each protocol and project it sponsors.

2. Resource Types

2.1. Cultural Resources

You are working in areas with sensitive cultural resources (these include, but are not limited to: weapons, bullets, tools, human remains, etc.). If you come across a historic or pre-historic artifact in the field, you should not handle or move it. If avoiding the object results in inability to properly sample the site (using this design and protocols), the site should be rejected and a new site selected (from the over-sample list for that ecological type).

In cases where the object or remains are near the edge of a 0.5 hectare site, or when simple movement of the plot will eliminate any potential effects on the object or remains, use the described method for relocating sites.

In cases where you think an important or very sensitive resource has been discovered, record the location with a waypoint in the GPS, and take notes about the object(s) and location of the discovery. Report this information to the park unit staff.

2.2. Natural Resources and Paleontological Resources

It is important to be aware of any Threatened, Endangered, Rare, or Commercially valuable natural or paleontological resources that may be in the area where you will be working. If any are encountered it is important to take steps to preserve them from harm and keep their location secure. When simple movement of the plot will eliminate any potential effects, use the described method for relocating sites. If this is impossible the site must be rejected and another chosen as detailed in the protocols.

In cases where you think an important or very sensitive resource has been discovered:

- Record the location with a waypoint in the GPS.
- Document the discovery with the digital camera and note the picture name.
- Take notes about the object(s) and location of the discovery.
- Report this information to the park unit staff.

2.3. Restrictions

- Under no circumstances should you convey the location to anyone besides the official staff.
- Under no circumstances should you manipulate, move, or otherwise alter plants, animals, fossils, cultural objects, or remains.

3. Roles and Responsibilities

Role	Responsibility
Field Crew and Supervisors	• R1 - Protect all sensitive resources. • R2 – Report important discoveries to Appropriate Park Staff.

Table 1. Roles and Responsibilities

4. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Quality Assurance/Quality Control

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Author(s): Brent Frakes, David Pillmore
Abstract: This document describes the best practices for quality assurance and control.
Suggested Citation: NPS-ROMN (2007). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This SOP provides quality assurance/quality control (QA/QC) guidance when working with Network information. QA/QC is integral to all steps of managing information, so it is difficult to provide one set of procedures that fulfill all needs. However, the general QA/QC steps do depend on whether the information originates from external sources, where the Network has minimal control, or is created by the Network, where the Network has both full control and the obligation to produce quality information. Thus, this document is split into two sections. Section 2 covers QA/QC recommendations for all stages of a network project – from initiation to close-out. Section 3 discusses the procedures for handling externally generated information that is to be incorporated into one of the network operations.

2. Internally-Generated Information: Project

Most of the information generated by the Network will originate from the Vital Sign Monitoring Operation. Each Monitoring Protocol will contain its own individual data management section. However, the QA/QC requirements have the same general structure. While monitoring is an ongoing operation, each year's effort is distinct and may be viewed as a specific project. Therefore, the QA/QC requirements may be viewed within the framework of the project life cycle (See Data and Information Management Plan Chapter 2, – NPS-ROMN 2007a). This section is primary written for data collection in the field, although a subset of the guidance will apply to any type of project, whether or not field work is involved. Figure 1 provides the general steps for project QA/QC.

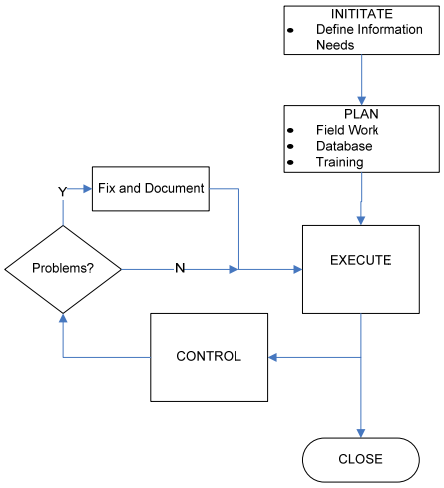


Figure 1. Quality Assurance and Control Steps During the Project Life Cycle

2.1. Initiate

During the project initiation phase, the important step for quality assurance is to clearly define the data and information needs. Without a clear definition, it will be impossible to generate the information. This includes review of the protocols and ensuring that all sample techniques are clear, complete, and fully recorded.

2.2. Plan

The planning stage is where quality assurance (QA) is initially implemented. There are a number of areas where quality can be assured, most importantly in planning for field work, in database design, and in staff training.

2.2.1. Field Work

Planning for the field work is planning for the media that collect, record, and store the information. Common types of media include field sheets, personal digital assistants (PDAs), global positioning system units (GPS), digital cameras, and field personal computers.

Field forms generally exist only on paper field sheets or electronic field forms on PDA's or field personal computers. Field forms of any type should be developed by the Principle Investigator working with the data management staff and field personnel input whenever practical. They should not only accommodate the requirements of the protocol or study plan but maximize the ease of use in the field and reflect the structure of the data being recorded.

In general effective planning in field sheet (paper) development will ensure that the forms:

- Fit a common and accepted format (e.g., 8.5x11 inch)
- Provide space for the observer to record the name, version and date of the monitoring protocol (or study plan) used for data collection and processing
- Are protected from inclement weather or other damages (e.g., "write-in-rain" paper)
- Utilize checkboxes, selection lists, and other data formats that are quickly and easily entered in the field with a minimum of writing. Think of using gloves in a freezing rain.
- Have font sizes and formats that are legible in the field (e.g., not smaller than 8 points)
- Include sufficient space (i.e. empty rows/columns) to enter all data from a site on one form (e.g., don't provide too little space so data often ends up on the back of a sheet)

- Have strict 'penmanship' rules (e.g., sevens with slashes, zeros with lines, All/no caps, acronyms and codes) that optimize the use of space and time and minimize confusion in the forms

In some cases a Personal Digital Assistant (PDA) can be used to replace a paper field form. This should be done whenever possible since it removes a separate data entry step at the end of the field season. However, the limited size of PDA screens, memory, and battery can be limiting – the Project Leader must carefully evaluate the advantages and disadvantages. PDA utilization requires:

- Form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, intuitive codes, and error checking
- Clear directions for use based on the data collection needs
- Provisions for data backups battery replacement and recharging
- Plans for how and when backup field sheets are to be used, should the PDA fail
- Directions for data transfer and backup when in the field and/or upon returning to the lab/office.

A field PC can provide the flexibility of paper with the efficiency of a PDA (at a greater financial expense). Properly designed field forms on this media should be able to completely replace paper as long as adequate steps are taken to protect the media and the field data collected on it. Field PC utilization requires:

- Form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, and intuitive codes, and error checking
- Provisions for data backups and battery replacement and recharging
- Functional forms developing using the Microsoft Access application
- Plans for data transfer and backup in the field and upon returning to the lab/office
- Plans for how and when backup field sheets are to be used, should the computer fail, or when carrying the computer into the backcountry is impractical.

When a GPS is used, there will be:

- Clear directions for use of the GPS unit based on the data collection needs
- Provisions for battery replacement and recharging
- Specified and consistent datums and projections
- Provisions to determine and record the accuracy and precision of the GPS during data collection
- Directions for data downloads and connecting GPS data with other tabular or database formats (when the GPS isn't integrated with a field computer)
- See also the Network's GPS SOP (NPS-ROMN 2007b)]

When a digital camera is used there will be:

- Provisions for battery replacement and recharging;

- Plans for data transfer and backup when in the field and/or upon returning to the lab/office;
- Plans for how and when backup cameras are to be used, should the primary camera fail.

2.2.2. Database

A good relational database is important to effectively store, preserve, and present all of the data. While database design is complex the aspects that are related to QA/QC are straight forward.

- Have record-level tracking of who entered the information, when the information was entered, and what protocol, study plan, or method was used to collect the data;
- Contain built-in automated error checking features;
- Have controlled access and defined security levels (i.e., forms are set for data entry only, which prevents accidental deletion or alteration of existing data) and can control the sequence of data entry (i.e., certain fields require an entry before more information can be entered);
- Utilize lookup tables whenever possible to minimize data entry errors;
- Share common lookup tables with other Network databases;
- Have full-screen forms that resemble the field sheets (this greatly facilitates quality control checking);
- Distinguish between newly-entered and previously validated data;
- Utilize form fields that minimize and enhance data entry through the use of auto-fill, auto-correct, range limits, pick lists, lookup tables, intuitive codes, and error checking;
- Prevent duplicate records entry;
- Contain a mechanism for a random audit for errors of commission. In cases where errors are greater than 2%, a complete review (i.e., 100% re-evaluation) will occur;
- Contain complete descriptions of all data fields to minimize errors of omission.

2.2.3. Training

The project leader must thoroughly know and understand the protocols, SOPs, and field techniques guiding a project. All field staff will be aware of the key points, although it is not imperative they have the protocols memorized, as long as they have immediate reference to the necessary information. Training will include:

- Use of graphical (e.g., flowcharts) and text information;
- An overview of the protocols and SOPs ;
- A complete walk-through of the field techniques and SOPs with staff assistance;
- A test to confirm they are able to conduct the SOPs without assistance;
- Open scenario of possible field problems and how the staff would respond

2.3. Execute

The execution phase of a project is when the sampling is occurring and measurements are being recorded. Quality Control (QC) begins with this phase and QA continues throughout the phase. QA requirements outlined for the planning phase are carried out during this phase. QC requirements for data recording during this phase differ slightly depending on the media that is being utilized to record field data.

During the execution phase, digital data QC requires:

- Completed field forms will be reviewed for errors each day and data that were not entered in the field will be recorded on the digital media;
- All digital files will be backed up to recording media (thumb drive, external hard drive, etc) at the end of the day;
- When extended field work is carried out periodic backups must be done to a permanent media such as writing a CD in addition to the backup above;

Paper field sheet QC requires:

- If corrections to the data are necessary, the original information will be crossed out with a single line and the new information written next to the original entry. Information will never be erased and old information will never be overwritten.
- Upon return from the field, copies of all original data sheets will be made (backup for paper field sheets). The copies of the data sheets will be stored as specified in the protocol SOP, and the original data sheets will be used for data entry.
- Data will be entered as soon as reasonably possible after collection. Data entry will not be delayed until all the project data have been collected.
- Data entry will be done by someone familiar with data collection. Data entry staff will be familiar with the database software, database structure, and any standard codes. At a minimum, data entry technicians will know how to open a data entry form, create a new record, and exit the database properly.
- If feasible, data will be entered by two qualified persons; one person will read the observations and the other will enter the data
- All data entries will have a quick visual review during the time of data entry where the data entry technician verifies each record after input.
- At the end of each data entry session, the records will be printed to hardcopy forms and visually compared

2.4. Control

This phase is shown as a separate step from the execution phase but actually occurs both during the execution phase and after it is completed. In fact, throughout the project life cycle it is important to evaluate shortcomings in information collection. Where possible, these errors must be corrected during the project life cycle, in every case they must be recorded to inform proceeding projects (the next seasons monitoring effort). Important QA/QC measures involved with this phase include:

- A broad requirement for both QA and QC for periodic random 'spot checks' to ensure compliance with protocol SOPs and QA/QC procedures. Deficiencies should be noted, corrected, and reported to the project manager.
- A review of QA/QC and SOP procedures for shortcomings noted during the execution stage;
- An exploratory data analysis, including normal probability plots, Grubb's test, and simple and multiple linear regression techniques that provide insight into potential logical errors;

When errors are detected, corrections or deletions will require notation in the original field records about how and why the data were changed, the date of change, and who approved the edits.

2.5. Close

During the closure of a project:

- There will be a means to track data errors reported after dissemination
- QA/QC and SOP procedures will be reviewed by the project manager and recommendations for change will be included in a report.
- A statement of data quality will be composed by the project manager and incorporated into formal metadata
- Following closure, and assuming that all of the QA/QC steps were followed during the project life cycle final project data will be incorporated into the correct operation databases and the appropriate metadata will be updated

3. External Information

Unlike information generated by the network, externally-generated information can be much more difficult to evaluate for quality. Figure 2 indicates the general steps when dealing with external information. Quality assurance is impossible, while quality control is limited to ensuring the information is decipherable and valid.

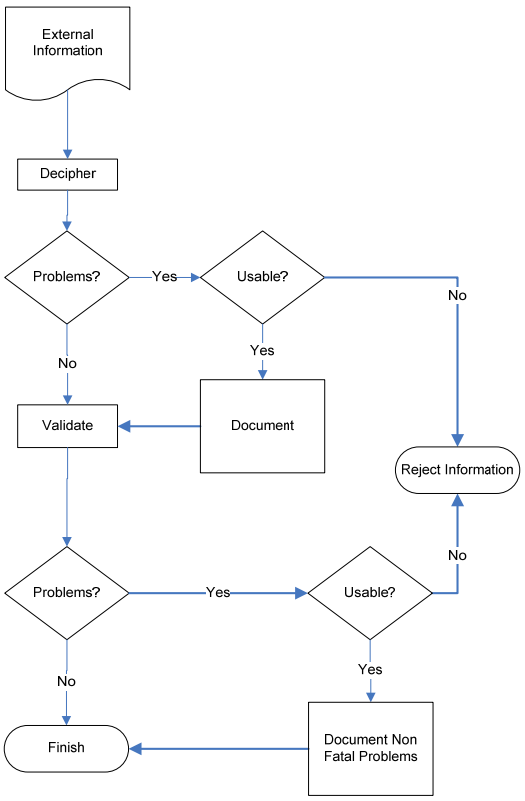


Figure 2. General Quality Control Steps for External Information

3.1. Decipher

The first stage of evaluating externally generated information that is being reviewed by the Network for use is to make sure that it can be read and understood (deciphered). This process answers such questions as:

- Is there adequate metadata? (Complete, Clear, Contact Persons, etc).
- Are the protocols and SOPs that governed the collection of the data available?

3.2. Validate

Once the information has been deciphered and can be read and understood it must be reviewed for completeness and accuracy. This can include any or all of the following quality control reviews:

- Are there errors of omission? (Have important measures been left out?)
- Are there errors of logical consistency?

Upon review of the metadata, protocols, and SOPs:

- Do inconsistencies in the documentation cast doubt on the validity of the dataset?
- Do inadequacies in the SOPs cast doubt on the validity of measures?

- Is the study design documented in the protocols flawed?
- Was the field staff sufficiently trained to carry out the SOPs correctly?

3.3. Problems?

If there are problems with either of the above steps the nature of the problems must be carefully evaluated and a decision must be made about the information's usability. If the metadata is inadequate or nonexistent it must either be corrected by reference to the author of the dataset or the dataset must be judged unusable.

In other cases the specific problem must be judged as to how seriously it jeopardizes the usability of the information by the appropriate members of the Network staff. The Data Manager is finally responsible for deciding on the usability of questionable data, although Network Staff will need to provide guidance based on their area of expertise.

4. Roles and Responsibilities

Role	Responsibility
Project Leader	• Ensuring the appropriate QA/QC procedures are integrated throughout the project life cycle • Ensuring the field staff are adequately trained
Data Manager	• Assisting the Project leader in integrating QA/QC procedures throughout the project life cycle • Assisting the Project Leader in training the field crew • Approving externally-generated information as being of adequate quality

Table 1. Roles and Responsibilities

5. References

NPS-ROMN (2007a). Data and Information Management Plan, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Using the Garmin GPS 76csx, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

6. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Requesting Park Research Permits

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore, Mike Britten; Billy Schweiger, Originally modified from GRYN (Elizabeth Crowe)
Abstract: This document describes the process all network staff will follow when applying for and conducting research in network parks.
Suggested Citation: NPS-ROMN (2007). Requesting Park Research Permits, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

A Scientific Research and Collecting Permit is required for most scientific activities pertaining to natural resources in National Park System areas that involve fieldwork, specimen collection, and/or have the potential to disturb resources or visitors. Depending on the Park's requirements, these should be applied for on an annual basis before the field season. Long-term projects, such as vital sign monitoring, will require a separate permit for each year and for each park.

The Research Permit Reporting System (RPRS; NPS 2006) is available online. Instructions are available at the same web site, including Instructions for Researchers and Application Procedures and Requirements for Scientific Research and Collecting Permits

Figure 1 shows the general steps for completing a research permit.

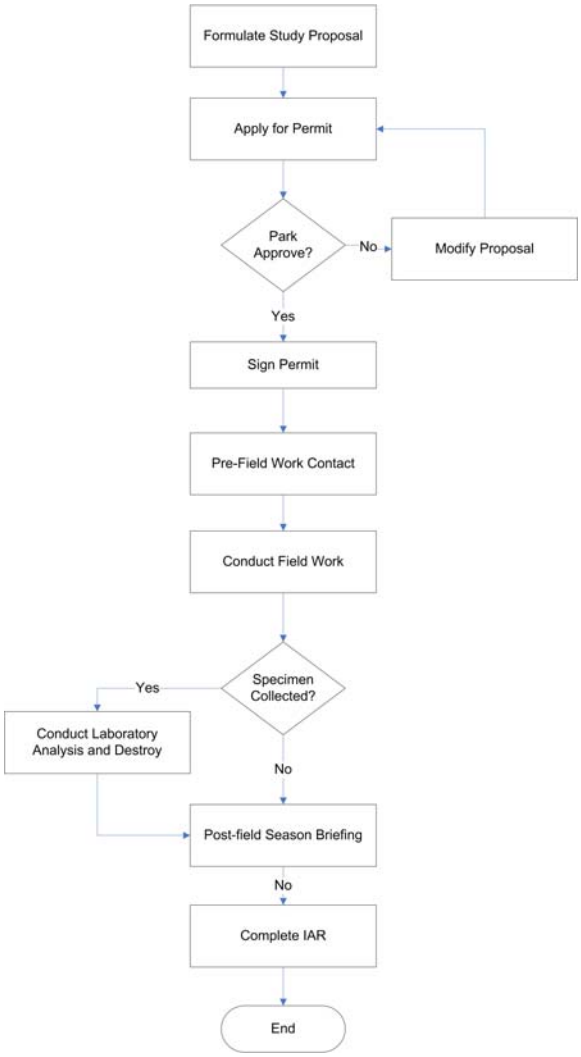


Figure 1. Research Permit Request Workflow

The Principle Investigator (PI) has ultimate responsibility for writing the study plan and proposal (including the sample design), applying for the research permit, making necessary modifications, and completing the investigator's annual report. PIs may be ROMN or other NPS staff or cooperators from other agencies, academic institutions or non-government organizations.

2. Develop Study Proposal

The study proposal describes the work to be carried out in the park during the field season. All study proposals sponsored by the ROMN will be:

- Included in the Annual Work Plan approved by the ROMN Board of Directors by January 31st of each fiscal year.

- A subset of a scientifically peer-reviewed and approved ROMN Monitoring Protocol or a pilot study implemented with the goal of including it in a peer-reviewed ROMN Monitoring Protocol

Study proposals will include:

- A map of the year's sampling locations with the exact timing of sampling at each site;
- A map or description of the transportation and routes of field crew members and equipment to sampling locations
- Contingency plans for unforeseen inability to reach a sampling site(s) on originally scheduled date(s).
- A standard operating procedure (SOP) for park- and protocol-specific safety issue and concerns
- Field accommodation requirements for lodging (cabins, dormitories, front- and back-country camping)
- Include enough information so the park can address potential NEPA, Wilderness Act, ESA, CWA (section 404 – wetlands), NHPA, etc. concerns (* see below for a list of likely activities that parks will want more information and the IMR Environmental Screening Form (website) for and list and criteria)
- Identification of any procedures that may be deemed controversial (e.g. lethal sampling of a charismatic spp.)

PIs must also ensure additional park-specific research permit requirements are met. The following parks have research needs are articulated for each park:

- FLFO - None
- GLAC - http://www.nps.gov/glac/research.htm
- GRKO - None
- GRSA - http://rprs.nps.gov/research/ac/search/parks/ParkInfo?method=research&parkCode=GRSA
- LIBI - http://rprs.nps.gov/research/ac/search/parks/ParkInfo?method=research&parkCode=LIBI
- ROMO - http://www.nps.gov/romo/resources/research/needs.html

Field methods or procedures the may raise NEPA compliance concerns for ROMN parks:

- Ground disturbing activities
- Installation of permanent markers or wells (or other devices)
- Sampling, capture, handling of Threatened or Endangered species (or candidate species)
- Impacts to species of management concern
- Activities in rare plant communities
- Activities that potentially could introduce invasive/exotic species
- Activities that could impact archeological or historical resources

Activities that could impact wilderness values including:

- Use of helicopters to drop people off or to ferry equipment
- Use of any motorized equipment (chainsaws, increment borers driven by gas-powered engines, generators)

- Use of any wheeled vehicles (carts w/ wheels)
- Use of motor boats in the no-motor zones of lakes
- Deployment of equipment (e.g., exclosures, weather stations, large permanent monitoring equipment) for greater than a "season".
- Installation of permanent, visually obtrusive instruments or site markers

3. Apply for Permit

The online Research Permitting and Reporting System (RPRS; NPS 2006) will be used for all permit applications. The application and required accompanying documents will be submitted at least 90 days in advance of the first planned field activities for the calendar year.

