INTRODUCTION

Cultural landscapes are an important cultural resource in the national park system. As recognition of their significance to the national heritage grows and as technology becomes available to aid in research, the need for information about how to conduct cultural landscape research becomes clear. In response to this need, the National Park Service (NPS) has published *A Guide to Cultural Landscape Reports: Landscape Lines*. This collection of documents gives detailed and up-to-date technical information on cultural landscape research topics and techniques that directly apply to the development of Cultural Landscape Reports (CLR).

The Landscape Lines collection has two companion documents:

- *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques* provides a general history of landscape research in the NPS; describes the relationship of the CLR to park planning, design, and resource management; and describes the content and format of a comprehensive CLR.
- *A Guide to Cultural Landscape Reports: Appendices* provide examples and general reference materials related to the information included in the guide.

Landscape Lines and *Process, Contents, and Techniques* are available for purchase as a set. Contact the Superintendent of Documents, Government Printing Office, Washington, DC, 20402-9325, Stock Number 0245-005-01187-1. The materials included in the *Appendices* are available from various sources. For information on how to obtain these materials, contact the Park Historic Structures and Cultural Landscapes Program, National Center for Cultural Resource Stewardship and Partnerships, 1849 C Street NW, Room NC360, Washington, DC, 20240.

The technical information in Landscape Lines is presented in three formats:

- general information highlighting the application of existing technology to cultural landscape research (for example, pollen analysis)
- comprehensive information on subjects for which limited reference material currently exists, especially as the subjects are applied to cultural landscape research (for example, treatment of biotic resources)
- procedural guidelines for subjects related to preparing a CLR (for example, graphic conventions)

Each of the documents contained in this first release were prepared with input from experts in each respective area. Landscape Lines is intended to be expanded and updated over time. Additional publications will be released as topics are refined and experts are available to develop content. The 14 documents contained in this first release include the following:

Issue #	Title	Description
1	Project Agreement	Describes how to prepare a project agreement, which identifies and describes the work to be performed as part of a CLR project.
2	Levels of Investigation	Defines and explains three levels of investigation (exhaustive, thorough, and limited) used in conducting research for a CLR.
3	Landscape Characteristics	Defines the classification system to be used to describe a cultural landscape's character and physical qualities.
4	Historic Plant Material Sources	Explains how to identify, document, and analyze vegetation and determine its relationship to the history of a cultural landscape.

5	Graphic Documentation	Describes methods, including line drawing and photography, for graphically documenting a cultural landscape.
6	Geophysical Survey Techniques	Describes survey techniques used to detect and locate archeological resources beneath the earth's surface.
7	Pollen, Phytolith, and Macroflora Analyses	Explains three archeological techniques used to investigate the prehistory and history of vegetation in a cultural landscape.
8	Tree Coring	Describes the technique of tree coring as a method for determining the age of a tree and understanding its physical history.
9	Surveys	Describes different types of surveys, including site, topographic, ground control, utility, cadastral, boundary, and hydrographic, that may be needed for a CLR project.
10	Geographic Information Systems	Explains the basic concepts of geographic information systems and how they can be used in cultural landscape research.
11	Global Positioning Systems	Describes global positioning systems as a surveying and mapping tool, identifies different types of GPS receivers and their uses, and gives how-to information about using GPS in cultural landscape research.
12	Treatment of Plant Features	Explains the process of investigating the historical significance of vegetation and determining appropriate treatment methodologies.
13	Accessibility	Describes concepts and legislation pertaining to accessibility, gives sources of information about the subject, and lists requirements for ramps, stairs, handrails, curbs, and other physical structures used by visitors to cultural landscapes.
14	Cataloging, Printing, and Distribution	Gives guidelines for preparing a CLR for printing and distribution.

Project Agreement

Introduction

A project agreement for a Cultural Landscape Report (CLR) establishes consensus from two or more individuals, offices, or organizations for project work to be completed. The term, project agreement, is used in this text to define the specific issues, tasks, management objectives, and anticipated products involved in a CLR project.

Note that for work involving individuals or offices within the National Park Service (NPS), the term "task directive" describes a project agreement. For contracts outside the NPS, a project agreement is often called a "scope of work."

Content of a Project Agreement

A CLR project agreement is developed to meet management objectives and answer specific management questions. The project agreement addresses Part I of a CLR, titled "Site History, Existing Conditions, and Analysis and Evaluation," and Part 2, "Treatment." The project agreement may outline the scope of Part I, Part 2, or both parts. (See Figure 1.)