A detailed study proposal following the outline in Appendix 1 should be prepared prior to initiating the RPRS online submittal process. Much of the material asked for in the online application can be 'copy-pasted' out of this proposal. However, there will also be more detail in the proposal required by most parks than is in the online forms. The proposal can be attached to the online application and/or sent to the permit review staff in each park separately.

The following information will be asked by the RPRS for successful completion the application process:

- Contact information about the applicant. (Required)
- Project title. (Required)
- Purpose of study. (Required)
- Study start and end dates (Required)
- Identification of any federal funding agencies
- Location of activity in the park
- Method of access
- Names of co-applicants
- If you are collecting specimens, contact information of repositories
- A copy of the study proposal (discussed above), in MS Word format
- A copy of all peer reviews, in MS Word format

4. Permit Renewal

Research permits are authorized on a calendar year basis, starting when the permit is issued and expiring on December 31 of that same year. After this date, the permit is no longer valid. Therefore, following the initial year of monitoring fieldwork, the project

leader for a monitoring project will apply for a renewal of the research and collecting permit every year in which fieldwork will be done.

If the proposal is essentially unchanged (i.e., the objectives and methodologies are the same), another copy does not need to be sent. However, the annual fieldwork plan containing the location of sampling sites, timing of sampling, routes and methods of transport of crews and materials, collections that will be made, and any requests for accommodations that are handled by the permitting office is required. The annual fieldwork plan document(s) may be uploaded through the File Upload screen under the "Proposal file" or "Peer review file(s)" field.

5. Modifying Proposals

There are two cases where a proposal will be modified. First the PI will need to modify the proposal if the park identifies potential NEPA, Wilderness Act, ESA, CWA (section 404 – wetlands), NHPA, etc. concerns. Second if project objectives or methodologies change during a multi-year project, the PI will need to provide an addendum reflecting the changes.

6. Sign Permit

When the request is approved, a Research Permit will be sent to the PI. The PI will, in turn, sign the Research Permit and return it within 14 days. The validated and approved permit will be returned to the PI from the park.

7. Pre-Fieldwork Contact with the Park

The PI will contact the park research permit coordinator (in person or by phone or e-mail per the research permit coordinators preference) several weeks prior to initiating fieldwork reminding them of the scheduled fieldwork and asking for updates on park activities that may affect the project (e.g., special wildlife closures or park road or trail closures). The research permit coordinator may request the PI and/or field crews brief park staff before initiating fieldwork.

At the advice of the park contact, the PI will also consult with park staff who are aware of resources that may be harmed.

8. Conduct Field Work

The Permit will accompany the field crews in the park.

It is important to keep the permit updated as conditions change throughout the field season. For example, lists of personnel included on the permit will need to be kept current. If something occurs that mandates a change in the study plan, the change will be communicated to and approved by the park research administrator.

In cases where the field work terminates early or unexpectedly, the PI will notify the park within 5 working days.

9. Collection and Curation of Biological Specimens

The Network is not equipped to curate permanent biological specimens and therefore, as a policy, will not acquire such specimens for curation. Any specimens must be destroyed in the process of analysis. This policy will be clearly stated on the permit if collecting samples is requested.

10. Post Field Season Briefing

The PI and/or field crew members will contact the park research coordinator after the completion of field work to give them a short briefing on the work, accomplishments, issues, etc. This may be in person or by phone or e-mail per the park research permit coordinators preference.

11. Complete Investigator Annual Report (IAR)

Following each year of fieldwork, the PI is required to complete an Investigator's Annual Report (IAR) for each permit which was received. IARs are due by March 31st of the calendar year following the year for which the permit was issued. The IAR will be completed as a document and then pasted into the appropriate field online at the RPRS (NPS 2006). In cases where the same IAR applies to multiple parks (and therefore multiple permits), references that are not specific to the investigation at the individual park for which the IAR is being submitted will be removed.

Each Investigator's Annual Report (IAR) will pertain to the research accomplishments of a single study, conducted within an individual park, during all or part of the report calendar year. The IAR will discuss the study objectives, methods, and results. The

IAR is intended to be used by the public, therefore, it will (1) not reference the location of any sensitive information (See Approving Information for Distribution SOP; NPS-ROMN 2007), (2) not contain undefined acronyms and abbreviations, and (3) not use excessive jargon or technical language.

The following fields are required to be completed:

- **Reporting Year:** The calendar year to which the research accomplishment report pertains.
- **Park:** The name of the park to which this report pertains.
- **Project Title:** The title associated with the study. It should be brief and remain constant over the life of the study unless otherwise recommended by NPS/park research coordinator. Do not enter all the information in this field in upper case.
- **Park-assigned Study:** The NPS-assigned study number on the permit.
- **Park-assign Permit:** The NPS-assigned permit number in the format "PARK-YEAR-NUM", where "park" is the four-character code for park name, "Year" is the past calendar year the permit was active in and "Num" is the unique permit number issued by the park for past calendar year. If the permit number is unknown, contact the appropriate park research office and request the permit number.
- **Permit Start Date:** The starting date on the permit received from this park for this study.
- **Permit Expiration Date:** The expiration date on the permit received from this park for this study.
- **Study Starting Date:** The date the study initially began.
- **Study Ending Date**: The estimated date the study may be concluded. Use 50 years as a maximum estimate even if the study will continue for a longer period, such as vital sign monitoring.
- **Study Status:** The choices are: “Completed”, “Continuing”, “Suspended” and “Terminated before completed”. The study will be identified as completed when the final reports have been completed (not just when the field work is completed). Vital sign monitoring will have a status of “Continuing”
- **Activity Type:** For ROMN monitoring protocols, this will be “Monitoring”.
- **Subject:** A list of natural resources subjects. One of these must be chosen as applying to the project.
- **Objectives:** The overall objectives of the study. The maximum number of characters for this section is 4000.
- **Findings:** Description of the annual findings of the study. If there are no accomplishments to report for the past calendar year, enter "No activity was conducted this report year". The maximum number of characters for this section is 4000.
- **Funding provided by NPS:** The total funding amount provided by the U.S. National Park Service for this study during this reporting year.
- **Funding provided by other:** The total funding amount provided by other sources (not the U.S. National Park Service) for this study during this reporting year.

If there are no accomplishments to report because field work or other planned activities were not conducted, an IAR will still be provided (briefly explaining that no activities took place during the reporting year).

An IAR cannot be edited after it has been submitted to the NPS database. The PI is responsible for the content and accuracy of each report submitted.

The following is an example entry for the findings field:

> *To detect changes in home range, we radio-collared 15 wolverines in the Cottonwood and Kantishna Hills in July and recorded their movements at weekly intervals until September (10 weeks). The average home range of wolverines in the Cottonwood Hills (7 wolverines) was 5.7 square miles, and in the Kantishna Hills (8 wolverines) was 4.5 square miles. Both of these home ranges were twice the size of the range recorded in 1998. We attribute the larger home ranges to lowered food supply of moose and marmots. One wolverine traveled more than 20 miles from where it was first collared….*

12. Roles and Responsibilities

Role	Responsibility
Principal Investigator	• Writing the study plan • Writing the proposal (including the sample design) • Applying for the research permit • Making necessary modifications to the permit • Completing the investigator's annual report as required
Park Contact	• Reviewing the permit applications and providing guidance for research in the parks

Table 1. Roles and Responsibilities

13. References

NPS (2006). Research Permit and Reporting System (RPRS), National Park Service [http://science.nature.nps.gov/research/ac/ResearchIndex], November, 2006.

NPS-ROMN (2007). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

14. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

Appendix 1 – Guidelines to Researchers for Study Proposals

GUIDELINES TO RESEARCHERS FOR STUDY PROPOSALS

United States Department of the Interior
National Park Service

Your proposal should include each of the required information items listed below, in enough detail that an educated non-specialist can understand exactly what you plan to do. If you have already prepared a relevant proposal for a funding application, work plan, formal agreement, or similar document, then your original proposal likely will satisfy National Park Service (NPS) proposal requirements. The primary area where new information may be necessary concerns the ability of the park to assess what, if any, impacts your research may have on park resources. You should compare your original proposal to these guidelines to be certain that you have provided all the required information. If additional information is required, you can provide it in a cover letter or supplement to your proposal, as appropriate. If a required topic does not apply to your proposed study, simply list the topic and write "not applicable."

The length of your proposal depends primarily on the complexity of the work planned. In some cases, a proposal may consist of a couple of pages for a study expected to have no significant impact on park resources or visitor experiences. However, proposals for lengthy or complex research problems, for extensive collecting, and for work with special status species or sensitive cultural resources are typically longer, more detailed, and well-organized. Incomplete, disorganized, or illegible proposals may be returned for revision.

I. INTRODUCTION

A. **Title**

B. **Date of proposal**

C. **Investigators -** Provide the name, title, address, telephone number, FAX number, email address, and institutional affiliation of the principal investigator and the name and affiliation of all additional investigators listed in the proposal.

D. **Table of contents** - Recommended for long or complicated proposals.

E. **Abstract** - Provide a brief summary description of the proposed project. Include up to five keywords that can be used by the NPS to quickly identify the proposal subject (for example, microbiology, geology, ecology).

II. **OVERVIEW** - Summarize the proposed project by describing in general the problem or issue being investigated as well as any previous pertinent research.

A. **Statement of issue** - Describe the issue to be investigated and its importance and relevance to science and to the park. Provide relevant background information that clarifies the need for the project and why it is valuable for the research and/or collecting to be conducted in the park.

B. **Literature summary** - Summarize the relevant literature regarding the issue, problem, or questions that will be investigated.

C. **Scope of study** - Describe the overall geographic and scientific scope of the project.

D. **Intended use of results** - Describe how the products will be used, including any anticipated commercial use.

III. **OBJECTIVES/HYPOTHESES TO BE TESTED** - Describe the specific objectives of the proposed project. Where appropriate, the objectives should be stated as specific hypotheses to be tested.

IV. **METHODS** - Describe how the proposed methods and analytical techniques will achieve the study objectives or test the stated hypothesis/question. Provide pertinent literature citations.

A. **Description of study area** – Clearly describe the study area in terms of park name(s), geographic location(s), and place names. Provide maps, park names, or geographic coordinates as appropriate. Indicate whether your work will take place in an area designated or managed as “wilderness” by the NPS.

B. **Procedures** - Describe the proposed study design that addresses the stated objectives and hypotheses. Explain the methods and protocols to be employed in the field and laboratory.

C. **Collections** - Describe the type, size, and quantity of specimens or materials to be collected, sampled, or captured, and your plans to remove them from the collecting site. If you are aware specimens of the proposed types already exist in a repository, explain why additional collecting is necessary. Provide scientific nomenclature where possible. Provide information on all other applicable federal or state permits where required.

D. **Analysis** - Explain how the data from the study will be analyzed to meet the stated objectives or test the hypotheses. Include any statistical techniques or mathematical models necessary to the understanding of the analysis.

E. **Schedule** - Provide a schedule that includes start of project, approximate dates or seasons of fieldwork, analysis, reporting, and completion dates.

F. **Budget -** Briefly outline the expenses associated with this project and identify your expected funding source(s). Include the anticipated costs pertaining to the cataloging of collected and permanently retained specimens or materials.

V. **PRODUCTS**

A. **Publications and reports** - Describe the expected publications or reports that will be generated as part of this study.

B. **Collections** – Describe the proposed disposition of collected specimens or materials. If you propose that the NPS lend the specimens or samples to a non-NPS institution for long-term storage, identify that institution and give a brief justification for this proposal.

C. **Data and other materials** - Describe any other products to be generated as part of the project, such as, photographs, maps, models, handouts, exhibits, software presentations, raw data, GIS coverages, or videos, and the proposed disposition of these materials. If data are to be collected from the public as part of this study, provide a copy of the data collection instrument (survey, questionnaire, interview protocol, etc.).

VI. **LITERATURE CITED** - Include full bibliographic citations for all reports and publications referenced in the proposal.

VII. **QUALIFICATIONS -** Provide a background summary or curriculum vitae for the principal investigator and other investigators listed in the proposal. Identify their training and qualifications relevant to the proposed project and their ability to conduct field activities in the environment of the proposed study area. Describe previous research and collecting in NPS areas, including study and permit numbers if available.

VIII. **SUPPORTING DOCUMENTATION AND SPECIAL CONCERNS** - Provide information on the following topics where applicable. Attach copies of any supporting documentation that will facilitate processing of your application, such as other required federal and state permits, copies of peer reviews, letters of support and funding commitments, and certifications. Collection of information from the public when federal funds are used may require approval from the Office of Management and Budget (OMB). Upon your request, the NPS Social Science Program will advise you on steps needed to obtain this OMB approval.

A. **Safety** - Describe any known potentially hazardous activities, such as electrofishing, rock climbing, scuba diving, whitewater boating, aircraft use, wilderness travel, wildlife capture, handling or immobilization, use of explosives, etc.

B. **Access to study sites** - Describe the proposed method and frequency of travel to and within the study site(s). Explain any need to enter restricted areas. Describe duration, location, and number of participants for planned backcountry camping.

C. **Use of mechanized and other equipment** - Describe any field equipment, markers, or supply caches by type, number, and location. You should explain how long they are to be left in the field. Explain the need to use these materials in restricted areas and the alternatives that were considered.

D. **Chemical use** - Identify any chemicals and hazardous material that you propose using within the park. Indicate the purpose, method of application, and amount to be used. Describe plans for storage, transfer, and disposal of these materials and describe steps to remediate accidental releases into the environment. Attach copies of Material Safety Data Sheets.

E. **Ground disturbance** - Describe the type, location, area, depth, number, and distribution of expected ground-disturbing activities, such as soil pits, cores, stakes, or latrines. Describe plans for site restoration of significantly affected areas.

Proposals that entail ground disturbance may require an archeological survey and special clearance prior to approval of the study. You can help reduce the extra time that may be required to process such a proposal by including identification of each ground disturbance area on a USGS 7.5-minute topographic map.

F. **Animal welfare** - For vertebrate species that require review by your Institutional Animal Care and Use Committee (IACUC) according to the Animal Welfare Act, please include a photocopy of the study protocol, and IACUC review form and approval.

For vertebrate species not requiring IACUC review, describe your protocol for any capture, holding, marking, tagging, tissue sampling, or other handling of these animals (including the training and qualifications of personnel relevant to animal handling and care). Please discuss alternative techniques considered and outline any procedures to alleviate pain or distress. Include contingency plans to be implemented in the event of accidental injury to or death of the animal.

G. **NPS assistance** - Describe any NPS field assistance you would like to receive to complete the proposed study, such as use of equipment or facilities or assistance from staff.

H. **Wilderness "minimum requirement" protocols** - If some or all of your activities will be conducted within a location administered by the NPS as a designated, proposed, or potential wilderness area, your proposal should describe how the project adheres to wilderness "minimum requirement" and "minimum tool" concepts. Refer to the park's wilderness management plan for further information.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Research Permitting and Reporting System Desktop Viewer

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes
Abstract: This document describes the MS Access desktop application which enables network staff to track park permits and manage the information locally.
Suggested Citation: NPS-ROMN (2007). Research Permitting and Reporting System Desktop Viewer, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

The NPS current tracks permitted research at the parks using the Research Permitting and Reporting System (RPRS; NPS 2006). This system has an online interface with limited functionality, particularly for keeping up-to-date on relevant research. This SOP documents a desktop viewer which enables network staff to track park permits and manage the information locally. Figure 1 provides a conceptual model for how the application functions.

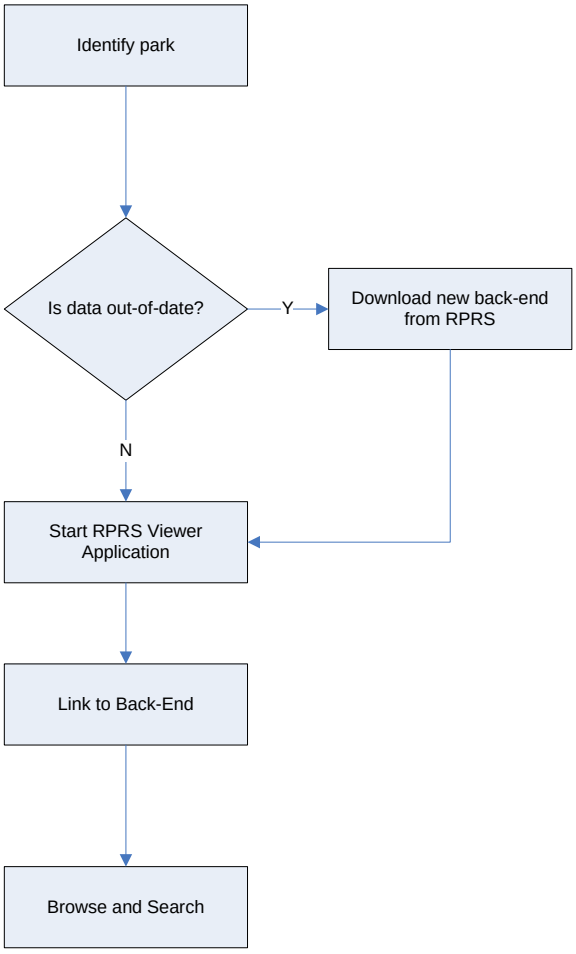


Figure 1. RPRS Viewer Application Workflow

2. Process Steps

The RPRS viewer is found in Z:\TOOLS\RPRS\

2.1. Determine Whether Current Data is Outdated

The online enterprise version of the RPRS is changing daily as new research information is added and modified. Because the Network relies on a static desktop database, it is necessary to regularly update these files. The subfolder \ParkData\ contains the park data where each database is named by the park code and the date for which the data is relevant (e.g., GLAC_May_27_2006).

2.2. Download RPRS Back-End

The web-based version of the RPRS (NPS 2006) allows one to download the back-end of RPRS system (Figure 2).

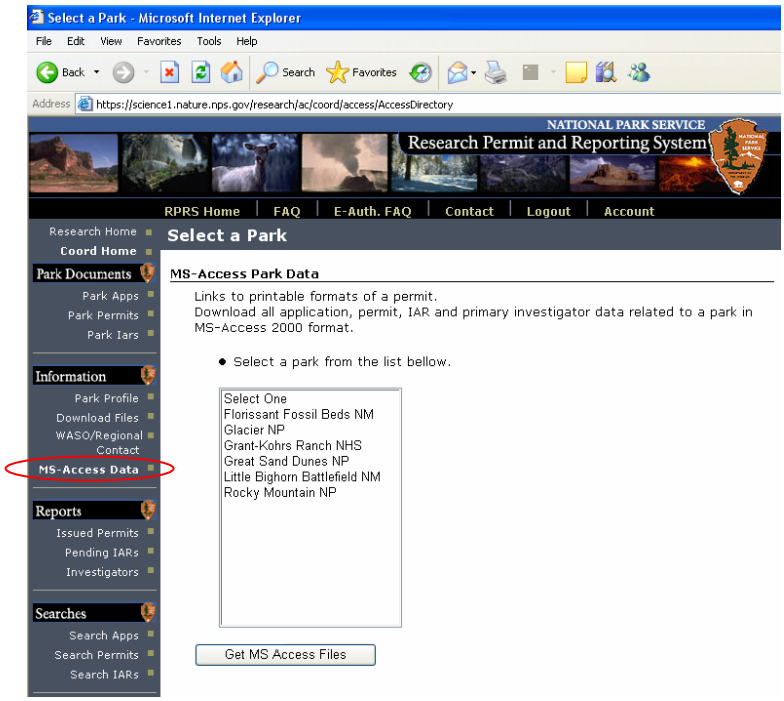


Figure 2. Access Database Download screen

This database is in Access 2000 format and contains only data tables and their explicitly defined relationships. Figure 3 shows the relationships of the core tables. In total, there are 17 data tables, which include legacy permits and reports from an earlier and less robust version of the RPRS.

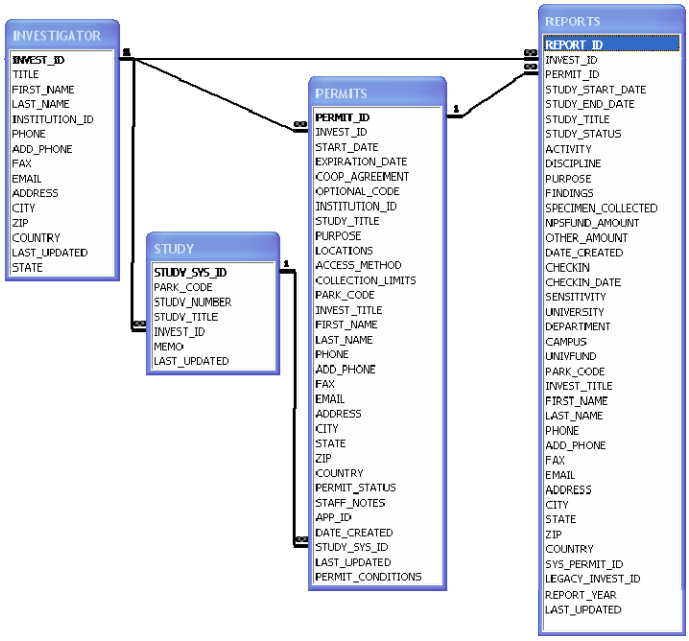


Figure 3. Core Tables and their Relationships in the RPRS System

2.3. Link Application to Data

The MS-Access back-end database is separate for each park. Therefore, when using the application, it is necessary to specify the park. This is accomplished by selecting the linked table manager option (Figures 4 and 5) under the Tools heading.

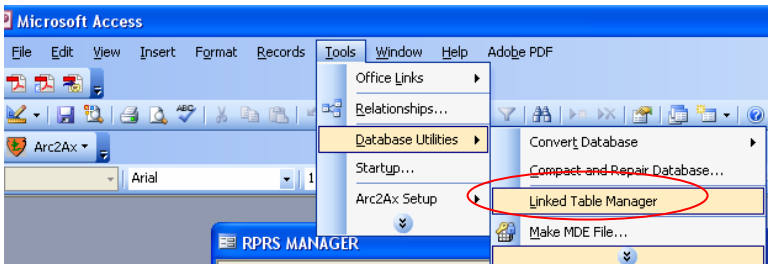


Figure 4. Linked Table Manager

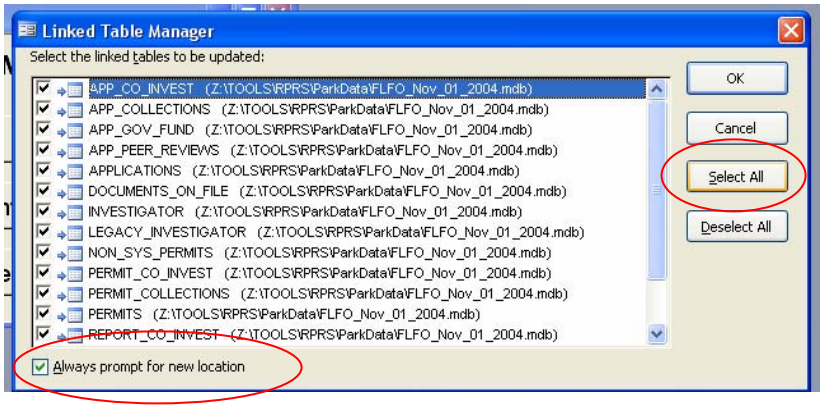


Figure 5. Linked Table Manager Options

2.4. Browse Research Permits

The main interface provides a means to browse all permits. Because the official information is managed from a park service server, this data is read-only.

3. References

NPS (2006). Research Permitting and Reporting Systems, National Park Service [https://science1.nature.nps.gov/research/ac/ResearchIndex], November 2006.

4. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Software Development

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document describes the project life cycle specific to the development of software and database applications for the Rocky Mountain Network.
Suggested Citation: NPS-ROMN (2007). Software Development, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document lays out the ROMN's Software Project Management Design Strategy. It is intended to provide the basic structure which all such projects should strive to achieve. Emphasis is on working with both the immediate users of the system (i.e., data entry personnel and their supervisors) and the higher level users that rely on the system to provide required reports and information in a timely manner. The goal is to produce software and database products which are intuitive to use, incorporate quality assurance and control measures, and deliver reliable information quickly and simply. The process fits the Project Life Cycle Model: Initiate, Plan, Execute (and Control), Close.

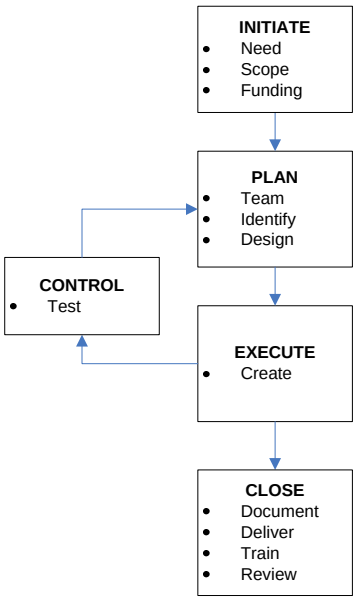


Figure 1. Software Project Life Cycle

2. Initiate

2.1. Recognize the Need for a Software Product

Most software products developed by the Network will be databases to meet specific and limited needs. These needs will arise from the Network's Vital Sign Monitoring Protocols and may also develop from administrative requirements, park support projects, internet webpage information distribution, and other sources. Until a need is formally recognized and clearly stated no significant database project should be undertaken.

2.2. Determine the General Scope and Objectives

Before proceeding, a realistic understanding of the size and complexity involved in a database development project must be achieved. This can be general as long as it is sufficient to give a sound estimation of the total cost.

2.3. Identify the Funding Source and the Project's Priority

Every database development effort involves an allocation of resources whether simply the time of the ROMN data management staff, actual funds budgeted (i.e., to hire a contractor), or some combination (staff time and travel expenses). A project's priority must be determined as part of the decision process involved in the allocation of Network resources. Unfunded projects wait at this step or are discarded, only funded projects proceed further.

3. Plan

3.1. Assemble a Design Team

The first step in the planning process is to assemble a design team. The team will initially involve the software developer (either ROMN Staff or the contractor), the higher level users that will ultimately use the outputs from the database, and representatives of the data entry personnel who will use the database to produce the outputs. In later stages, the working team may be only the software developer (developer) and a user representative (user).

3.2. Create a Detailed List of Products

It is critical to define the products expected from the database as thoroughly as possible at this stage. Data that are not entered into the system and stored in the correct data type can neither be reported nor used in calculations. Making additions and modifications to the database to accommodate changes can be complex, expensive, and time consuming.

3.3. Identify the Data Sources

Once the products expected from the database are defined (above) it is possible to identify the data that needs to be stored by the database. It is important however to discover any elements that should be captured even though not needed immediately. For example, a vital sign protocol may call for capturing measurements and sample data that are not needed currently for reports or analysis but may be required at some

future time (for example, to integrate these data with that from other monitoring programs).

3.4. Design the Database Structures

After the data elements have been identified they can be analyzed and proper data structures can be developed. The Natural Resources Database Template (NRDT) will be the basic model for most databases developed by the ROMN (all monitoring databases). This step involves identifying the structures that suit the data, not creating them.

3.5. Design the User Interface

This final step of the planning process involves the design team working closely together to incorporate the data elements and structure into a design that facilitates the workflow of the users. For example, in a vital sign monitoring database the user interface should be designed at the same time as the field forms are designed, each informing the design of the other. The two should match as closely as possible, facilitating the workflows of field teams, data entry, and quality control (NPS-ROMN 2007a).

4. Execute & Control

4.1. Create the Database Structures

After the planning has been completed the database itself can be created. The first step is to build the data structures that were designed above. This consists of the series of tables called for by the database design, creating primary keys, building relationships, enforcing referential integrity, and establishing limitations on data values that help provide quality assurance by the use of lookup tables, data ranges, and validation routines. When possible and practical, design of the tables will follow the Natural Resources Database Template (NPS 2006).

4.2. Create the User Interface

The user interface that was designed above should be implemented to provide the data entry, editing, reporting, and analysis routines that make the database useful. The construction of queries, event functions, global functions, reports, and data export routines occurs during this step.

4.3. Test for omissions and bugs

This step begins at the advanced stages of completing the user interface. As errors (bugs) and omissions show up feedback information for finishing the user interface and finalizing the database structures is developed. The process actually continues throughout the life of the database as the data it is required to store and the information it reports evolves over time. Eventually it results in a new software development project to define the modifications required to create functionality.

5. Close

5.1. Formal Beta Testing By the User

Before turning the database over to the users for unrestricted use a beta test version of the database should be provided so that the users can test for omissions and bugs. The users have a different perspective on the database and use it in ways that the developer may not have predicted. This process can discover new bugs. An additional advantage is that the users gain some experience with the database in an environment where mistakes are not critical to the validity of the data.

5.2. Create help screens and documentation

The database must be fully documented to remain useful over time.

5.2.1. Metadata

Metadata lets future users understand the information that a dataset contains, datasets that lack it become meaningless collections of numbers and letters. Detailed instructions are found in the Network's Documentation SOP (NPS-ROMN 2007b).

5.2.2. Software Development Project Documentation

It is extremely helpful to have the process that gave birth to the database documented as well; what needs it should fulfill, who were the members of the design team, what were the scope and objectives, etc.

5.2.3. User Manual and Online Help Screens

The more complex and long lived a database is the more important it is to have a user manual and online (F1) help screens. As people begin using the system who were not involved in the development process a resource for answering their questions becomes extremely useful.

5.3. Deliver System and Train Users

The tested and documented system can be delivered and the data entry personnel trained after any problems or omissions discovered during the beta test have been fixed and the documentation is ready.

5.4. Project Review

Following completion of the software, it will be necessary to review the project and evaluate successes and failures.

6. References

NPS (2006). Natural Resource Database Template, National Park Service [http://science.nature.nps.gov/im/apps/template/index.cfm], November, 2006.

NPS-ROMN (2007a). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

7. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Travel Time Cost Surface Model

Data Management Operation

Data and Information Management Plan

Version*: 1.4
Status: FINAL
Revision Date: June 14, 2007
Authors: Brent Frakes, Courtney Hurst, David Pillmore, Billy Schweiger, Colin Talbert
Abstract: This document describes using the cost surface model in ArcGIS 9.2. This model uses a digital elevation model, streams, lakes, roads, trails and landcover to determine the relative time required to reach any location within a park unit. The result can be used to help stratify random sampling points to ensure that most occur in accessible areas.
Suggested Citation: NPS-ROMN (2007). Travel Time Cost Surface Model, Version 1.2, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document describes a cost surface model (CSM) which calculates travel-time, (in seconds), from either single or multiple starting location(s) to any given point within a user-defined area. This model was specifically created for calculating travel times within national park units. As such, this model can be used in the creation of monitoring designs which stratify sampling locations by accessibility, and it can also be used as a planning tool for coordinating field work. Furthermore, this model is not limited to park management, but has broader applications to other land management agencies.

In the CSM's calculation of the travel time, it uses spatial data themes readily available for most parks. Themes include movement facilitators, such as roads and trails, and movement barriers, including slope, land cover/vegetation, and water features. The model can accommodate one starting point or can integrate all initial starting points from a linear feature (e.g., road network). The CSM output is a raster map in which each cell value is the total number seconds it takes to reach the given cell from the specified starting point(s). It is assumed that the user is already proficient in the use of ArcGIS 9.1 or 9.2, has the spatial analyst extension license running, and is familiar with the limitations and assumptions of the datasets.

NOTE: This model is developed for sampling design and is not intended for trip planning where safety is an issue. Travel times are only relative to each other and may not accurately reflect actual travel times in the field.

The CSM uses seven parameters, **all of which must be in the same datum , projection, and grid resolution**:

- **Starting Point(s):** The starting point is a vector layer that contains the starting point(s) from which travel time will be calculated. It can be either point(s) or line(s). For example, this layer could be the park road network, a single field base camp or multiple park entrances.
- **Elevation:** This is a digital elevation model (DEM) of the area of interest.
- **Streams:** This is a vector layer that contains stream hydrological features. The data used for this input must have a column (type: short, length: 4, precision: 4) titled "speed".
- **Lakes:** This is a vector layer that contains lake hydrological features. The data used for this input should have a column (type: short, length: 4, precision: 4) titled "speed".
- **Roads:** This is a vector layer that contains the road network in and around a park. The data used for this input must have a column (type: short, length: 4, precision: 4) titled "speed".
- **Trails:** This is a vector layer that contains the trail network in the park. The data used for this input must have a column (type: short, length: 4, precision: 4) titled "speed".

- **Landcover:** This is a raster dataset containing vegetation / land cover.

Figure 1 provides the general model logic.

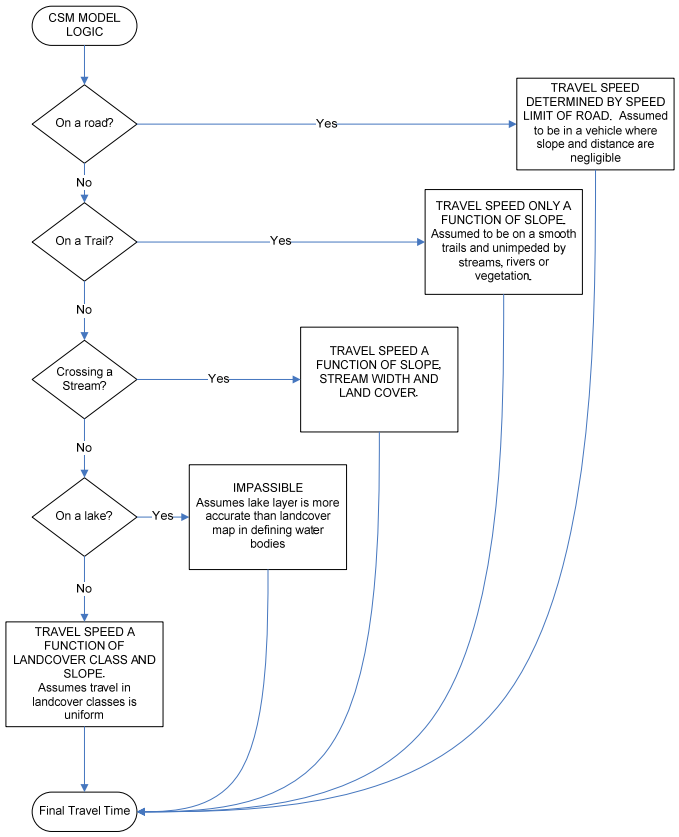


Figure 1. Cost Surface Model Logic

2. Model Specifications and Parameterizations

When traveling by foot, travel speed can be positively or negatively affected by terrain or landcover and therefore, such travel cost(s) must be factored into each layer used in the CSM. In the CSM, travel time cost of traversing different landcover and terrain types is accounted for with the designation of a “speed” value. This “speed” value ranges between 0 and 100.

- A value of 0 represents an absolute barrier, indicating 0% movement relative to normal conditions.
- A value of 100 represents no impairment. Movement is 100% of what it would be without influence from a particular layer.
- A value of 50 is 50% as fast as it would be without the layer and takes twice as long to traverse.
- A value of 25 is 25% as fast as it would be without the layer and takes four times as long to traverse.

When selecting the appropriate speed, one should always compare the travel time with walking on a smooth, cement path. Furthermore, speed versus travel time should not be confused. As Table 1 shows, travel time increases exponentially as the relative travel speed approaches zero (Table 1).

Speed (% of maximum)	Travel Time Units (e.g., Minutes)
100	1.0
95	1.1
90	1.1
85	1.2
80	1.3
75	1.3
70	1.4
65	1.5
60	1.7
55	1.8
50	2.0
45	2.2
40	2.5
35	2.9
30	3.3
25	4.0
20	5.0
15	6.7
10	10.0
5	20.0
0	Indefinite (Forever)

Table 1. Speed Versus Travel Time

Model users must create a “speed” column for each layer used in the CSM. If a landcover raster layer is used, such as a National Landcover Dataset (NLCD; NLCD 1992) raster, the user will need to construct a re-class table for use in the model. The re-class table will assign a travel speed (% speed relative to normal travel) to each different landcover type represented by the NLCD layer. “Speed” values for the re-class table can be derived from (1) the user’s knowledge of the terrain and the impacts of various landcover types on travel; or (2) park staff questionnaires which address the impedance of various cover types. The sections below outline suggested methods for calculating the cost of each layer. The methods outlined are quite general, and attempts should be made to gather more information about each layer as possible. Knowing what cost values to assign to various layers is not an easy task. The following section provides examples and not definitive cost values; ***your cost values should be carefully evaluated for each situation, tailored to your needs, and confirmed in the field.***

2.1. Streams

For streams, the Strahler Order provides a consistent and simple means of assigning travel cost (Table 2). In this case, order was calculated from the **high resolution** (1:24,000) National Hydrography Dataset (NHD 2006) using the ArcHydro toolset (Center for Research in Water Resources 2006).

Strahler Order	Speed (% of normal)
1	80
2	70
3	60
4	50
5	40
6	30

Table 2. Example Costs for Strahler Order

2.2. Lakes

Unless boats or other watercraft are available to transport field crew across lakes, it is recommended to assign lakes to be an absolute barrier to travel (i.e., 0).

2.3. Trails

In our example, trail condition was unknown and thus we gave all trails a cost value of 100. This value of 100 is based on the assumption that there were not any on-trail obstacles that would slow a traveler down. For this layer, travel cost values could further be refined through the use of questionnaires given to the park staff about the conditions of the trails within the park.

2.4. Land Cover

There are a number of potential land cover layers that can be used, including the National Landcover Dataset (NLCD 1992), GAP data (GAP 2006), or, when it exists, a park vegetation map. In our example, we use the NLCD dataset. Table 3 shows the example costs for Great Sand Dunes National Park. These were estimated by averaging answers from staff familiar with the park.

NLCD Cover Class	Speed (% of normal)
Grass	80
Aspen	75
Ponderosa Pine	75
Fir - Spruce Pine	70
Grass – Shrubs	70
Pinyon-Juniper	70
Riparian	60
Grass – Wetland	50
Sand - Sparse Grass	40
Sand	30

Table 3. Example costs assigned to NCLD cover classes

For the landcover layer, the user will have to create a re-class table that is appropriate to the travel cost of the cover types present in the park. ***If the user has a park vegetation map available for use in the model, then this file should be converted from a feature to a raster before use in the CSM***. ***When the vector is converted to raster, the Field used for the conversion from feature to raster should be the vegetation code.*** When converting the vegetation map from feature to raster, the new cell size of the output raster needs to be the same as the DEM.

Reclassification of a raster requires a lookup table with “From”, “To”, and “OUT” fields. The “FROM” and “TO” fields are the same and represent the different landcover classes. The “OUT” field is the speed assigned to that respective class (Figure 2).

FROM	TO	OUT
0	0	100
2	2	100
3	3	100
4	4	100
5	5	100
6	6	100
7	7	100
8	8	100
10	10	100
11	11	90
12	12	50
13	13	100

Figure 2. Example of a Reclass Table

When using a Vegetation Map, it is important to understand how the water polygons lap or do not overlap with the streams and lakes layer. In cases where the two do not overlap, water layers may be over represented.

2.5. Roads

For the roads layer, speed is only a factor of the speed limit and/or road condition, rather than landcover or terrain variation. Thus, speed is represented by the time in seconds it takes to traverse one meter (m) multiplied by 1000. For example if a speed

limit on a given road is 25 Miles per hour (mph): (1) convert to Kilometers per hour (kph) (i.e., 40), (2) convert to meters/ second (i.e., $\frac{40*1000}{3600}=11.11$), and (3) convert to seconds/meter (i.e., 0.09).

2.6. Maximum Travel Time

As the impedance increases due to denser vegetation, wider streams, and higher slope, the accumulated travel time will approach infinity. Therefore, the user will need to specify a maximum time (in seconds) for the model to use as a cutoff. The model is set to run on a default of 14400 seconds, or 4 hours.

2.7. Speed Calculation

Potential foot speed along a path is determined by slope (Theobold, 2003; Tobler 1993) where

$$6 * EXP\left(-3.5 * ABS\left(TAN\left(\frac{Slope}{57.29578}\right)+0.05\right)\right).$$

Potential foot speed is further reduced by the influence of landcover, lakes, and streams.

Potential speed along a road is determined only by the speed limit.

3. Workspace Preparation, Results, and Data Management

3.1. Preparation

In order to decrease the time needed to run the model, it is recommended that the user run the model locally and not use a network server. The user will need to replicate the following directory structure at the root of the C: drive (i.e., C:\CostSurface\; Figure 3).