The scope of a project agreement is based on the management objectives, which may require information on site history, existing conditions, and the analysis and evaluation of a landscape (excluding treatment). If park management has adequate information from former research, management objectives for a CLR may be concerned only with treatment. This information is reflected in the project agreement.

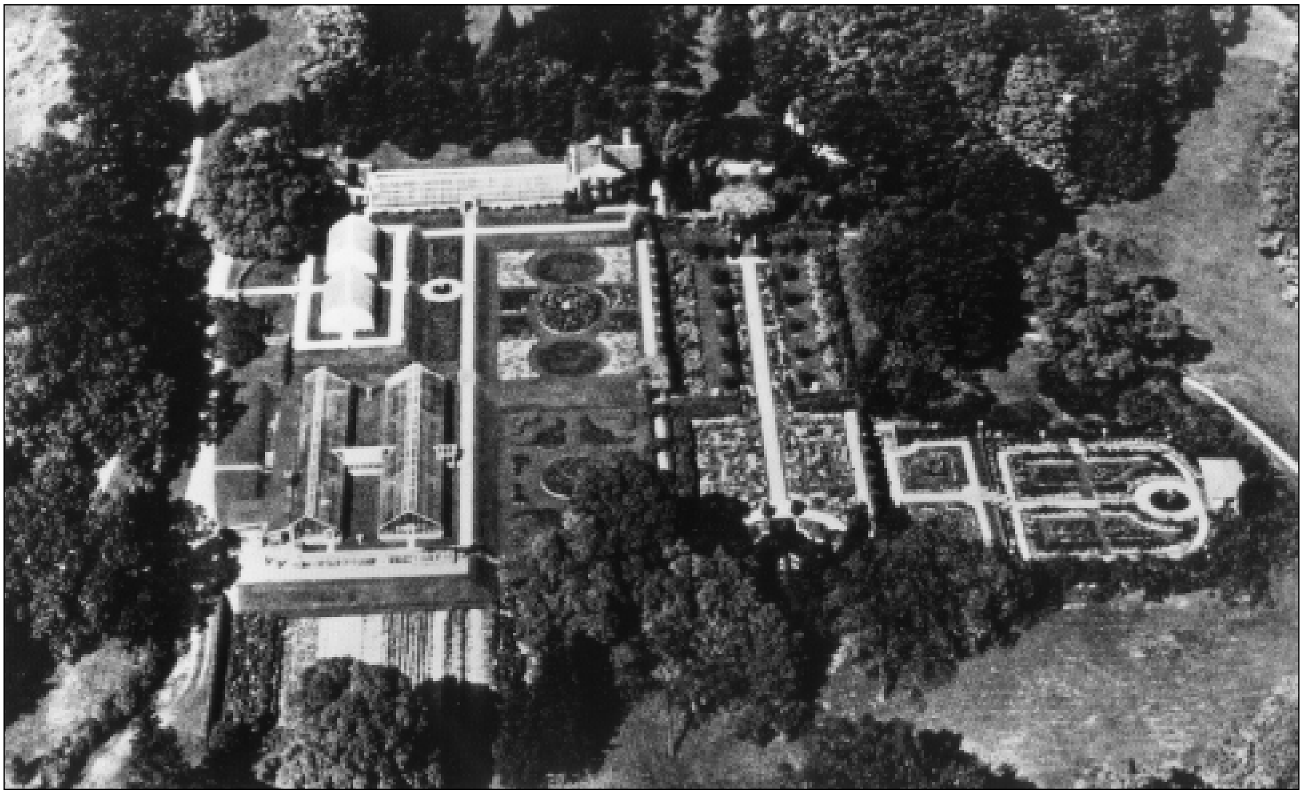


Figure 1. The project agreement for Volume 1 of the CLR for Vanderbilt Mansion involved the preparation of only Part I, titled "Site History, Existing Conditions, and Analysis and Evaluation." Vanderbilt Mansion National Historic Site. (NPS, c. 1930s)

Regardless of whether a CLR project agreement addresses Part I, Part 2, or both, all project agreements for a CLR should include the following:

- description of the study site, site boundaries, and site context
- description of the project's purpose and its relationship to management objectives
- description of the project scope, including level of investigation
- list and description of the tasks to be completed
- list identifying the office and staff responsibilities
- list and description of the interim and end products or deliverables
- schedule for completing individual tasks, products, and payments
- statement of the project budget

A project agreement also identifies constraints and special considerations, compliance requirements, information and data gathering needs, and coordination requirements, including the desired period for public comment if appropriate.