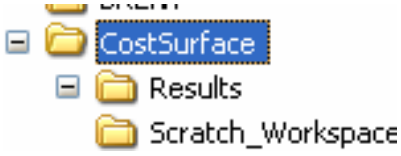


Figure 3. Example Cost Surface Model Temporary Folders

Prior to running the model, the following items must be confirmed:

1. The Scratch_Workspace and Results folders are cleared out; otherwise the CSM is likely to fail.
2. By default, the model is set to run using the datasets in "ExampleInputs_20070510" datasets. If other data is to be used, the user can specify the alternative.
3. The current model is will only work in ArcGIS 9.2
4. All inputs should be confirmed from the graphical user interface (Figure 4).

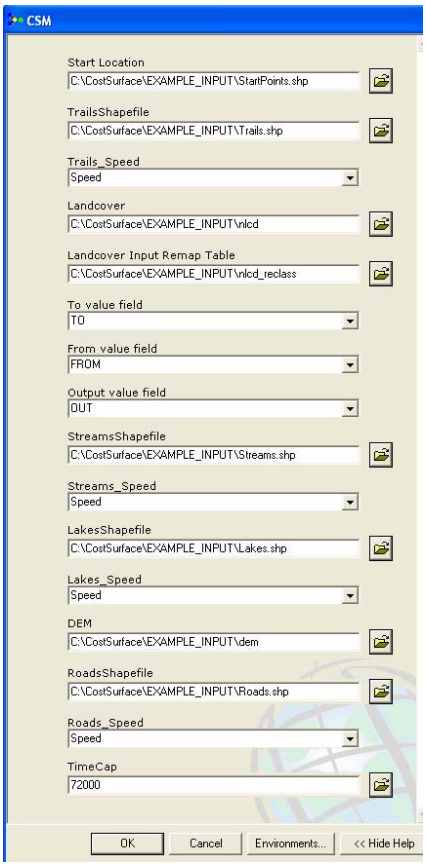


Figure 4. Cost Surface Model GUI

3.2. Results

All resulting files will be written to one of two folders:

- Scatch_Workspace – These are the temporary files used in the various calculations. These may be referred to if the model does not appear to be working properly
- Results – Contains four files. Three represent the final travel times in different units seconds (tt_sec), minutes (tt_min), and hours (tt_hrs); othweise, all three files are the same. The fourth file (speed_mph), is the calculated speed for each grid cell.

3.3. Data Management

Preserving the model settings and input data (metadata) for each model run is essential to the adequate interpretation of the model. If datasets change through time, either because they are updated or because the speed values are modified, they will affect the final travel times. To minimize confusion, it is imperative that careful thought be given to workflow. Procedures for this Network are:

- The official model version and input datasets are maintained on the server as read-only.
- The model should not be added to the toolbox since it creates versioning issues.
- All of the input data for a park is versioned by the date (e.g., ROMO_Input_20070510).
- The model version is specified by the date (e.g., ROMN_CSM_20070510.tbx)
- The model is run using a copy of the toolbox saved to the “Results” folder. All data specifications are saved in the model using the Toolbox Editor. Maintaining a copy ensures that the final travel time grid is also saved with the model version and data specifications.
- Final travel time grids, along with a copy of the model with the settings, is saved by the date (e.g., ROMO_TT_20070510).

4. References

Center for Research in Water Resources (2006). Arc Hydro Online Support System, , University of Texas at Austin [http://www.crwr.utexas.edu/giswr/hydro/ArcHOSS/index.cfm], November, 2006.

GAP (2006). GAP Analysis Program, USGS [http://gapanalysis.nbii.gov/portal/server.pt], November, 2006.

NHD (2006). National Hydrography Dataset, USGS [http://nhd.usgs.gov/data.html], November, 2006.

NLCD (1992). National Land Cover Dataset, The USGS Land Cover Institute (LCI) [http://landcover.usgs.gov/natllandcover.php], November, 2006.

Theobald, D.M. (2003). GIS concepts and ArcGIS Methods, Conservation Planning Technologies, Fort Collins CO.

Tobler, W. (1993). Three presentations on geographical analysis and modeling. Technical report. 93-1, National center for geographic information and Analysis, University of California, Santa Barbara.

5. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
0.0-1.0		Colin Talbert	Initial Model Development	Model Creation	1.0
1.0	20070412	Courtney Hurst	Update Methods and Parameters: (1) Reclass table option added for landcover layer (2) Cost fields from each layer added as a model parameters—user can then choose the field from the layer from which to draw cost values	Model Updates—Updates were made to make the model useful for a general audience	1.1
1.1	20070510	Brent Frakes	-fixed clipping problem when trails or roads are less than the extent of the DEM -Added time cap and process steps -Cleaned up temporary file names -Added calculation of travel time in minutes and hours -Changed version # to the date	-All fixes were to make model more universal	20070510
20070510	20070510	Brent Frakes	-Fixed clipping problem of roads and lakes		20070514
20070514	20070614	Brent Frakes	-revised logic of stream layer -Included in the output is a speed layer -removed “100” hardwire for the trails layer		1.4

Table 4. Change History

This table reflects changes this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Using GPS-Photo Link to Georeference and Watermark Photographs

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore, Joel Cusick
Abstract: This SOP describes the process for linking digital photographs to geospatial locations found using a GPS.
Suggested Citation: NPS-ROMN (2007). Using GPS-Photo Link to Georeference and Watermark Photographs, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This SOP provides instructions for using the GPS-Photo Link (version 4.0.15) software. This software imprints digital camera photos with watermarks of the coordinates (latitude, longitude, UTM, etc.) where the photo was taken without requiring a physical connection between the camera and the Global Positioning System (GPS) receiver. It works by matching the time stamp on the photos with the closest timestamp of a GPS waypoint or tracklog point. It also allows the user to enter manual photo positions, additional attribute information for inclusion on the photo or with the metadata, and creates both a shapefile and text file to be used with GIS software and databases. This SOP provides general descriptions of the use of the GPS and camera. The examples used are specific to the Garmin GPS units and Mapsource software (version 6.10.2); detailed guidance for using a GPS and camera are found in their respective SOPs. Figure 1 diagrams the processes and steps involved in this SOP. These are further described in the remaining sections of this document.

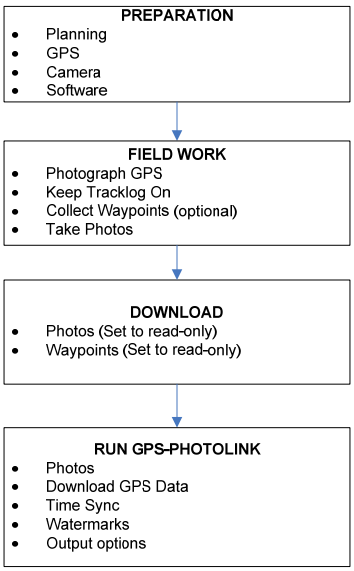


Figure 1. Process diagram for using GPS-Photo Link Software

2. Preparation

While having the GPS and camera work properly is fundamental to the operation of the GPS-Photo Link software it is important to understand the different pieces of information that each provides, how the software integrates the information to georeference the photographs, and how this process fits in with the monitoring protocol and the field work SOPs. Therefore, careful planning and preparation prior to the field work is necessary.

2.1. Planning

It is important to review the status of photographic images in the specific monitoring protocol. With that in mind and the information from this SOP these steps can be integrated with the protocol's Field SOPs. If necessary, modifications of these steps can be addressed with the Network Data Manager. This should result in a single integrated field SOP that makes the entire process as simple and reliable as possible.

2.2. GPS

While operating independently of the camera, the GPS provides all of the spatial information. This is accomplished using either the GPS's automated tracklog feature or by collecting waypoints. For limited field work where storage space on the GPS is not an issue, setting the tracklog to record every five seconds is generally acceptable. When storage space is an issue, setting the GPS to record the tracklog at longer intervals may be necessary. In some cases, use of the Auto tracklog option may be acceptable because it conserves space by recording fewer points when the unit is stationary and more points when the unit is in motion. Although collecting waypoints is an option, unless required, they are not recommended because of the added complication and time factor involved. Waypoints do have the advantage of having the highest accuracy, lowest battery consumption, and it is possible to take multiple photos of one thing (e.g., one waypoint linked to four views of a building). However, waypoints do require being recorded BEFORE taking the photographs and must be more than 1 minute apart.

Furthermore, we recommend against using a mixture of waypoints and track – the protocol will decide the best approach.

The following will be confirmed prior to field work:

- The tracklog is cleared, turned on, and set to collect points at the appropriate interval.
- All unnecessary waypoints will be purged from the GPS.
- Batteries and replacements will be fully charged.
- The time on the GPS will be verified to ensure that it is set to the correct time zone.
- The projection and datum will be UTM NAD 83 with the appropriate zone.
- In cases where field work is extended and the field crew intends to turn the GPS receiver tracklog off to save on memory and/or turn the receiver off to save battery power, thought will go into how the crew will be reminded to turn the unit back on. One recommendation is to integrate a reminder directly into the field forms.

This section does not provide guidance on how to obtain accurate information from a GPS. The user will refer to the Network GPS SOP [NPS-ROMN 2007a] or the appropriate field data protocol for the data collection standards using a GPS.

2.3. Camera

The following will be verified prior to operating the camera in the field:

- The batteries will be fully recharged to minimize the need for battery replacement in the field
- Fully charged backup batteries
- Set camera time as close as possible to GPS. Most cameras can be turned over at the top of the minute when the GPS minute changes on the GPS screen. This technique can be tested by then observing the minute on the camera time screen and the minute on the Garmin satellite status page. The closer the camera-GPS synchronization, the more likely the photos will be properly georeferenced. The user is advised that camera clocks may drift by up to 5 seconds a week.

This section does not provide guidance on how to obtain useful photographs from a camera. The user will refer to the camera specifications SOP [to be developed], or field protocol SOP [in development] when using a digital camera.

2.4. Software

Outdated software frequently causes unanticipated issues; all software will be current. After loading and registering the GPS-Photo Link software, one should check the website (Geospatial Experts 2006) for latest version. The GPS and camera software – for both the unit and desktop software - may also require updating.

Before collecting data in the field, one will confirm that the camera-GPS configuration works properly with the GPS-Photo Link software. Confirmation is especially important for GPS units not manufactured by Garmin.

3. Field Collection

3.1. General Guidelines

When in the field, the following guidelines apply:

- GPS should be warmed up. That means, if it has not been used in more than 7 days, place GPS in open area to ensure that it has a fresh almanac.
- The first shot of the day will be of the front of the GPS receiver with the time / date showing. This is referred to as the “Time-Sync” photo;

- The GPS tracklog will be turned on, unless otherwise specified by the protocol or field procedure;
- Waypoint can be collected at important points; however, unless it is essential that the reading be as accurate as feasible, this procedure is discouraged because of the added data collection complications. Nevertheless, when desired, to ensure adequate representation of a waypoint, at least 30 readings must be averaged. The optimal number to collect is 120, while more than 180 do not provide more information (Thomas 2006). Waypoints must be marked before taking the photograph and will be at least 1 minute apart.
- If the camera batteries are replaced while in the field, the time and date will require verification and may need to be reset. One will also take another picture of the GPS screen and note if there were any adjustments to the date/ time. If there were adjustments, the photos will have to be processed in separate groups.

3.2. Photo Methods

There are four methods for recording photographs in the field:

- **Standard (S)** - the camera and GPS unit are in same location as the target position. This is most common method and does not require notation. The camera direction is optional.
- **Offsetting (O)** – Camera and GPS are not in the same location as the target position. This method is used when the photographer is unable to be in the target position or must be at a distance to record the target position (e.g., building).
- **Two Persons (2P)** – The camera is in one location while the GPS, held by a second person, is in the same location as the target position.
- **One Person (1P)** - The camera is in one location while the GPS is set on the target position (being careful not to obscure the antenna).

The photographer has the option of recording camera direction for the standard method; the three other methods require extra notation regarding the method, camera direction, and distance to the object. Method will be recorded by the shorthand S, O, 2P or 1P. Camera direction is expressed as the cardinal direction (N, NE, E, SE, S, SW, W, or NW) the photographer is facing from true north. Distance to the object will be expressed in whole meters (i.e., rounded to the nearest meter) and can be either estimated (e) or measured (m). An example of proper notation for any of the methods is:

2P-NE-10m

Preferably, notation will be included in the photograph itself, along with any site notation, using a white dry erase board with blue or black ink. Photograph notation will always appear below the site notation. When a dry erase board is not available, notes will be recorded in a field book designed for outdoor use. These notes will be used to augment the photograph information in Section 5.1.5 of this SOP.

4. Download

4.1. Pictures

All pictures from the camera will be downloaded to a specified folder in the appropriate project folder. Unless otherwise specified, original photos will be placed in a folder titled with the date of download (e.g., 20070424). If possible, it is desirable to download the pictures without a change in their attributes – specifically the date and time the photo was taken. Fortunately, however, GPS-Photolink relies on the EXIF file for that information and is unaffected by a change in the photo's general attributes.

Following download, all photos will be **set to read-only**. Before deleting the photographs from the camera, it is important to confirm that all photos have been copied and are uncorrupted. These photo image files must not be edited or changed in any way.

If the camera time was reset in the field and there was a difference in the camera time of more than one minute from the GPS, the photos will be saved into separate sub-folders.

4.2. Waypoints

A copy of the waypoints (and/or tracks) will be saved to the same folder as the original photographs. Waypoints will be saved either as GPS Exchange Format (*.gpx) and/or as a shapefile and named appropriately (e.g., Waypoints_ProjectID_YYYYMMDD).

When using a Garmin GPS unit for point collection, the Minnesota DNR Garmin software (Version 5.2; Minnesota Department of Natural Resources, 2007) is the most straightforward application.

5. Run GPS-Photo Link

Directions for using GPS-Photo Link can be organized according to the five option screens provided to the user when the program is activated. These screens enable the user to specify where the photographs are located on the computer, how to download the tracklogs (and waypoints) from the GPS, specify any differences in time between the camera and GPS unit, select the watermark, and determine other output options.

5.1.1. Select Photos

The first screen allows the user to specify where the photographs are located (Figure 3). The photo source, found on the left side of the screen, will be set to “Camera Folder.” This enables the user to specify the source (Original) and destination (Final) folders.

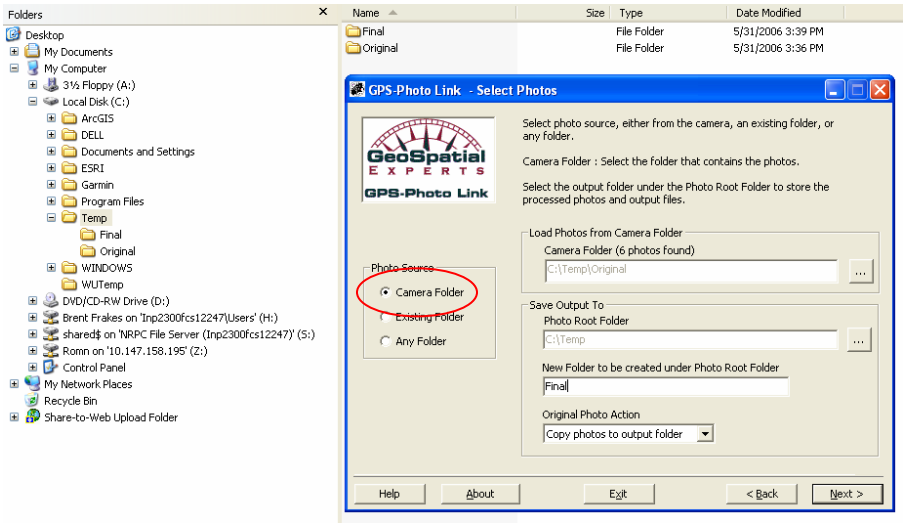


Figure 2. GPS-Photo Link Select Photos Screen

5.1.2. Download GPS Data

The following will be specified on the GPS data form (Figure 4):

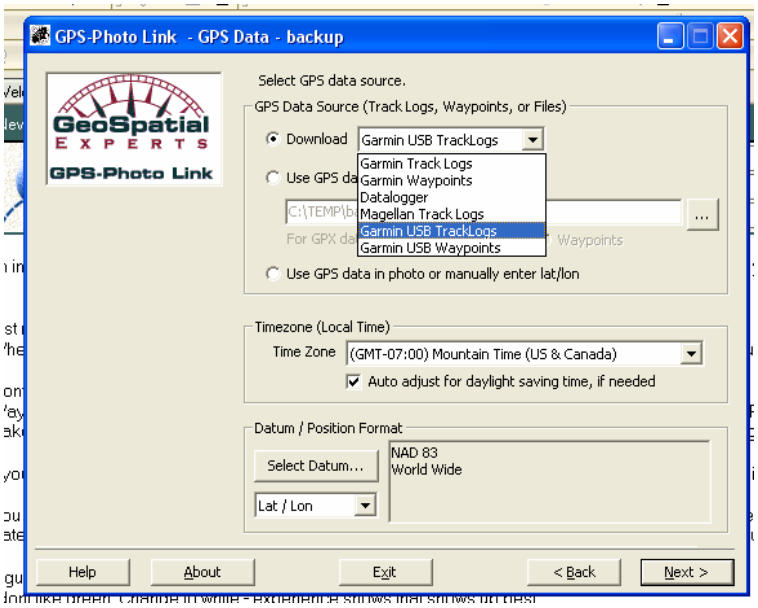


Figure 3. GPS Photo Download GPS Data Form

- Tracklogs (and waypoints) will be downloaded directly from the GPS unit. This option is preferable because it avoids some of the projection confusion issues inherent in using other 3rd party download packages such as MapSource.
- When using a Garmin, there are four options for connecting, depending on whether the unit connects through a com port or USB and whether the data is tracklogs or waypoints.
- The time zone that the pictures were taken in (i.e., Mountain) and check for daylight savings time adjustment
- The Datum/Position format. This specifies how the images are to be watermarked and does not refer to the projection of the tracklog file. To make the photos as user-friendly as possible and control for collecting data across two UTM zones, Lat/Long (NAD83 World Wide) will be used.

5.1.3. Time Sync

Matching the digital photos to the GPS location is accomplished by synchronizing the Camera and GPS time (Figure 4).

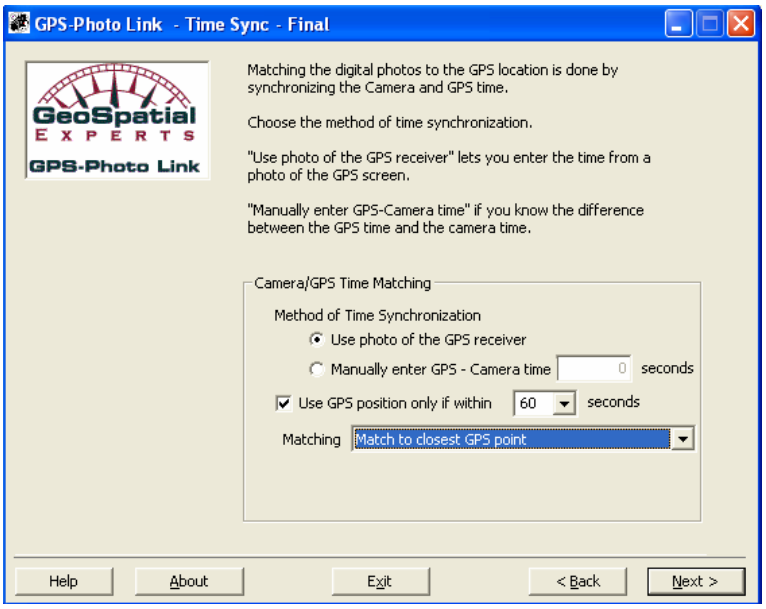


Figure 4. GPS-Photo Link Time Sync Form

The following will be set:

- The Method of Time Synchronization will be “Use photo of the GPS receiver”.
- When using the tracklog, select “Match to closest GPS point”. NOTE: If waypoints were collected, the “Point BEFORE Photo” option will be selected.
- When using waypoints, select “Match to closest point BEFORE photo”

5.1.4. Time Offset Entry Watermark

Figure 6 shows how it is possible to modify the watermarked time for each photo. Except for rare cases, this step can be skipped.



Figure 5. GPS-Photo Link Time Offset Entry Watermark Form

5.1.5. Data Entry/Photo Edit Watermark

The Data Entry/Photo Edit Watermark form (Figure 7) provides more watermark options. There are no formal requirements for this form, unless a photo method other than standard was used. Title is recommended.

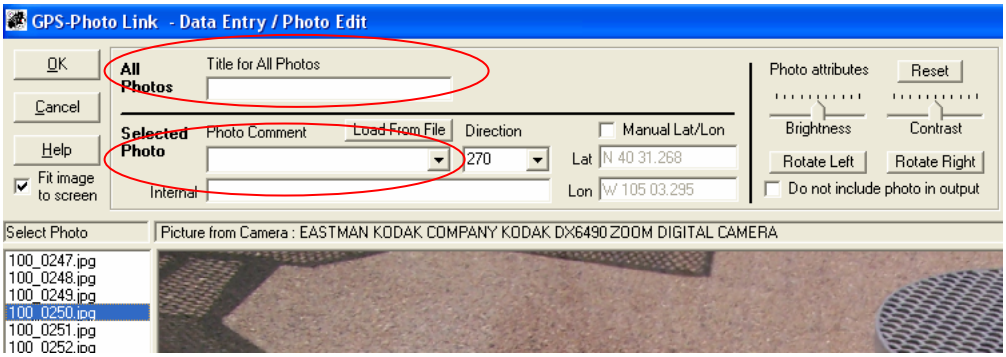


Figure 6. GPS-Photo Link Data Entry/Photo Edit Watermark Form

In cases where notes were recorded about the photo method, they will be recorded in the “Photo Comment” section. Camera directions, recorded as cardinal directions, do not need to be converted to degrees.

5.1.6. File Output

The Output Options form (Figure 8) provides choices for the format of the watermarks, including color and font. The following are required:

- The resize photo will be unchecked. In other words, the photos will not be resized;
- The watermark font will be Arial;
- Text color is white with black halo (this shows up best);
- Save a text file CSV for backup;
- Place Latitude, longitude and datum on image;
- Watermark will be placed inside photos;
- Output form will be a watermarked photograph;
- The jpeg quality will be “best” or “max”; and
- The watermark text size, color, alignment and position will be consistent and legible for all photographs.

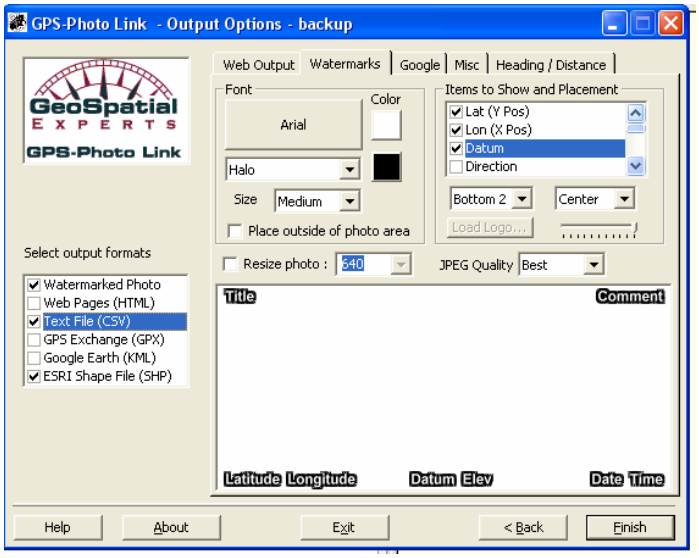


Figure 7. GPS-Photo Link Output Options Form

6. References

Geospatial Experts (2006). GPS Photo Link [http://www.geospatialexperts.com/], November, 2006.

Minnesota Department of Natural Resources (2007). DNR Garmin Application [http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html], April, 2007.

NPS-ROMN (2007). Using the Garmin GPS 76csx, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

Thomas, Ron (2006). Personal Communication regarding the appropriate number of GPS points to collect, GIS Coordinator, Rocky Mountain National Park.

7. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 1. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Using the Garmin GPS 76csx

Data Management Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, Leona Svancara (UCBN), David Pillmore
Abstract: This document describes the general procedures for using the Garmin GPS units for data collection in the field.
Suggested Citation: NPS-ROMN (2007). Using the Garmin GPS 76csx, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document addresses the Network standards for using the Garmin 76csx GPS units in the context of work that is likely to be conducted by network staff and cooperators for vital sign monitoring and other related field work. We anticipate that most of our work will involve navigating to selected waypoints; the mapping and attributing of points, lines and polygons (with complete data dictionaries) is less likely to occur.

This SOP is not intended to substitute as a basic user's guide to the Garmin units. Basic instructions are found at the Garmin Website for the GPS 76csx (Garmin 2006).

Figure 1 shows the general steps that occur during the use of the unit. The following sections detail each of these steps more fully.

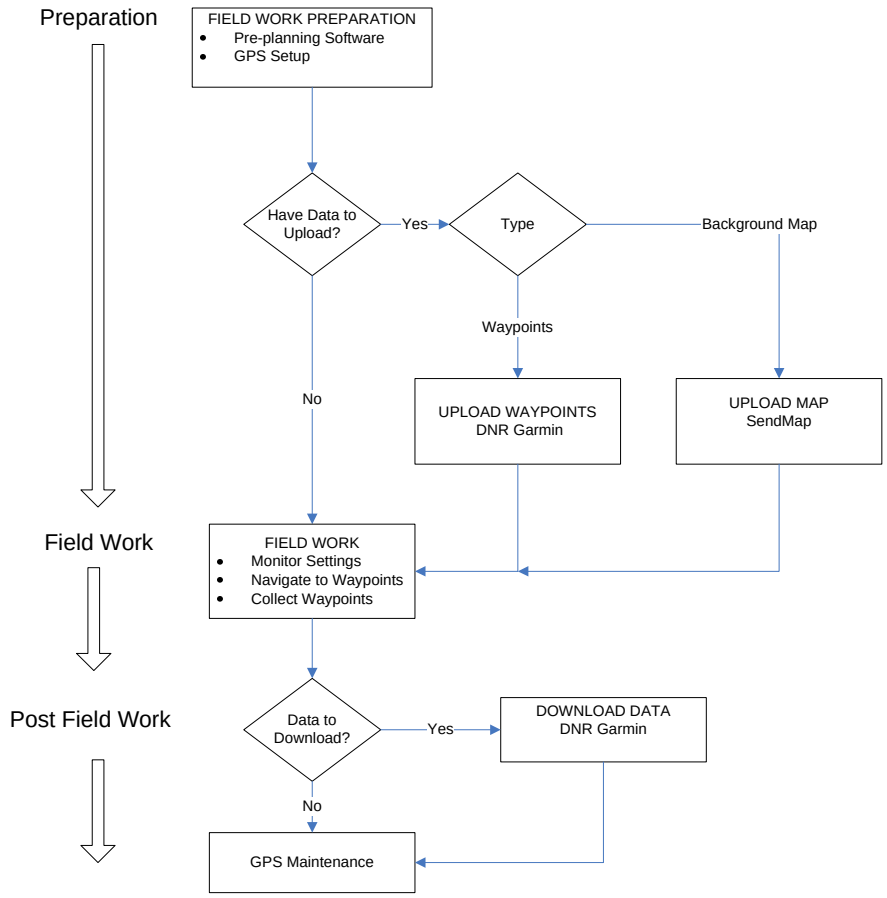


Figure 1. Steps for Using the Garmin GPS 76csx

Note: This SOP is written for the following software versions: DNR Garmin (5.1.1), Trimble Planning (2.7).

2. Preparation

Preparation is key to successful field work, and is the easiest way to assure quality information.

2.1. GPS Setup

Prior to conducting fieldwork, the following will be set and confirmed:

- The GPS is functioning properly
- There is an extra set of fully charged batteries ("A")
- The Garmin is set to UTM NAD 83. Note that it is not possible to specify the zone since Garmin determines this automatically while in the field. Use the Units Setup Menu to select the position format and map datum. When in doubt, use WGS84 and reproject to UTM NAD83 after data collection. For more help on projections, see the MN-DNR projection utility references and MN-DNR Frequently Asked Questions (MN-DNR 2006).
- WAAS (Wide Area Augmentation System) is enabled. This allows for real-time correction of GPS coordinates as long as the WAAS satellites are in view. Due to the fixed position of these satellites over the equator, signal reception is best in open areas with a clear view of the southern sky. Use the System Setup Menu to enable WAAS.
- Compass is calibrated. The internal compass will be calibrated prior to each use for increased accuracy in navigation. Use the Calibration Setup Menu to calibrate the compass.
- If photographs are to be linked to waypoints or tracks, the field crew will need to integrate the SOP for Using GPS-Photolink (NPS-ROMN 2007a).

In addition to the GPS setup, it will be necessary to specify to field specifications. First, it is necessary to define the maximum allowable error that will be tolerated when navigating and collecting data. This will preferably be specified in the field protocols. If nothing is specified, 10 meters (~33 feet) will be the default maximum error allowed for the collection of waypoints and tracks. Second, the number of waypoints to average will also need to be specified. The default number to average is 30.

2.2. Plan Trip With Pre-Planning Software

The baseline GPS constellation consists of 24 satellites that orbit the earth approximately every 12 hours. The position and time signals transmitted by these satellites are used by GPS receivers to trilaterate a location on Earth. The coverage of these satellites is not continuous and reliable all of the time. Therefore, it is important to plan the field trip around times when the satellite position is optimal.

Trimble offers a free stand-alone program that determines visibility for GPS, GLONASS, and WAAS satellites. The software can be downloaded from the Trimble web site (Trimble 2006). The software will only need to be installed once. For each planning session, it will also be necessary to download the current Ephemeris file (current.ssf) and import that using the Almanac function.

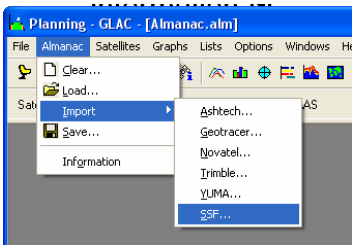
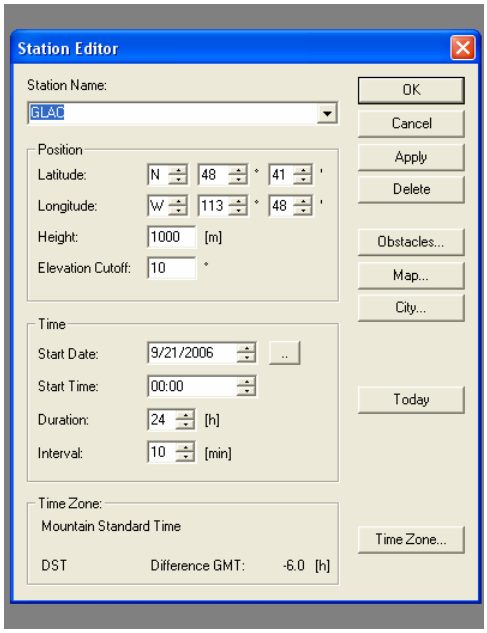


Figure 2. Importing the Ephemeris File Using the Almanac Function

Selecting File→Station calls the Station Editor where it will be necessary to select the location, date, and time of data collection (Figure 3).



When navigating to multiple locations, the centroid of those locations and average elevation will be calculated. When centroids and elevations are unknown *a priori*, the following default centroids and elevations for each of the parks can be used (Table 1).

Park	Latitude	Longitude	Min Height (m)	Max Height (m)	Avg Height (m)
FLFO	N 38° 54´	W 105° 16´	2494	2736	2604
GLAC	N 48° 41´	W 113° 48´	946	3189	1716
GRKO	N 46° 24´	W 112° 44´	1360	1445	1380
GRSA	N 37° 46´	W 105° 34´	2293	4130	2616
LIBI	N 45° 33´	W 107° 25´	932	1049	981
ROMO	N 40° 21´	W 105° 42´	2323	4343	3203

Table 1. Park Centroids and Average Elevations

The Graph Tool shows the time of day when the most satellites are available and the PDOP (Position Dilution of Precision) is lowest. PDOP is the measurement of error introduced by satellite orientation or geometry and can be easily minimized through the timing of field data collection. For instance, Figure 3 indicates that late afternoon readings on the 21st of September will generally yield more accurate results than the morning. Times to avoid collecting GPS data are centered around 6:00-7:00 AM and 9:00 AM.

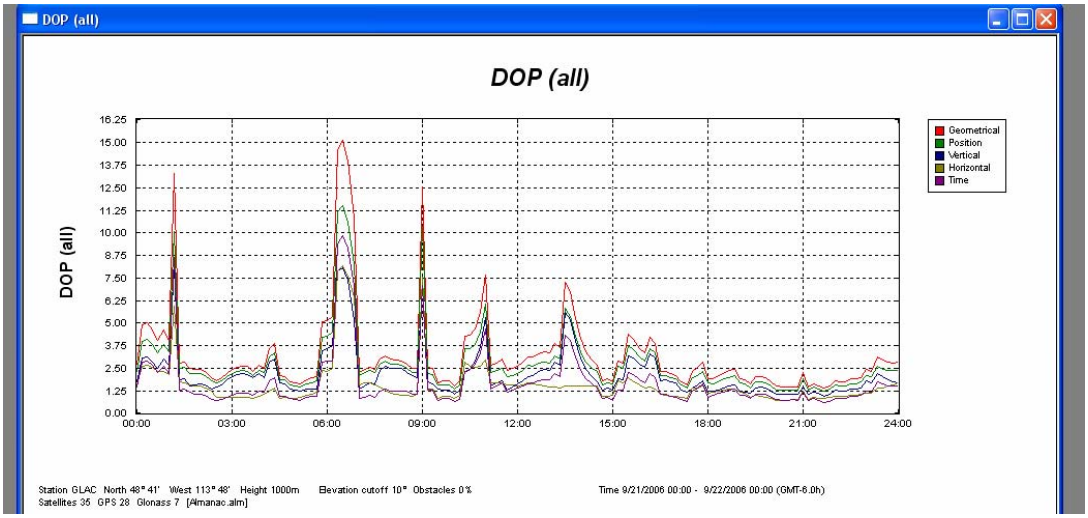


Figure 3. Example PDOP Graph

2.3. Create and Upload Waypoints

There are some important considerations with the Garmin GPS76csx that will determine the name of number of waypoints to upload. First, Garmin units sort all waypoints alphabetically by name, regardless of whether there are numbers or text. Thus, to order numbers sequentially, they will need to be treated as text and have the appropriate

numbers of zeroes preceding small numbers (e.g., 001, 002,…,050, 051,….101, 102, etc.). Likewise, to differentiate between waypoints to navigate to and those collected in the field, all waypoints will have a pre-defined prefix to differentiate navigation waypoints from those collected in the field. Unless otherwise specified by a field protocol, points prefixed with "n" will be navigation points (e.g., n103) and "c" (c103) will be the collected points.

Second, because the Garmin screens are small, long names for waypoints are not recommended. The recommended waypoint name will be

Type_PlotNumber_[ID], where

- Type – navigation or collected in the field (single text)
- Plot Number - Plot number
- ID – GPS or observer ID or some other identifier – (single text). This is an optional field.

Following the recommended naming convention, acceptable waypoints might include c001d (collected waypoint, plot #1, collected by Fred) or n502d (navigation point d in the area defined by plot #502).

A final consideration is the number of waypoints that can be stored by the Garmin GPS76csx - 1000. This becomes important if a waypoint is to be collected for each navigation point - only 500 of each can be stored before clearing out the unit's memory.

Once the waypoints have been properly named and defined in a shapefile, DNR Garmin (MN-DNR 2006c) is a useful program that interfaces the Garmin software with native shapefile format. To use this tool, navigation waypoints will be in a shapefile with a projection specific to the park standards:

Park	Projection
FLFO, GRSA, LIBI, ROMO	UTM Zone 13N, NAD 83
GLAC, GRKO	UTM Zone 12N, NAD 83

Table 2. Park Standards for Map Projections

This projection will also need to be specified in DNR Garmin (Figure 4).

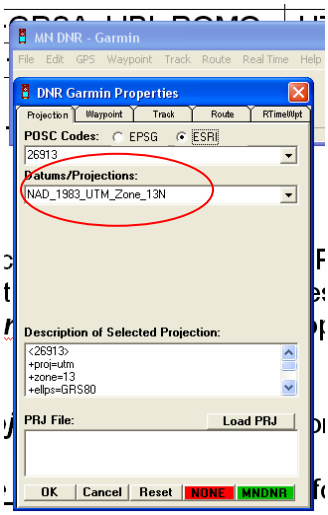


Figure 4. Setting the Projection in DNR Garmin

The following steps will enable one to upload a shapefile of waypoints into the Garmin unit:

1. Select File _ Load From _ *File*.
2. Browse the file location.
3. Select the correct file type (i.e. Arcview Shapefile (.shp)). Click *Open*.
4. Select a ID field (ex. *ID*) that is a number or text.
5. Select a comment text field, usually a description or name of the point. Click *OK*.
6. Select Waypoint _ *Upload*. This will transfer the points to the Garmin.
7. Click *OK*.

2.4. Upload a Custom Base Map

It is also possible to create custom basemaps that include points, lines and polygons. These custom basemaps are not intended for navigation, but can provide valuable background information (e.g., locations of streams and roads). The Network SOP Developing Custom Basemaps for Garmin Units (NPS-ROMN 2007b) provides instructions for this task using the SendMap software.

3. Field Work

3.1. Monitor Settings

Monitoring the satellite strength and relative location error is possible by using the Satellite Main Page (Figure 5).

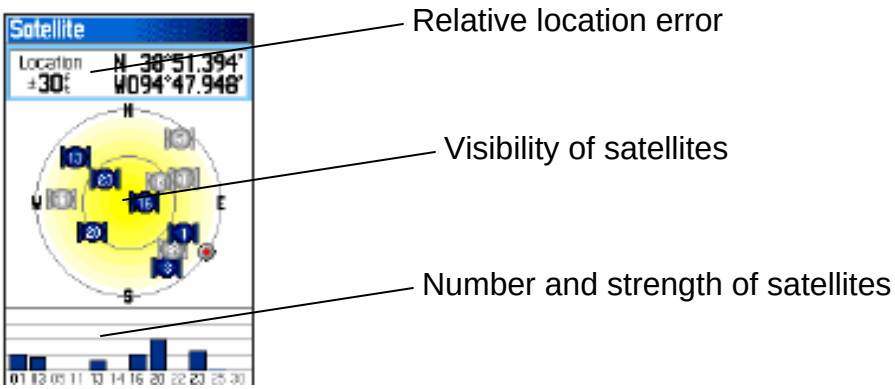


Figure 5. Satellite Status Page

These values will be monitored frequently during data collection and navigation to ensure that data is not collected when the maximum relative location error is above the maximum threshold (determined prior to beginning field work).

3.2. Navigating to Waypoints

The following steps will be followed when navigating to a waypoint:

1. Select the Find Menu to search for a waypoint of interest.
2. Select the waypoint and GoTo to navigate to the point
3. Select the Compass page (Figure 6). Please note that the layout for individual GPS units may differ slightly in the fields shown.
4. Holding the GPS level, walk in the direction indicted by the compass until the 'Dist to Dest' window reads zero.



Figure 6. Compass Page for Navigating to Waypoints

3.3. Collecting Waypoints

To provide as accurate a reading as possible, at least 30 readings will be averaged. The optimal number to collect is 120, while more than 180 do not provide additional information.

3.4. Defining Areas

Although Garmin units are not dedicated for the collection of polygons in the field, it is still possible to define areas using the Tracklog function. Starting from a marked point and turning on the Tracklog, one can navigate the perimeter.

4. Post Field Work

4.1. Download Data

The following steps will enable one to download a shapefile based on the waypoints into the Garmin unit:

1. Start DNR Garmin and specifify the correct projection (See Table 2)
2. Select Waypoint->Download
3. Select File->Save As to a shapefile
4. Open data in ArcGIS to confirm download
5. Confirm the shapefile projection file matches the projection and datum of the GPS. Do any reprojections necessary (e.g., WGS84 to NAD83).

Unless specified by the field protocol, the waypoints will be saved as a shapefile in the respective project folder and named WayPoints_YYYYMMDD.shp, where YYYYMMDD is the date (See the network naming conventions for further guidance; NPS-ROMN 2007c). The file will immediately be set to read-only.

4.2. GPS Maintenance

Once the data has been downloaded from the GPS unit, the following will be completed as final steps:

- When appropriate, delete all waypoints, tracks and maps on the GPS units.
- Remove batteries from the GPS units

4.3. Recommended Materials

The following web sites contain useful references for Garmin units:

- Alaska Region GPS Site (NPS-Alaska 2006)– NPS only
- US Forest Service GPS Site (USFS 2006)

5. References

Garmin (2006). Garmin Web Site [http://www.garmin.com/], November 2006.