Preparation of a Project Agreement

A project agreement is the first step in clarifying management objectives and specific tasks for a CLR. Preparing an agreement involves conducting preliminary research and compiling background information about the cultural landscape. This task may require a team of individuals with different backgrounds and expertise. A historical landscape architect usually leads the project team. The historical landscape architect receives support from park staff and other professionals in allied disciplines, such as history, historic architecture, natural resources, archeology, cultural anthropology, interpretation, and park maintenance.

The time required to prepare a project agreement varies from project to project. In some cases, a short site visit allows enough time to review park files, meet with park staff, and conduct preliminary site reconnaissance. Preparing a project agreement requires more time when the site is large and specific issues are complex, or the site has a national level of significance with numerous interest groups involved.

Preparing a CLR project agreement involves three primary steps: 1) project initiation, 2) preliminary research, and 3) site visit. These steps are described in the following sections.

Project Initiation

To develop a CLR project agreement, park and technical staff meet to define the purpose, management objectives, and key issues to be addressed. Management's information needs and specific questions should be addressed. Information about the availability of historical materials, planning documents, base maps, and specific site data in park collections is collected during the meeting. Other pertinent repositories, contacts, and public interest groups are also noted, along with information about current maintenance practices and park operations. Maintenance information may influence project logistics, such as scheduling, site access, and field inventory.

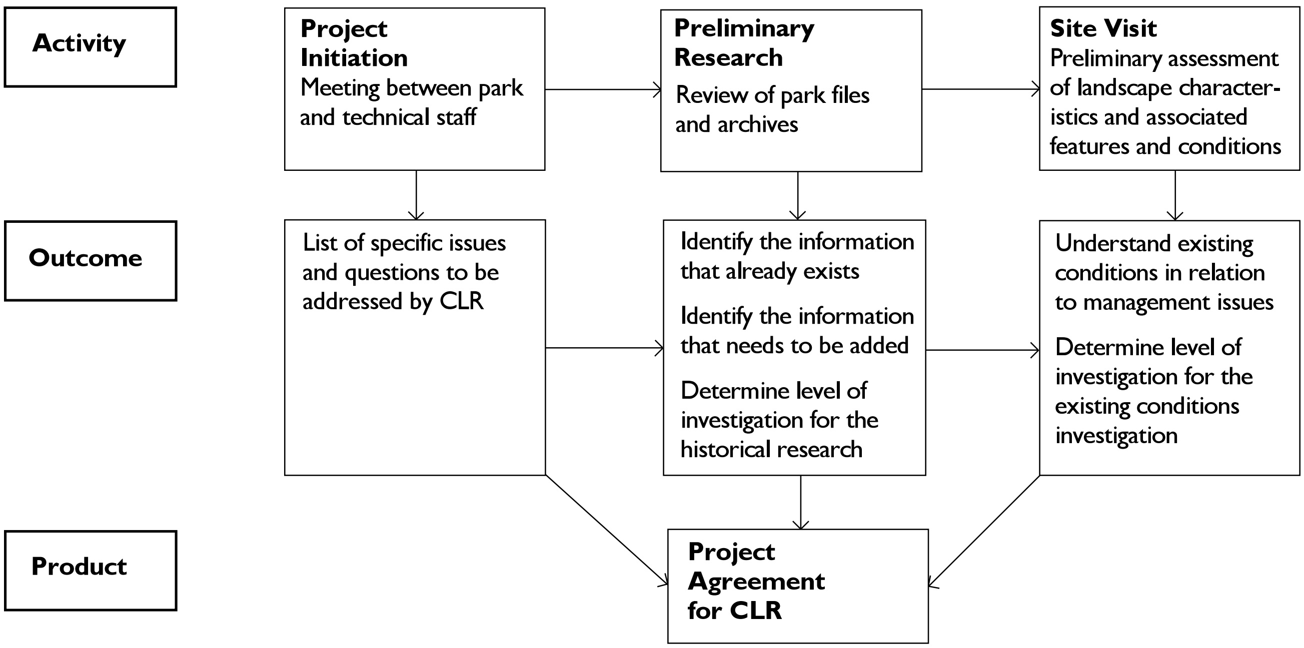
Preliminary Research

The second step in developing a project agreement involves a preliminary review of historical materials related to the site. Extensive information may be found in park files and in a variety of cultural and natural resources databases, such as the Cultural Landscapes Inventory, the List of Classified Structures, the Cultural Sites Inventory, natural resource inventories, and geographical information system databases. When reviewing historic materials, it is necessary to determine whether additional research is required to fully address the management objectives for the project. This step is critical for providing fundamental background information and clarifying what is known about the landscape and what additional information is needed. It is important to recognize that this research is quantitative but not extensive; research is conducted to identify and evaluate the adequacy of primary and secondary sources and collections, and to gather preliminary site information, ensuring the project agreement's accuracy and completeness.

Site Visit

The final step in preparing a project agreement is a site visit. The site visit provides a preliminary assessment of the landscape characteristics

PROCESS FOR PREPARING A PROJECT AGREEMENT



and associated features, as well as the physical condition of the landscape. The site visit may take the form of a windshield survey or walk-through. It is preferable to be accompanied by someone who is knowledgeable about the site and the salient issues to be addressed in the CLR. The purpose of the visit is to understand management issues and existing conditions so that the project agreement can accurately reflect the required level of effort.

SUMMARY

Although a project agreement directs and organizes the scope and content of a CLR, the agreement is not a static document. Because the research to prepare an agreement is preliminary, it is not uncommon that additional information or material becomes available during the course of a project, influencing or altering the original assumptions. In this case, it may be appropriate for park and technical staff to amend the original project agree-ment to respond to the new information. (See *A Guide to Cultural Landscape Reports: Appendi-ces,* "Appendix J: Project Agreements.")

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

U.S. Department of the Interior
National Park Service
Cultural Resources
Park Historic Structures & Cultural Landscapes

Levels of Investigation

INTRODUCTION

The Cultural Landscape Report (CLR) has a flexible format so that it can be used for various landscape types, address different management objectives, and guide treatment activities. While every CLR should be similar in format and content, not every CLR needs to contain the same level of information or have the same outline of contents. A project agreement defines the level of investigation for a CLR. (See *Landscape Lines 1: Project Agreement*.)

THREE LEVELS OF INVESTIGATION

The level of investigation refers to the type and extent of information gathered and processed during three activities conducted for a CLR. The three activities are historical research, existing conditions investigation, and analysis and evaluation. The National Park Service (NPS) *Cultural Resources Management Guideline,* defines the level of investigation for these activities as exhaustive, thorough, and limited.

DETERMINING THE LEVEL OF INVESTIGATION

Within a CLR, the level of investigation required for historical research, existing conditions investigation, and analysis and evaluation may be different. For example, the historical research piece of a CLR may warrant an exhaustive level of investigation because no previous research on the landscape exists. In contrast, the existing conditions investigation may require only a limited level of investigation because reliable information is available from another source, such as a recent, detailed site survey. (See Figure 1.)