MN-DNR (2006). ArcView Field Guides and Training Resources, Minnesota Department of Natural Resources [http://thoreau.dnr.state.mn.us/mis/gis/tools/arcview/Training/training.html], November 2006.

NPS-Alaska (2006). Alaska Region GPS Site, National Park Service [http://inpakroms03web/rgr/gps/tips.htm], November 2006.

NPS-ROMN (2007a). Using GPS-Photo Link to Georeference and Watermark Photographs, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Developing GPS Basemaps for Use in Garmin Units, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

Trimble (2006). Trimble web site [http://www.trimble.com/planningsoftware.html], November 2006.

USFS (2006). US Forest Service GPS Site [http://www.fs.fed.us/database/gps], November 2006.

6. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 3. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Library Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes; David Pillmore
Abstract: This narrative describes the library operation, which is responsible for the management of all finalized reports and other documents, both pertaining specifically to the network and as general references.
Suggested Citation: NPS-ROMN (2007). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

The Library Operation is concerned with the management of digital and analog publications, including maps, NPS publications and guidelines, reports, and peer-reviewed scientific manuscripts. Most of the publications are likely to be specific to either one of the Network parks or the Network itself; however, publications may also be those that serve as references for vitals signs monitoring. Figure 1 illustrates the various stewardship steps involved in the management of this operation.

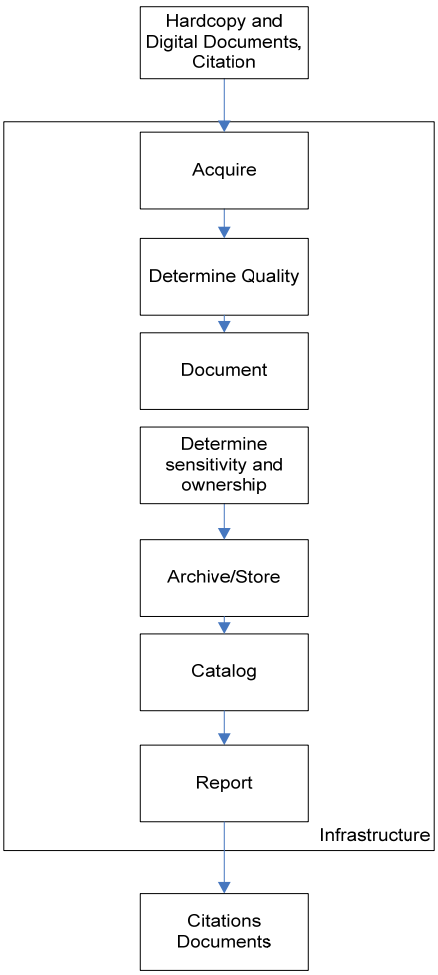


Figure 1. Conceptual Model of the Library Operation

This Operation is similar to the Data Management Operation (NPS-ROMN 2007b), in that it manages the master information for the Network. However, because the processes and skills required for managing data and documents are so different, and for the meantime difficult to resolve, the two are split.

2. Acquisition

This is the Scope of Collection for the library. It determines whether a document fits within the scope of this operation. In addition to the guidelines provided by the Network Data and Information Management Plan (NPS-ROMN 2007c), the scope of the Library Operation is further defined by the format, status, subject, and the age of the document. First, all documents should either be in portable document format (PDF) or as a bound document (e.g., book). In cases where the document is an unbound hardcopy, the Network's SOP on Digitizing Documents (NPS-ROMN 2007d) provides guidelines on this conversion. Second, documents should be in final form - drafts are not acceptable. This rule may be relaxed, however, if the "draft" version is the *de facto* "final" version. Third, all documents specific to the Network or a network park, regardless of age, are important to acquire and maintain indefinitely. Finally, general reference documents of interest will be reviewed to determine their age and acquired if they are not older than:

- Books – <20 years
- Publications and gray Literature – <10 years
- Periodicals – <1 year
- Journal Articles – <10 years
- References – <5 years
- Photos – <10 years
- Maps – <20 years

Documents acquired by the Library Operation will be placed in one of two categories. Master References must meet at least one of the following criteria:

- They must be published by or be about the Network (contain a direct reference to the Network by name);
- A natural resource in one of the member parks is discussed; Or
- It has been determined to be a key network resource by Network or park staff.

Documents that are acquired but do not meet the above criteria will be treated as a General Reference.

Digital documents acquired awaiting processing will be initially placed in one of two locations based on these categories:

- Documents that meet the Master Reference criteria will be placed in Z:\LIBRARY\NewMasterRefs\
- General reference documents will be placed in Z:\LIBRARY\NewGeneralRefs\

In cases where a hardcopy requires digitization, or a digital copy needs information added that is not immediately obvious from the document, Network staff will complete the “Add Document to the Library Request” form (Appendix A).

3. Quality Control

For a document to be of sufficient quality, it will:

- Contain all pages - Missing pages will be flagged as missing;
- Have pages in the correct order - visible page numbers will be present on each page;
- Be citable - having a known author, year, title, and place of publication;
- Be in final version - drafts are not acceptable (with caveats described above);

Further guidance on quality assurance and control are found in the respective SOP (ROMN-NPS 2007f).

4. Documentation

For all digital documents specific to the Network or a network park (i.e., master references), additional documentation requirements beyond the Network’s Documentation SOP (ROMN-NPS 2007e) include:

- All pages will be numbered to match the Table of Contents;
- In cases where the document is >30 pages, bookmarks for the major chapter/section headings will be created. All erroneous bookmarks will be removed;
- All documents in PDF format will have basic metadata, including the title, author(s) and at least three keywords;
- All documents scanned as images will have optical character recognition (OCR) applied to all pages;
- In cases where a title page is not clear or does not exist, it will be necessary to create a new title page for the front of the document;
- The “Resize window to initial page” will be checked (Figure 2);
- The “Show” option will be set to “Bookmarks and Panel Page” (Figure 2)

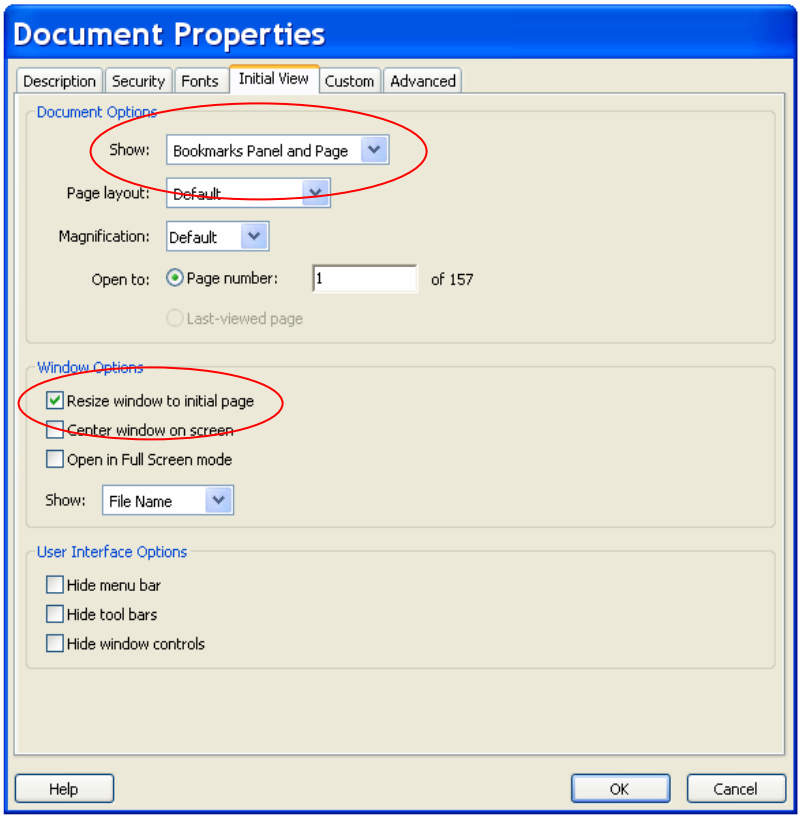


Figure 2. Properties to modify for any master reference document.

General reference documents do not require any additional level of documentation.

5. Sensitivity and Ownership

Sensitivity and ownership policies are identical to the Network's Data and Information Management Plan (ROMN-NPS 2007c) and the implementation of these policies is detailed in the Approving Information for Distribution SOP (ROMN-NPS 2007a), which assists in determining whether a document is sensitive or proprietary. Documents determined to be sensitive or proprietary will be noted accordingly, since their status will affect where they are stored and cataloged.

6. Archiving/Storage

6.1. Digital Documents

The location where documents are to be stored is determined by their format, content, and sensitivity. Figure 2 shows the major sub-folders managed by the Library Operation.

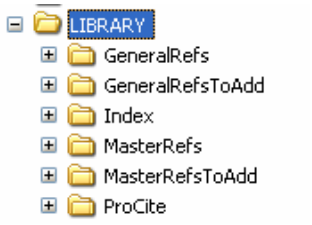


Figure 3. Major Sub-Folders of the Library Operation

These sub-folders have the following functions:

- **GeneralRefs** –Finalized documents in PDF format. These documents serve a reference to the Network, although do not refer directly to the Network or Network Parks. This is read-only to Network staff.
- **GeneralRefsToAdd** – The temporary repository where new general references are added by Network staff. Once processed, these documents will be moved to \GeneralRefs\. No formal quality control will be applied to these documents – it is entirely up to the staff member posting this information to ensure that it is to an appropriate quality level.
- **Index** – contains the ROMN search index, an Adobe Acrobat file that enables one to search the entire library for a keyword or phrase. This is the tool that should be used when attempting to find a document in the most efficient manor.
- **MasterRefs** – folder contains all of the Park- or Network-specific documents that have been quality controlled. These will be copies of documents already uploaded to NatureBib but maintained here for Network staff convenience.
- **MasterRefsToAdd** – The temporary repository where new Master References are added by Network staff. Once processed, these documents will be moved to \MasterRefs\
- **ProCite** – Contains the Pro-Cite database of all references used by the Network.

6.2. Hardcopy (Analog) Documents

All non-sensitive documents with a solid binding (i.e., they are strong enough to stand vertically), will be stored in the Network's hardcopy library. Books will be organized by editor, first author, year of publication, and title, respectively.

Unbound and softbound documents will be stored in the Network's file cabinet. Each document will receive its own manila folder and be organized by first author, year of publication, and title.

All sensitive hardcopy documents will be stored in the Network's locked file cabinet.

7. Cataloging

All documents, including master and general references, will be cataloged using ProCite. ProCite can contain citations the Network does not have physically.

In addition to ProCite, all digital citations will be indexed using Adobe Acrobat 7.0. This enables a complete word search of the entire holdings within the Library Operation. The Library Tech will update this regularly.

Until the NPS successfully revises NatureBib (NPS 2006), this system will not be used.

8. Analysis & Reporting

To ensure that the documents remain current, it is necessary to regularly analyze the inventory. All documents that are considered to be general reference (i.e., not pertaining to the Network or specifically to a network Park), will be evaluated annually for being out-of-date following the criteria established in section 2.2 of this SOP. In cases where the document is considered out-of-date, the Data Manager will check with the Network staff to determine whether the document should be purged or retained.

9. Roles and Responsibilities

Role	Responsibility
Network Data Manager	• Has full responsibility for this operation • Will notify Network staff if a regarding the purging of documents
Library Tech	• Day-to-day updating of NatureBib references maintained by the Network • Maintaining a current Pro-Cite database • Updating the Adobe Acrobat Index • Notifying the Data Manager concerning problems with the applications, workflows, and/or guidelines
Network Staff	• Understand and following the guidelines herein • Respond to the notices regarding the purging of outdated documents • Regularly submit key documents to the Library Operation

Table 1. Roles and Responsibilities

10. References

NPS (2006). NatureBib, National Park Service [https://science1.nature.nps.gov/naturebib/nb/simple/clean], November, 2006.

NPS-ROMN (2007a). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DMO_ApprovingInformationForDistribution], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007b). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DataManagementOperation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007c) Data and Information Management Plan, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/ Data/ROMN/DATAMAN/ROMN_IMP.pdf], Fort Collins, Colorado.

NPS-ROMN (2007d). Digitizing Documents, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DMO_DigitizingDocuments.pdf], Fort Collins, Colorado.

NPS-ROMN (2007e). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DMO_Documentation.pdf], Fort Collins, Colorado.

NPS-ROMN (2007f). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ROMN/ DATAMAN/ ROMN_DMO_QAQC.pdf], Fort Collins, Colorado.

11. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

12. Appendices

12.1. Appendix A: Add Document to Library

Add Document to Library Request

REQUESTOR: **NatureBibID:**
DATE:

DOCUMENT PATH AND FILE NAME (if digital):

Only fill out the following fields if this information is not immediately obvious:

AUTHOR(s):

YEAR OF PUBLICATION:

TITLE:

PUBLISHER OR SOURCE:

KEYWORDS:

SENSITIVITY: PARK ONLY NPS ONLY PUBLIC

COPYRIGHT: YES NO

WHERE TO SAVE: MasterRefs GeneralRefs

PARKS/NETWORK:

FLFO **GLAC** **GRKO**

LIBI **ROMO** **GRSA**

ROMN

OTHER PARKS:

NOTES:

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Using ProCite to Manage Network References Locally

Library Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes
Abstract: This document details how to use ProCite to manage references locally.
Suggested Citation: NPS-ROMN (2007). Using ProCite to Manage Network References Locally, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

This document provides guidance on how to manage NatureBib (NPS 2006) bibliographic references locally with ProCite (ProCite 2006). Using ProCite locally, while managing references in NatureBib nationally, utilizes the strength of each system, yet prevents the redundant entry of information. Figure 1 provides the general steps involved in managing the citations.

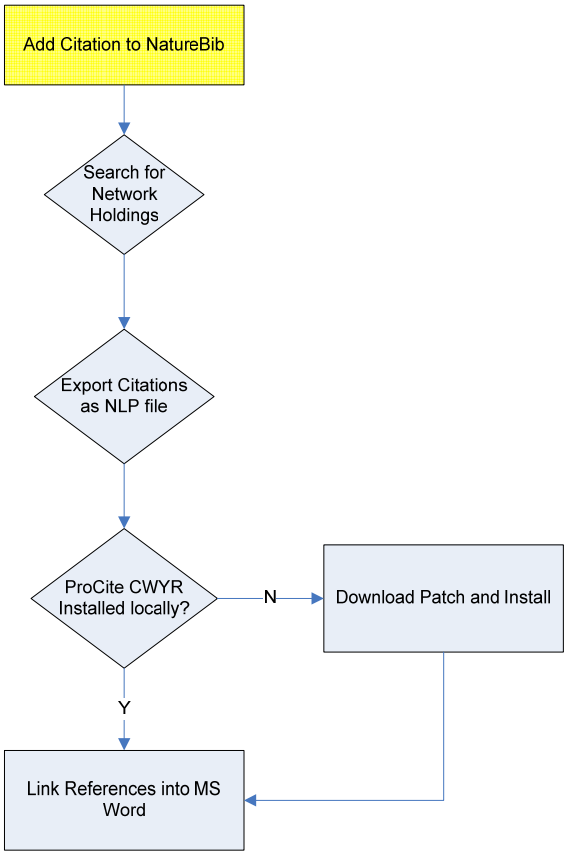


Figure 1. NatureBib to ProCite Workflow

2. Guidelines

2.1. Add Citations in NatureBib

The Library Operation (NPS-ROMN 2007) provides guidance on when to add new NatureBib citations that can be added to the Network's library.

2.2. Import NatureBib References

Importing NatureBib references is accomplished by first searching for the Network holdings. This is accomplished by conducting an expert search where two criteria are specified:

- The “Include citations where copy is held in park/office/network” should be checked
- The Network must be selected

Figure 2 provides a screen capture of these search criteria.

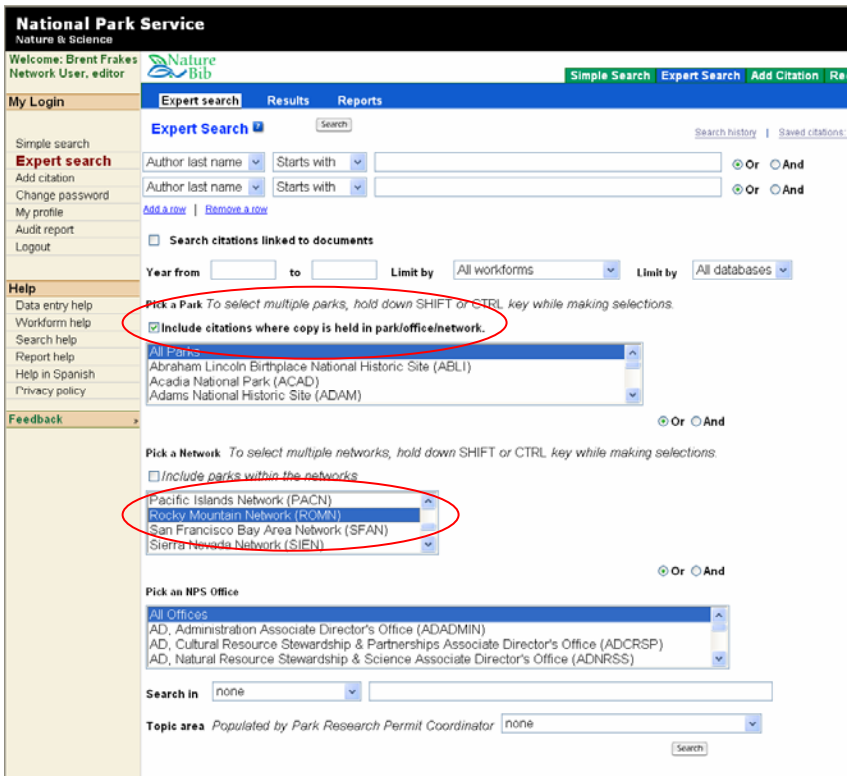


Figure 2. Search Criteria in NatureBib to Produce Network Collection

Once a search is returned, the next step is to request a complete download in “National Library Program” format (Figure 3). This format is comma delimited, which can be imported directly into Pro-Cite. This file will be downloaded to the \TEMP\ folder because it will be immediately discarded after importing into ProCite.

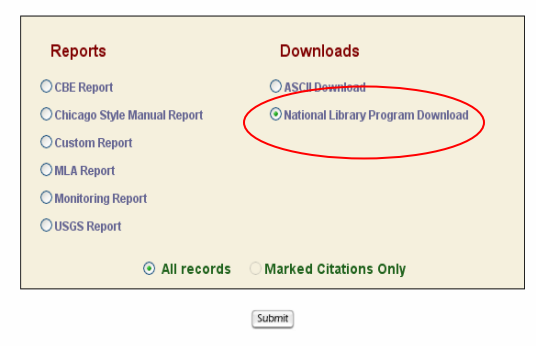


Figure 3. NatureBib Screen showing "National Library Program" format export.

After opening ProCite, link to the Network Pro-Cite database, located in \LIBRARY\ProCite\ROMN_LIBRARY.pdx. The "Import Text File…" option is located under the tools menu (Figure 4).

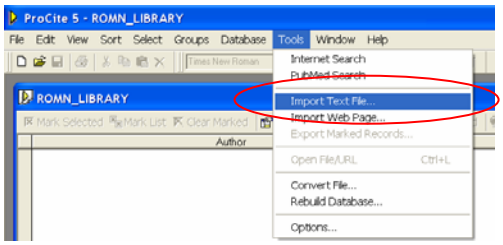


Figure 4. Import Text File Into ProCite Database

Because MS Word links to ProCite via a Record ID internal to ProCite (an autonumber field, not the NatureBib ID), it is critical to NOT delete records from the ProCite database or completely re-create the ProCite database. Deleting records or overwriting the database completely erases the record ID. To ensure that duplicate records are not imported, the "Discard Duplicates When Importing" option should be checked (Figure 5). Due to the possibility of overwriting critical data, the Data Manager will be responsible for implementation of this step.