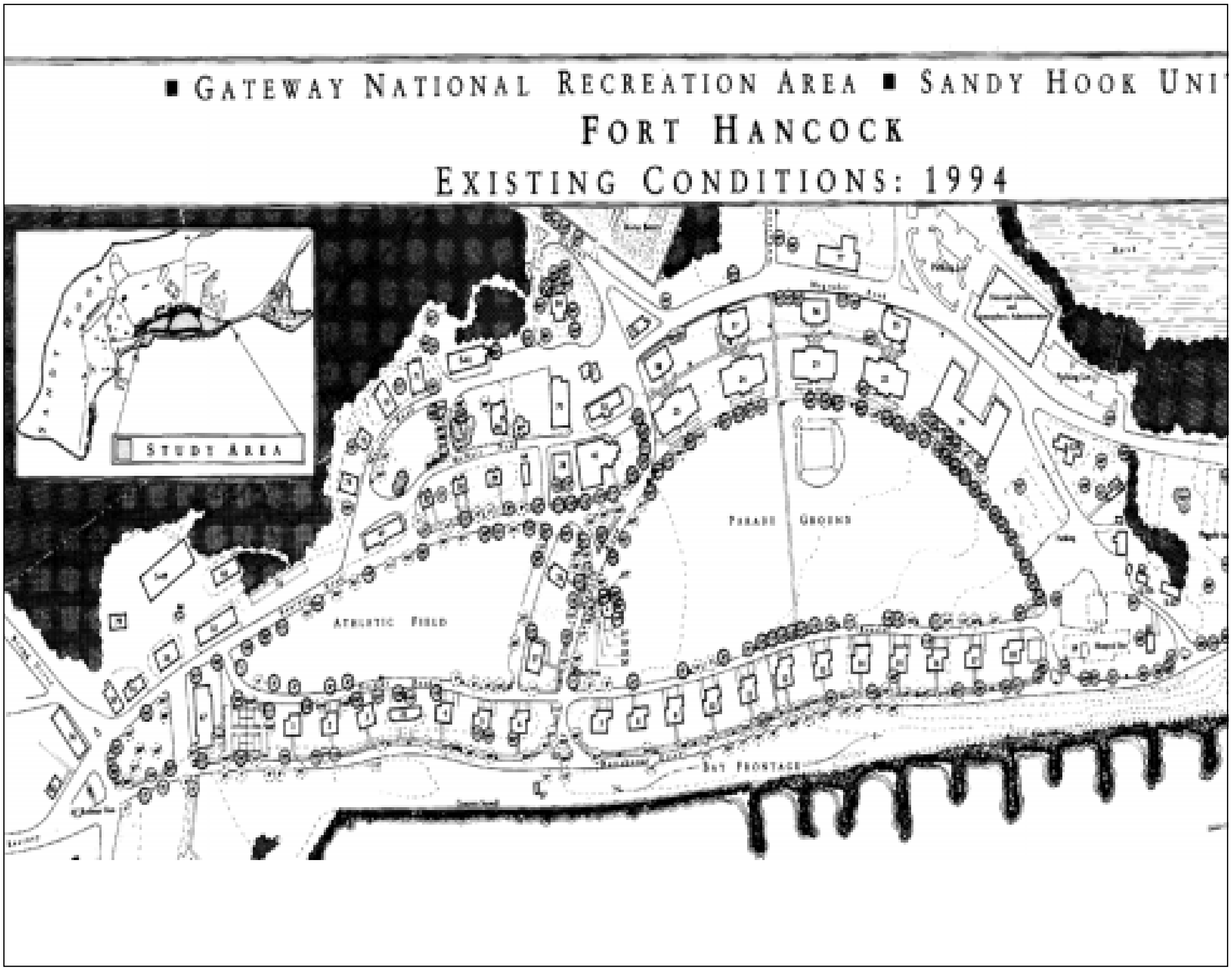


Figure 1. Management objectives for the Andrew Johnson National Cemetary CLR influenced the level of investigation for both the historical research and existing conditions investigation. A limited level of historical research and a thorough level of existing conditions investigation were required to create management zones, which indicated a historic zone, a buffer zone, and a development zone for new interments. Andrew Johnson National Cemetery. (NPS, 1988)

The level of investigation is influenced by several key factors:

- legislative mandate
- management objectives
- resource significance
- resource complexity
- proposed treatment
- operations and programs

Legislative Mandate

The legislative mandate or enabling legislation for a park describes the primary resources to be managed. In some cases, the enabling legislation for a park is very general with regard to the management of specific cultural and natural resources. In other cases, there is a clear statement that the landscape should be managed as a cultural resource. For example, the enabling legislation for Weir Farm National

Historic Site in Connecticut states that the site is established for the purpose of "...maintaining the integrity of a setting that inspired artistic expression and encourages public enjoyment...." If preservation of a cultural landscape is identified in legislation, it may warrant an exhaustive level of research and documentation. However, if the legislative mandate does not give specific direction for preserving a cultural landscape, this does not imply that an exhaustive level of investigation is unwarranted; rather, it means the process of defining the objectives and level of investigation is not directed by legislative mandate.

Management Objectives

A clear understanding of a CLR's management objectives is critical to defining the appropriate level of investigation for historical research, existing conditions investigation, and analysis and evaluation. When information is already available on the site history, management objectives may require only a limited level of historical research. When current site data does not exist, an exhaustive level of existing conditions investigation may be required. Other management objectives for a CLR may include the following:

- determination of historic significance according to National Register criteria for eligibility
- information gathering for resource management in the absence of a proposed treatment (such as preservation)
- information gathering for park interpretation of the resource

It is critical that the level of investigation of historical research, existing conditions investigation, and analysis and evaluation matches the complexity of the management issues.

Resource Significance

Resource significance is a factor that influences the level of investigation. There are four levels of resource significance.

- International: cultural landscapes that qualify as World Heritage Sites based on their universal significance.
- National: cultural landscapes that qualify as National Historic Landmarks are listed in the National Register as nationally significant, or are determined to be nationally significant by an act of Congress.
- State: cultural landscapes that qualify for the National Register and are determined to be significant at the state level.
- Local: cultural landscapes that qualify for the National Register and are determined to be significant at the local level.