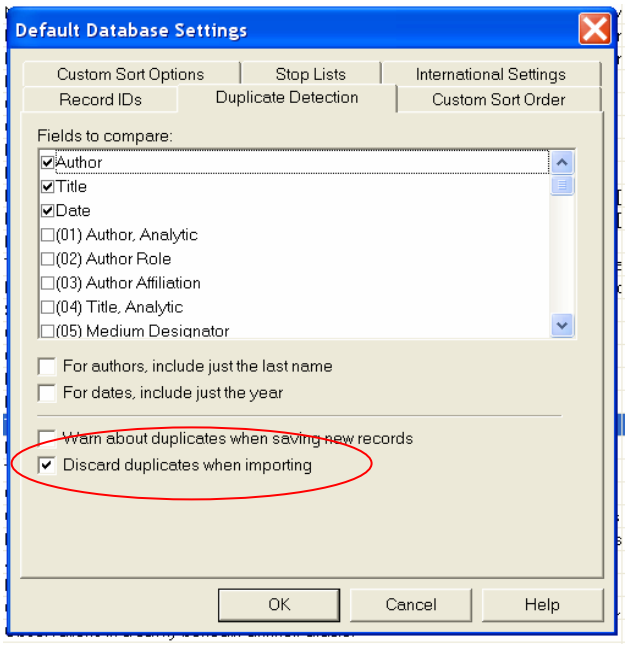


Figure 5. Discard Duplicates When Importing Check-box

2.3. Install ProCite Toolset for MS Word

The ProCite Website (ProCite, 2006) contains updated patches that enable the ProCite software to work with MS Word, or Cite While You Write (CWYR). This patch will need to be downloaded and loaded as administrator with the antivirus software turned off.

Given the problem with working with MS products, it may be necessary to manually install the toolset: If the CWYW tools do not install for any reason during program setup, the tools can be manually installed following these steps:

1. Within Microsoft Word go to the Tools menu and select Options.
2. Click the File Locations tab, highlight the Startup folder, and then click the Modify button.
3. Note the path to the Microsoft Word Startup folder. If no path is listed at the bottom of the window click on the "Look In" dropdown at the top of the window and note the path.
4. Close Word.
5. Launch Windows Explorer and locate your ProCite program folder. In this folder you will find a subfolder called "CWYW". There are two files in this folder you need to copy, depending on which version of ProCite you are using
6. Locate the Word Startup folder and paste these two files - Pc5wd8.dot and Pc5wd32.wll - into this folder. If you cannot find the specified folder, your Windows preferences may be set to hide the folder. In Windows Explorer go

to Tools / Folder Options / View tab and make sure that "Show hidden files or folders" is selected.

7. Launch Microsoft Word.
8. Open ProCite and a database, then re-open Word and click on one of the ProCite commands. The programs must only be opened in this order the first time you use the tools so that the registry will be updated correctly.

Directions for these steps are also found at http://www.procite.com/support/pccwyw.asp.

2.4. Add Citations from ProCite into MS Word

Complete directions for adding citations from ProCite can be found in Chapter 16 of the ProCite User's manual (which can be downloaded from the ProCite address; ProCite 2006).

3. References

NPS (2006). NatureBib, National Park Service [https://science1.nature.nps.gov/naturebib/nb/simple/clean], November, 2006.

NPS-ROMN (2007). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

ProCite (2006) ProCite, Thomson ResearchSoft [http://www.procite.com/], November, 2006.

4. Change History

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1.0					

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Infrastructure Operation (IFO)

Data and Information Management Plan

Version*: 1.4
Status: Final
Revision Date: July 16, 2007
Authors: Brent Frakes, David Pillmore, Mike Britten
Abstract: This document describes one of the core functions of the Rocky Mountain Network, which is the maintenance and oversight of the Network's hardware, software and local area network.
Suggested Citation: NPS-ROMN (2007). Infrastructure Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

The Infrastructure Operation oversees the local and wide area network (LAN and WAN), hardware and software that support Network's activities. It is also charged with backing up the network server.

2. Local and Wide Area Network

2.1. Fort Collins Office

Because the ROMN is located in the Oakridge Office in Fort Collins, CO, most of the LAN and WAN oversight is administered outside of the Network by the WASO IT support staff. WASO IT provides the following services:

Network

- All Network Connectivity
- 4-Gb per person storage space
- Web server administration
- User ID Management

Security

- Administration of spyware and antivirus software
- Patch updates
- Daily Backup of the 4-Gb personal storage space

Computers & Peripherals

- Setup of new computers
- Phone and fax maintenance
- New software installation

Requests for assistance should be directed to the NPS Helpdesk:

http://npshelpdesk.nps.gov/

NRPC-Fort Collins must be specified as the service location.

The IT program in the building also has some utilities that are found at

S:\it\ITUtilities

2.2. File Transfer Protocol

The NPS maintains a public FTP site that can be accessed using the following:

Public FTP Site address:	**ftp://63.220.43.40**
Username:	**npsftpwin**
Password (case-sensitive):	**FTP04npswin**
Note: 0 is a zero, not an 'O'	

Network staff and cooperators can post all non-sensitive information to this site under the \ROMN\ folder.

Files (not folders) are automatically removed from the FTP server after approximately two weeks. Therefore, this site should not house any information that is not backed up elsewhere.

All network staff should regularly remove folder and files no longer in use.

The Data Manager will clean up the site once every six months. Folders named with proper case (e.g., VegMap) will be removed. Folders named with capitals (e.g., VEGMAP) will not be removed without first confirming with other staff.

3. ROMN Data Server

The Network relies on a SnapServer, a 500GB system that utilizes a Unix operating system. The Snap Server is securely housed in the WASO IT Server Room and can be accessed over the LAN using the following address:

\\nps\10.147.158.195\ROMN

During the first Friday of June and December, the Snap Server will be checked by the ROMN Data Manager to see whether there are operating system updates.

The administrative functions of the SnapServer can be accessed through:

http://10.147.158.195/

To restrict access to the ROMN drive and control access by ROMN members to particular directories, four different groups were set up over the LAN. These groups are listed in order of increasing privilege:

- **ROMN_USER -** All permanent and term and other (e.g., Research Associates) Network staff.
- **ROMN_ProgramManager** – Specific privileges for the network Program Manager
- **ROMN_DataManager** – Privileges specific to the Data Manager.
- **ROMN_ADMIN** – Full administrative privileges. This group has full access to all folders on the ROMN network.

Detailed instructions for Network Back-up are found in its respective SOP (NPS-ROMN 2007a).

4. Hardware

4.1. Hardware Inventory

The current inventory of hardware is found in the Access database at:

Z:\DATAMAN\OPERATIONS\Infrastructure-IFO

All significant items (>$300 or by request) owned by the network that do not already contain a NPS Property Number will be clearly marked using a permanent marker and/or an inscribing tool. The following is the recommended naming scheme:

NPS-ROMN-AAA-BBB

Where AAA is a descriptive text code and BBB is an incremental number (e.g., NPS-ROMN-GPS-004).

The Data Manager is responsible for maintaining the hardware inventory. Network staff are responsible for notifying the Data Manager of hardware purchases.

All other property will be labeled **NPS-ROMN** using a permament marker (where appropriate).

4.2. Computers and Replacement

Time is money; a slow or insufficient computer wastes taxpayers' money. Therefore, the Network will maintain an up-to-date inventory of computers and peripherals for staff and the field crews. There are four types of computer needs, each with their own

specifications and replacement schedules – desktops, general laptops, field laptops, and PDAs.

Desktop computers are the most powerful and reliable of the network computers and serve as backup should the SnapServer or other computers fail. The Network will:

- Maintain a 1:3 ratio of desktops to staff;
- Replace desktops on a 5-year schedule;
- Upgrade desktops in their 3rd year (if necessary and possible given the current budget). Upgrades include additional memory and/or hard-drive space.
- Purchase the most powerful desktop computer available (at a reasonable price relative to the network budget) under the DOI contract.

Laptops include both general laptops and ruggedized field laptops (RFL). The Network will:

- Maintain a 1:1 ratio of laptops to full-time staff;
- Maintain 1 RFL in the laptop fleet;
- Replace laptops on a 3-year schedule;
- Purchase the most powerful laptop computer available (at a reasonable price relative to the network budget) under the DOI contract.

Personal Digital Assistants (PDAs) are small data collection platforms. The Network will:

- Purchase PDAs on an as-needed basis;
- Replace PDAs on a 3-year cycle;
- Purchase the most powerful PDA available (at a reasonable price relative to the network budget) under the DOI contract.

Replacement of all computer hardware will follow the schedule in Table 1. The total number staff is determined by the number of full time computer needs + ½ the number of part time computer needs.

Year	Desktops	Laptops	# FT	#PT
2007	1	2 (1 RFL)	5	2
2008	0	2	5	2
2009	1	2	5	2
2010	0	2 (1 RFL)	5	2
2011	0	2	5	2
2012	1	2	5	2
2013	0	2 (1 RFL)	5	2
2014	1	2	5	2
2015	0	2	5	2
2016	0	2 (1 RFL)	5	2
2017	1	2	5	2
2018	0	2	5	2

Table 1. Computer Replacement Schedule

Prior to the purchase of a computer, all staff will be provided with the hardware specifications for comment. The Data Manager will summarize these comments, make needed changes to the hardware specifications, and obtain final approval from the Program Manager. The Data Manager will send all hardware specs to the Network Administrator for purchase.

User priority for receiving a new laptop is determined by need. Need is determined by the amount of computer central processing unit (CPU)-intensive work relative to the current CPU-capacity available to each staff. In short, staff who regularly do intensive modeling, database, GIS and other graphical analysis generally will need newer computers than staff that use their computer strictly for word processing and emailing.

All computers will need to be ordered through the Dell Premier Site (http://premier.dell.com/). To obtain a Premier account, one should do the following:

1. Call Dell - 1-800-727-1100
2. Contact the Dell Intermountain Region (Colorado) Sales representative for the Department of Interior – Currently John Roam (ext 7242034) and Angela A (ext 7246946)
3. Provide the representative with a NPS email account.

5. Software

The current software inventory is found in an Access database at the following location:

Z:\DATAMAN\OPERATIONS\Infrastructure-IFO\

The Network Data Manager is responsible for maintaining all software in a secure location and maintaining the software inventory. Network staff are responsible for notifying the Data Manager of software purchases.

All purchased software will be clearly marked using a permanent marker on the case on the CD, and/or with a text file in the same folder. The following is the recommended naming scheme:

NPS-ROMN-SFT-BBB

Where BBB is an incremental number (e.g., NPS-ROMN-SFT-004).

6. Inter-, Intra- and Extranet

6.1. Web Page

The Network maintains an internet and intranet presence for communication with NPS and other staff not directly involved with the Network. The SOP, The Rocky Mountain Network's Web Page (NPS-ROMN 2007b), provides details on maintenance and oversight of these sites.

6.2. Sharepoint

When internal collaboration is necessary among Network staff, park staff and external cooperators, the Network will use the Sharepoint site, maintained by the WASO office. The SOP, Using Sharepoint for Network Communication and Collaboration [NPS-ROMN 2007c], provides guidance on using and administering this site.

7. Administrative Passwords and Security

Each time passwords change, the Network Data Manager will provide the administrative password to the Program Manager in a sealed envelope. The envelope will read:

ROMN ADMIN PASSWORDS – SENSITIVE – [DATE]

The Network Program Manager will keep this envelope in a secure location.

Copies of all keys, along with a clear description of their use, will also be provided to the Network Program Manager.

8. Roles and Responsibilities

Role	Responsibility
Network Data Manager	• Regular update of network hardware and software inventory
Network Staff	• Reviewing and commenting on all Network hardware purchases • Informing Data Manager of property additions and losses
Program Manager	• Approval of all purchases
Network Administrator	• Purchase of hardware and software

Table 2. Roles and Responsibilities

9. References

NPS-ROMN (2007a). Backing Up the Network's Digital Information, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Rocky Mountain Network's Web Page, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Using Microsoft Sharepoint Services for Network Communication and Collaboration, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

10. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0	5/18/2007	Frakes	-Added language regarding password and key locations		1.1
1.1					1.2
1/2					1.3
1.3	7/16/2007	Frakes	Added Dell Premier login directions		1.4

Table 3. Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Backing Up the Network's Digital Information

Infrastructure Operation

Data and Information Management Plan

Version*: 1
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document describes the process for securing the network's digital information through the use of EMC Retrospect backup software and Microsoft's robocopy.
Suggested Citation: NPS-ROMN (2007). Backing Up the Network's Digital Information, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

All of the Network's data is maintained on a "SNAP" server connected to the building's local area network. This server is accessed by ROMN Staff members as the "Z Drive" and is referred to in this document as the "server". Backing up the server is a powerful protection against the accidental or malicious loss of important Network information and fulfills national and network requirements for protecting information. For this Network, the goal is to ensure that under a worse-case scenario where all working media is destroyed in the Network office (e.g., the office burns completely), the loss of work will not be greater than 24 hours.

To meet this goal, the Network backup policy will fulfill the following objectives:

- All digital information that is created or modified will be backed up within 24 hours;
- At any time, there will be at least three copies of each digital file (the original and two backups);
- At least one of the copies will be in a different physical location;

To meet these objectives, the Network is addressing server backup using two backup systems – EMC Retrospect and laptop synchronization. The following sections describe each of these systems.

This SOP is written for EMC Retrospect Version 7.5.5.103 and the Microsoft Windows Server 2003 Resource Toolkit (Microsoft 2006).

2. EMC Retrospect

EMC Retrospect 7.5 (EMC 2006) is off-the-shelf backup software designed to incrementally backup information from the server. Figure 1 shows the general steps for using this software.

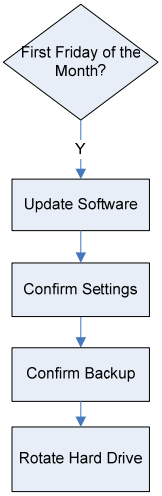


Figure 1. General Steps for Using EMC Retrospect Backup Software

2.1. Update Software

During the first Friday of each month, staff will check to see whether there is an update to the Retrospect software. This is a simple task since the software will automatically check for software updates when prompted under the Help menu (Figure 2).

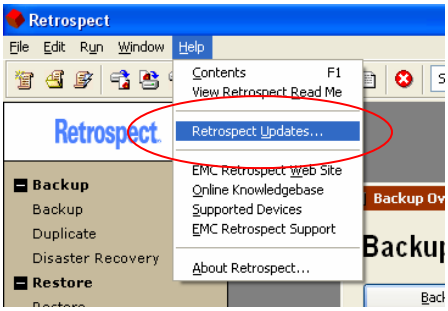


Figure 2. Retrospect Updates Option

2.2. Setup/Confirm Settings

Retrospect will write all information to external USB hard drives owned and maintained by the Network. For consistency, when a new hard drive is introduced, the following settings used:

- Backup will occur at 10:00 PM daily, including weekends
- All backup files will be written to the external hard drive under the folder \Retrospect\;
- Incremental backup is specified using the "Groom to Retrospect Defined Policy" (Figure 3)
- The Catalog will be compressed (figure 3)
- Each hard drive will have its own script, but each script will be identical to the other (Figure 4)

- All backups will require an administrative user name and password

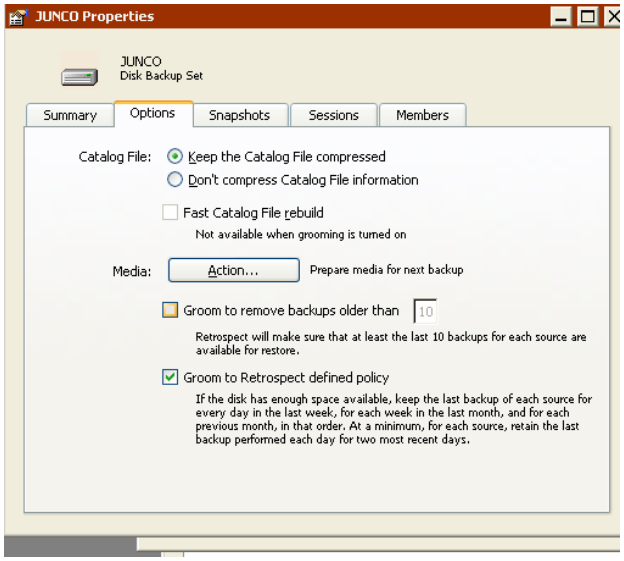


Figure 3. Retrospect Incremental Backup Option

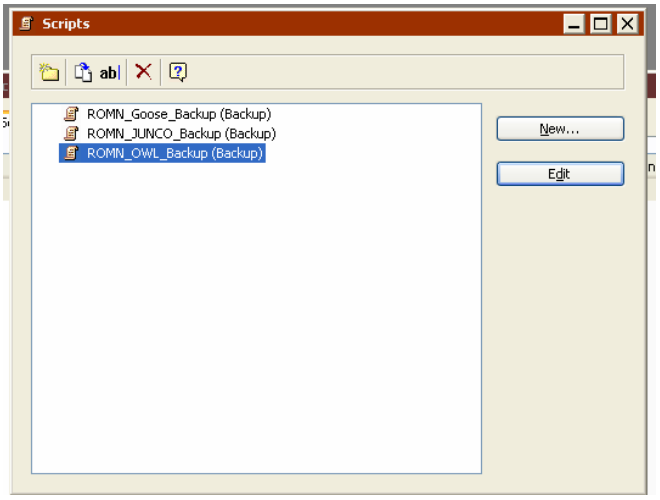


Figure 4. Retrospect Catalog of Scripts for Each External Hard Drive

Further instructions for the use of the EMC Retrospect Software (EMC 2006) can be found at the website.

During the first Friday of each month, all setting will be checked to ensure the backup script is working properly.

2.3. Confirm Backup

The recovery of information from the backup software will be confirmed every other month (first Friday of every odd month - i.e., January, March, May, July, September, November). Information recovery will be tested by randomly selecting a file and

recovering it from a week prior (assuming that the file has been in existence for at least a week).

2.4. External Hard Drive Rotation

On the first Friday of the month, the external hard drive will be swapped with another external hard drive residing off-site at a secure location. The script for the added hard drive will be turned on while the script for the hard drive being rotated out will be turned off following these steps:

- Select Catalog of Scripts (see figure 4 above).
- Choose the script to be turned off (or on) and select edit,
- Then choose Schedule and select Edit. This will show the following window.

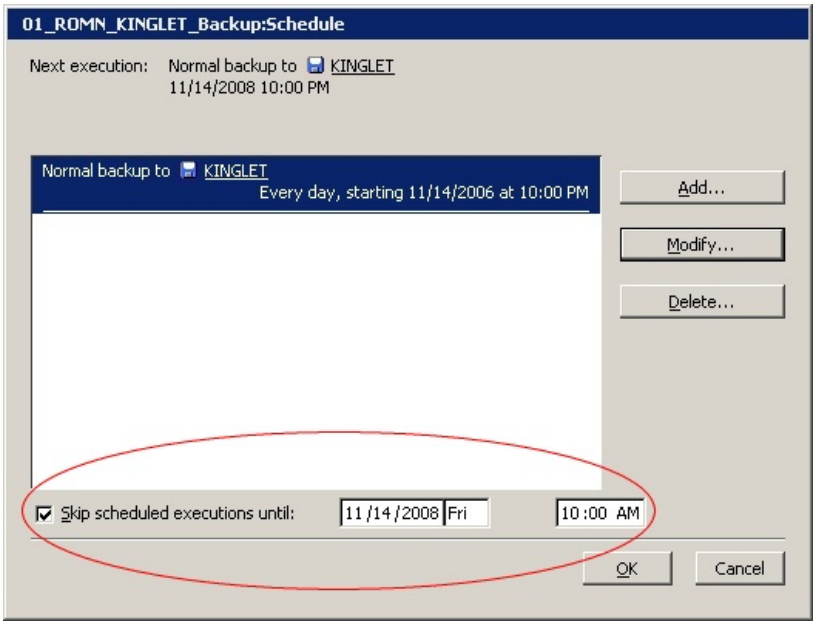


Figure 5. Retrospect Backup Schedule for the ROMN_KINGLET Hardrive.

The section circled in red is where changes are made to turn off one script and turn on another when the hard drives used as backup media are switched. Simply change the Skip Scheduled executions until: switch and set the date to sometime in the future to turn a script off and do the reverse to turn on the script for the new hard drive. The old script must be turned off and the new one activated.

3. Laptop Synchronization

Laptops, which are taken off-site evenings and weekends, are an easy way to house replicates off-site. Since many members of the Network staff spend significant time working without access to the server (offline), it is imperative that they have an up-to-

date copy of the Network's information. External hard drives maintained by Network staff are considered to be part of the laptop; the policies for writing to the hard drive are no different than to the laptop.

Easy synchronization is possible by using robocopy.exe (Microsoft 2006), a simple command-line management tool provided in the Microsoft Windows Resource Tool Kit. As with all command line tools, typing "robocopy /?" from a windows shell provides options for use of this tool. Robocopy is not configured to automatically read folders with spaces. In cases where it is necessary to specify such a folder, substituting a ~1 in the 7th and 8th character places (e.g., \Program Files\ converts to \Progra~1\) will accomplish this.

All staff will use a batch script "Copy2Local.bat" located in the C:\BATCH_SCRIPTS\ folder, which is set to run daily. This script mirrors the folders on the server to a local directory, C:\ROMN_BACKUP\.

The Copy2Local script differs slightly for each user's needs, although generally follows this script:

```
robocopy Z:\ADMIN\ C:\ROMN_Backup\ADMIN\ /S /PURGE /A+:R /XF *.ppt *.jpg /XD old\ sensitive\

robocopy Z:\GEODATA\ C:\ROMN_Backup\GEODATA\  /S /PURGE /A+:R /XD imagery\ DEM\ DRG\ NLCD\ sensitive\ /XF *.jpg *.aux
*.tif *.img *.sid

robocopy Z:\DATAMAN\ C:\ROMN_Backup\DATAMAN\ /S /PURGE /A+:R /XD old\ sensitive\

robocopy Z:\PROJECTS\ C:\ROMN_Backup\PROJECTS\ /S /PURGE /A+:R /XF *.jpg /XD old\ sensitive\

robocopy Z:\MONITORING\ C:\ROMN_Backup\MONITORING\  /S /PURGE /A+:R /XD old\ sensitive\

robocopy Z:\LIBRARY\ C:\ROMN_Backup\LIBRARY\  /S /PURGE /A+:R /XD generalrefs\ old\ sensitive\

robocopy Z:\TOOLS\ C:\ROMN_Backup\TOOLS\ /S /PURGE /A+:R /XF *.ppt *.jpg *.zip /XD old\ sensitive\
```

There are two key policies for using robocopy for copying folders and files to a personal laptop. First, all mirrored folder and files will be set to read-only. These files are intended as backup and are accessible for reference, but the user is prevented from saving information in this backup subdirectory. In cases where a user does want to modify a file, they will save a copy to the C:\WORKSPACE\ folder. Once a user returns to the office and connects to the server, he/she is responsible for moving the files from the laptop's C:\WORKSPACE\ to the appropriate folder and file location on the server.

Second, sensitive folders and their contents will never be copied to a personal laptop. The risk of a laptop being stolen is high, which may compromise sensitive information. Determination of sensitivity is found in the Approving Information for Dissemination SOP (NPS-ROMN 2007).

4. Roles and Responsibilities

Role	Responsibility
Network Data Manager	• backing up the network server and assisting other staff in the use of robocopy. • R2
Network Staff	• backing up their computer's hard drive

Table 1. Roles and Responsibilities

5. References

EMC (2006). Retrospect Version 7.5, EMC [http://www.emc.com/], November, 2006.

Microsoft (2006). Windows Server 2003 Resource Kit Tools, Microsoft Corporation [http://www.microsoft.com/downloads/details.aspx?displaylang=en&familyid=9d467a69-57ff-4ae7-96ee-b18c4790cffd], November, 2006.

NPS-ROMN (2007). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

6. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Rocky Mountain Network's Web Page

Infrastructure Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
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Authors: David Pillmore, Brent Frakes
Abstract: This document describes how key considerations for the maintenance of the Network's web site.
Suggested Citation: NPS-ROMN (2007). Rocky Mountain Network's Web Page, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

*The current version can be found at: http://www1.nrintra.nps.gov/im/units/romn/ -→ Data Management

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1. Introduction

The Network's web page is primary tool for Network communication. It will be a site for distributing reports, analyses, datasets, and other materials to its staff, member parks, the National Park Service, other government agencies, and the public. The web page is partitioned in two sites that are nearly identical structure, but differ in content. The first is the public internet-based web site with non-sensitive and non-proprietary materials. The second web site contains proprietary and sensitive materials considered of use and interest to the network staff, member parks, and other NPS personnel. The general format of the pages is guided by the standards set by the NPS and the I&M administration. Figure 1 provides a conceptual model of how this operation functions.

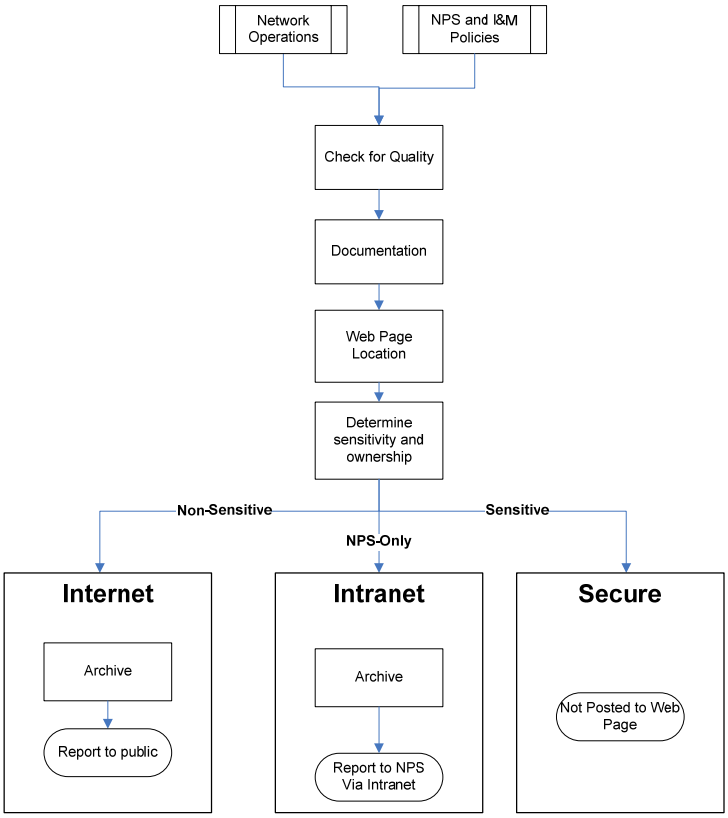


Figure 1. Information Flow Chart for Maintaining the Network Website Content

2. Information Sources

The web page operation receives all of its information from one of two sources. Externally, the NPS and I&M policies determine the web format and procedures while the Network's operations are responsible for content.

2.1. NPS and I&M

The web page administrator will regularly check the following regarding changes in NPS or I&M web page standards:

- Templates for I&M web pages are found at:
- NPS Natural Resource Web Manual (NPS 2006a)

Of important requirement is that any links to a non-NPS site must trigger a disclaimer intercept, unless the partner's web site has been reviewed and approved by the NPS under a formal agreement. One of the following scripts will be used as an intercept:

- **General Intercept Script:** <a href="/cgi-bin/intercept.pl?http://xxx.xxx.xxx">
- **Partnership Script** - to be used with formal partner's websites with who there is a written agreement- <a href="/cgi-bin/intercept2.pl?http://xxx.xxx.xxx/">
- **Corporate Partnership Script** - to be used with links to commercial partners with which there is a written agreement- <a href="/shell/intercept3.pl?http://xxx.xxx.xxx/">
- **Concessions Script** - to be used with links to all official NPS concessionaire sites - <a href="/shell/intercept4.pl?http://xxx.xxx.xxx/"> "

2.2. Network Operations

The network's various operations will provide this operation with the content. Primary information sources are Park Support operation (NPS-ROMN 2007d), monitoring protocols, and Administrative operation (NPS-ROMN 2007a).

Except for hyperlinks, all data and information intended for posting will be only be accepted in format specified by the Archive Format Standards SOP (NPS-ROMN 2007c).

3. Verify Quality

The web administrator will not post anything on the network web site unless it has been determined by another network operation (e.g., vital sign monitoring) to be of adequate quality. When received, it is not necessary re-evaluate the quality of information other than to verify this step was completed.

4. Verify Documentation

This web administrator will not post anything on the network web site unless it has been determined to be adequately documented. When received, it is not necessary re-evaluate the documentation other than to verify this step was completed.

5. Determine Web Page Location

The Network web site is divided among seven different themes

- **Contacts** - Contains the name, title, address, phone number, and email address of the ROMN members and officers of the ROMN Technical Committee. The Administrative operation is responsible for posting information to this page.
- **Inventory** - Contains the latest inventory information for the member parks. The Park Support operation is responsible for posting information to this page.
- **Monitoring** - Contains the available Vital Sign protocols, sample designs, and reports.
- **Data Management** - Contains the ROMN Data and Information Management Plan, operation descriptions, the complete set of standard operating procedures. The Data Management operation has primary responsibility for posting documents to this page.
- **News** – Current news. All operations share responsibility for updating this page.
- **Hyperlinks** – Links to sites of interest to the Network's parks. All operations are responsible to updating this page.

These themes are almost identical in look and structure between the inter- and intranet pages; the only significant difference is content.

6. Determine Sensitivity and Ownership

A critical step is the determination of sensitivity and ownership (See Approving Information for Distribution; NPS-ROMN 2007b) – this specifies whether the information will be available via the inter- or intranet. All content on the public internet website must be approved as "non-sensitive", meaning that the information is neither copyrighted nor sensitive. Content that has been classified as "Restricted – NPS Only" will be posted to the NPS Intranet website. Material designated as "Sensitive" will not be posted to either network websites.

It is the responsibility of each operation providing the information to specify the sensitivity.

7. Archive and Store

The Network maintains local copies of all web pages and their content in the \WEB\ folder. Under this folder are the internet (\PUBLIC\) and intranet (\PRIVATE\) sub-directories. Most of the folders adhere to the standard organization and naming conventions used by Cold Fusion. Content specific to the Network is found primarily in the \DATA\ folder, which is further sub-divided by park and network codes.

8. Infrastructure

The Network uses Macromedia Dreamweaver MX to administer the inter- and intranet pages. The following fields specify the configuration of each site:

Internet/Public:

- Address:
- Directory:

Figure 2 details the intranet settings:

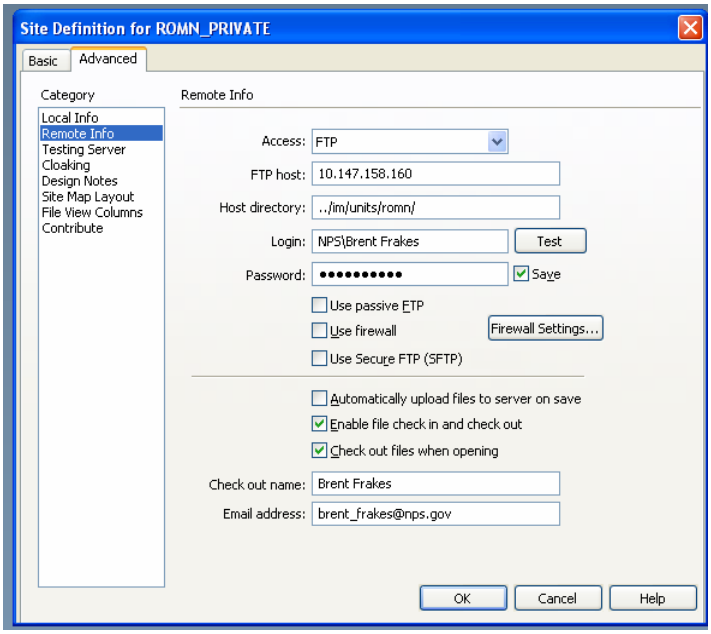


Figure 2. Intranet Settings

User names and passwords will be updated regularly through the Network Web Administrator in coordination with the I&M Data Manager.

Copies of the Dreamweaver configuration files are stored in \WEB\Settings\.

The Coldfusion license and the server that houses the network web page are maintained and supported by WASO. The primary contact is the I&M Data Manager.

9. Roles and Responsibilities

Table 1 summarizes the roles and responsibilities for the format, content and maintenance of the Network's web pages.

Role	Responsibility
WASO I&M	• Internet Server Facility
ROMN Web Administrator	• Web Page and Content Maintenance
Network Staff	• Update of web calendar

Table 1. Roles and Responsibilities

10. References

NPS (2006). NPS Natural Resource Web Manual, National Park Service [http://www1.nrintra.nps.gov/webnotes/NRWebManual/index.htm], November 2006.

NPS-ROMN (2007a). Administrative Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007b). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007c). Archive Format Standards for Network Data, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007d). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

11. Change History

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1.0					

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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Park Support Operation

Data and Information Management Plan

Version*: 1.0
Status: Final
Revision Date: August 14, 2007
Authors: Brent Frakes, David Pillmore
Abstract: This document describes one of the core functions of the network, which is the support of parks through collaborate projects (e.g., natural resource inventories, data mining). This document describes the process steps common to all projects.
Suggested Citation: NPS-ROMN (2007). Park Support Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

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1. Introduction

The Park Support Operation (PSO) includes Network support of park activities through the development and oversight of discrete projects. Many of the park support projects are related to the mining of legacy information, resurrecting and documenting dysfunctional databases, database development in support of research at the Parks (managed through the Research Permitting and Reporting System; NPS 2006), protocol development, and continuing natural resource inventories, including oversight of the vegetation maps.

Figure 1 presents the conceptual steps for managing data and information within this operation. The following sections provide more detail on each of these steps.

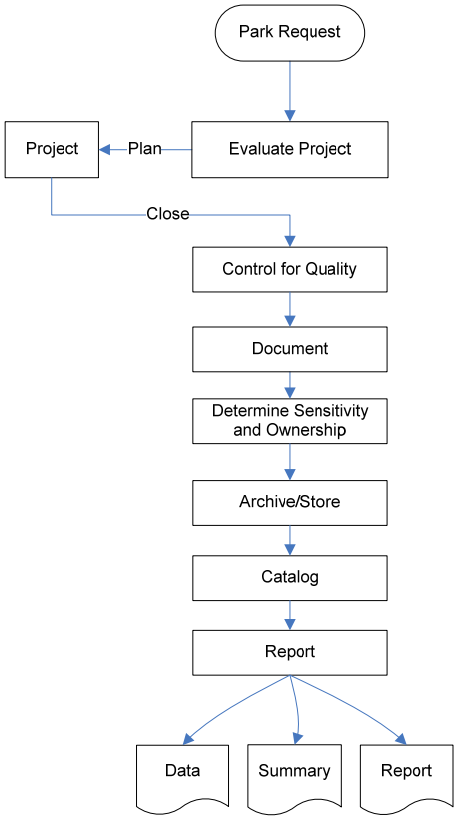


Figure 1. Conceptual Workflow for the Park Support Operation

2. Project Initiation

Project initiation is composed of two steps. First, it begins with a park request for help. Figure 2 details the appropriate steps for requesting help.

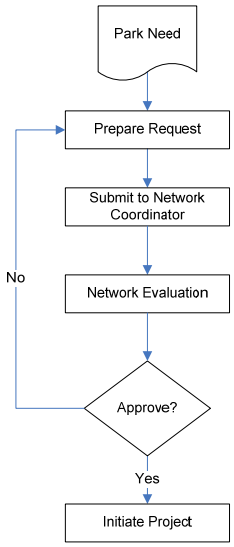


Figure 2. Project Request Process

Based on a park need, park staff will develop a request for help proposal which describes the following:

- **Park Lead:** Primary park contact.
- **Network Lead**: Primary network contact.
- **Project Lead**: Individual identified as having ultimate responsibility for management and success of the project.
- **Justification**: Brief description as to why this project is important and how it complements work conducted by the Network
- **Products**: Description of the desired final products, including databases, reports, etc.
- **Park Hours:** Expected number of hours park staff will commit to completion of the project
- **Network Hours:** Expected number of hours network staff will commit to completion of the project
- **Schedule:** Key dates related to the project including start and finish dates or other important meeting times
- **Other Costs:** Expected travel and/or equipment costs

Development of the proposal will likely require assistance from network staff, particular for time estimates and refinement of product descriptions.

The second component of the project initiation is the evaluation by network staff to determine whether a project is suitable for Network support. At least one of the following criteria, listed in order of priority, must be met for Network support:

1. The project contributes to a natural resource inventory of a Park

2. The project directly or indirectly supports knowledge of the vital signs identified by the Network
3. The project would compile background information for legacy natural resource work that has a report, data, and clear methods for how the data was collected.

In cases where the Network does not have the resources to respond to all project requests, those highest in priority with the fewest number of required staff hours will be given preference.

3. Project Life Cycle

All projects are to be managed according to the project life cycle. In cases where the Network has a specialized SOP for project management (e.g., software development; NPS-ROMN 2007i), it will take precedence over the general project management steps described in the Network's Data and Information Management Plan (NPS-ROMN 2007b).

The remaining steps document the process for the ongoing management of project information, both during the project life cycle and following project close-out.

4. Control for Quality

Quality Control procedures are outlined in the Quality Assurance and Control SOP (NPS-ROMN 2007h). Following project close-out, the Network will conduct a final review for quality to ensure the products meet network and park expectations.

5. Document

Documentation will occur during all stages of the project. Documentation steps are specified in the Network's Documentation SOP (NPS-ROMN 2007d). Following project close-out, it is important to conduct a final evaluation for sufficient documentation.

6. Determine Sensitivity and Ownership

Determination of sensitivity and ownership is specified in the Approving Information for Distribution SOP (NPS-ROMN 2007a). Because these projects are based on park needs, the parks are the default owners of all information generated by the project.

7. Store & Archive

All project-related digital information will be organized in \PROJECT\ folder under the respective park folder. In cases where a project pertains to more than one park, it will be located in the \ROMN\ sub-folder. The project folder will be named using the naming convention: *ProjectNumber_ParkCode_ProjectName*. Organization of the sub-folders within a project depend on the type of project being managed.

All project files will be named according to the Network's file naming conventions (NPS-ROMN 2007e).

Following project close-out, the entire project folder will be zipped as one archive and named *ProjectNumber_ParkCode_ProjectName_YYYYMMDD.zip* where YYYYMMDD is the date the project was archived. This naming convention, which is a modification to the Network's official file naming conventions (NPS-ROMN 2007e), was selected to preserve the same name as the original project.

8. Catalogue

All projects are to be catalogued using the Project Manager Application (NPS-ROMN 2007g).

9. Report

Once a project is completed, information will be delivered (reported) to the following, depending on the discretion of the Project Lead:

- All information products will be delivered to the respective park lead
- If the Network lead determines the spatial and tabular information to be of high enough merit and quality and there are no issues regarding sensitivity, it will be submitted to the Data Management Operation (NPS-ROMN 2007c) to become official Network data.
- All finalized reports will be submitted to the Library (NPS-ROMN 2007f).

10. Roles and Responsibilities

Role	Responsibility
Project Lead	• Project oversight. Oversight includes coordination of all stages of the project, including closure.
Park Staff	• Articulating needs, developing proposals, and providing feedback and support during the project life-cycle
Network Data Manager	• Assisting the Network Lead in the management of the project.
Network Coordinator	• Determining whether a project will be supported by the Network.

Table 1. Roles and Responsibilities

11. References

NPS (2006). Research Permitting and Reporting System, National Park Service [http://science.nature.nps.gov/research/ac/], November, 2006.

NPS-ROMN (2007a). Approving Information for Distribution, Standard Operating Procedure, Version 1.0, [http://www1.nrintra.nps.gov/im/units/romn/], National Park Service-Rocky Mountain Network, Fort Collins, Colorado.

NPS-ROMN (2007b). Data and Information Management Plan, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007c). Data Management Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007d). Documentation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007e). File Naming Conventions, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/DATAMAN/ROMN_DMO_FileNamingConventionsSOP.pdf], Fort Collins, Colorado.

NPS-ROMN (2007f). Library Operation, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007g). Project Manager Application, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007h). Quality Assurance and Control, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

NPS-ROMN (2007i). Software Development, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/], Fort Collins, Colorado.

12. Change History

Original Version #	Date of Revision	Revised By	Changes	Justification	New Version #
1.0					

Table 2. Operation Change History

This table reflects changes to this document. Version numbers will be incremented by one (e.g., Version 1.3 to Version 2.0) each time there is a significant change in the process and/or changes are made that affect the interpretation of the data. Version numbers will be incremented after the decimal (e.g., Version 1.6 to Version 1.7…1.10….1.21) when there are changes to grammar, spelling, or formatting, or minor modifications in the process that do not affect the interpretation of the data.

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Administrative Operation (ADO)

Data and Information Management Plan

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Version*: 1.0
Status: Draft
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Authors: Mike Britten, Gay Shockley, Brent Frakes
Abstract: This document describes one of the core functions of the network, which is the management of all personnel, travel, and budget information.
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National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

Standard Operating Procedure

Obtaining Project Funding

Administrative Operation

Data and Information Management Plan

THIS PAGE IS A PLACEHOLDER

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Authors: Brent Frakes, Mike Britten
Abstract: This document describes the process for obtaining funding for network projects.
Suggested Citation: NPS-ROMN (2007). Obtaining Project Funding, Version 1.0, Rocky Mountain Network-National Park Service, [http://www1.nrintra.nps.gov/im/units/romn/Data/ ROMN/], Fort Collins, Colorado.

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