Cultural landscapes that are nationally significant, such as the Blue Ridge Parkway or the grounds of the White House and President's Park, may warrant an exhaustive level of investigation because of their value to the nation and to ensure that management protects these values. Cultural landscapes that are significant at the state or local level, such as a backcountry homestead in Colorado, a settlement community in Wisconsin, or a sheep ranch in eastern Oregon, may not require an exhaustive level of investigation because they are not unique and are more representative of a type of historic property.

Resource Complexity

The physical scale and complexity, as well as the historic complexity of a landscape, may necessitate additional time and effort in preparing Part 1 of a CLR, titled "Site History, Existing Conditions, and Analysis and Evaluation." Although complexity does not affect the type of information gathered in preparing a CLR, it influences the effort required to review all the research materials of landscapes with extensive site histories or to document landscapes that are large, have complex spatial relationships, or have a high density of features.

Proposed Treatment

Treatment for a cultural landscape is often decided through the park planning process. Treatment may or may not be decided before a CLR is prepared. If a proposed treatment has been decided, a CLR documents implementation of the treatment. If treatment has not been decided through the planning process, but management objectives require a CLR to recommend a treatment, a CLR augments, or is combined with a Site Development Plan to determine a preferred treatment and physical design. This is outlined in the CLR project agreement along with specific questions to be answered. (See *Landscape Lines 1: Project Agreement*.)

The following two examples show how the type of proposed treatment can influence a CLR's level of investigation.

Example 1: If rehabilitation is the proposed treatment for a cultural landscape and the end product of a CLR is a new site plan or design illustrating the location, extent, and character of new development, then a thorough or exhaustive level of investigation is required.

Take, for example, the rehabilitation of a historic cattle ranch landscape to accommodate a new visitor center with parking and interpretive facilities. Here, historical research must be sufficient to allow for a very comprehensive review and assessment of research materials.

Existing conditions investigation and documentation must clearly illustrate the existing landscape, portray the landscape characteristics and associated features, and identify the conditions within which the rehabilitation can occur. The analysis and evaluation must consolidate and compare data from various sources (programs and professional disciplines) and from different perspectives to evaluate the impact of treatment activities on specific features within the landscape and identify the best option.

Example 2: If preservation is the proposed treatment for a cultural landscape and the end product of a CLR is a list of acceptable plants, then a limited level of investigation may be sufficient.

Take, for example, the replacement of plants around a new visitor center (which is also a historic building) with historically accurate plants. Historical research may include a review of primary historical records, such as drawings or historic photographs, for the purposes of identifying former plant materials. A review of written documents may reveal the historic design intent, function, or character of former plants, assisting in the selection of new plantings. An exhaustive review of all historic records related to the landscape is not appropriate. Similarly, existing conditions investigation and documentation may be limited to the examination of extant plant materials in the vicinity of the visitor center to identify extant historic plant species and document their condition and character.

The proposed treatment for a landscape defines the level of physical intervention of subsequent treatment activities. The level of intervention increases from preservation, through rehabilitation, to restoration, to reconstruction. It is critical that the level of investigation for historical research, existing conditions investigation, and analysis and evaluation adequately matches the type of information required for the proposed treatment. (See Figure 2.)

Operational and Program Factors

Operational factors, such as time, budget, and staff, and program factors, such as the relationship of the CLR to other projects, can influence the level of investigation. Although operational and program factors have low priority in determining the level of investigation, they often have a profound impact on a project. For instance, funding may determine the amount of time and the staff available for a project, set travel limits on the number of repositories a researcher can visit, and necessitate scheduling the completion of a CLR so that it is available for other planning and construction projects.

Levels of Investigation

Historical Research

The purpose of historical research is to develop a historic context that defines the significance of a landscape. Historical research is used to compose a site history, which describes and illustrates the appearance of a cultural landscape through each relevant historic period.

Exhaustive Historical Research

Exhaustive historical research uses all primary sources of known or presumed relevance, including the following:

- historic publications, unpublished manuscripts, and historic correspondence
- all pertinent historic graphic records, such as drawings, plans, and photographic materials
- interviews are conducted with knowledgeable persons, regardless of their location

Secondary sources are also reviewed, such as studies, reports, and topical publications. All gathered information is compiled and then documented chronologically in an illustrated narrative.

Thorough Historical Research

Thorough historical research uses selected documentation of known and presumed relevance. This includes primary and secondary sources that are available without extensive travel and interviews with knowledgeable people who are readily available. The findings are presented in an illustrated narrative.

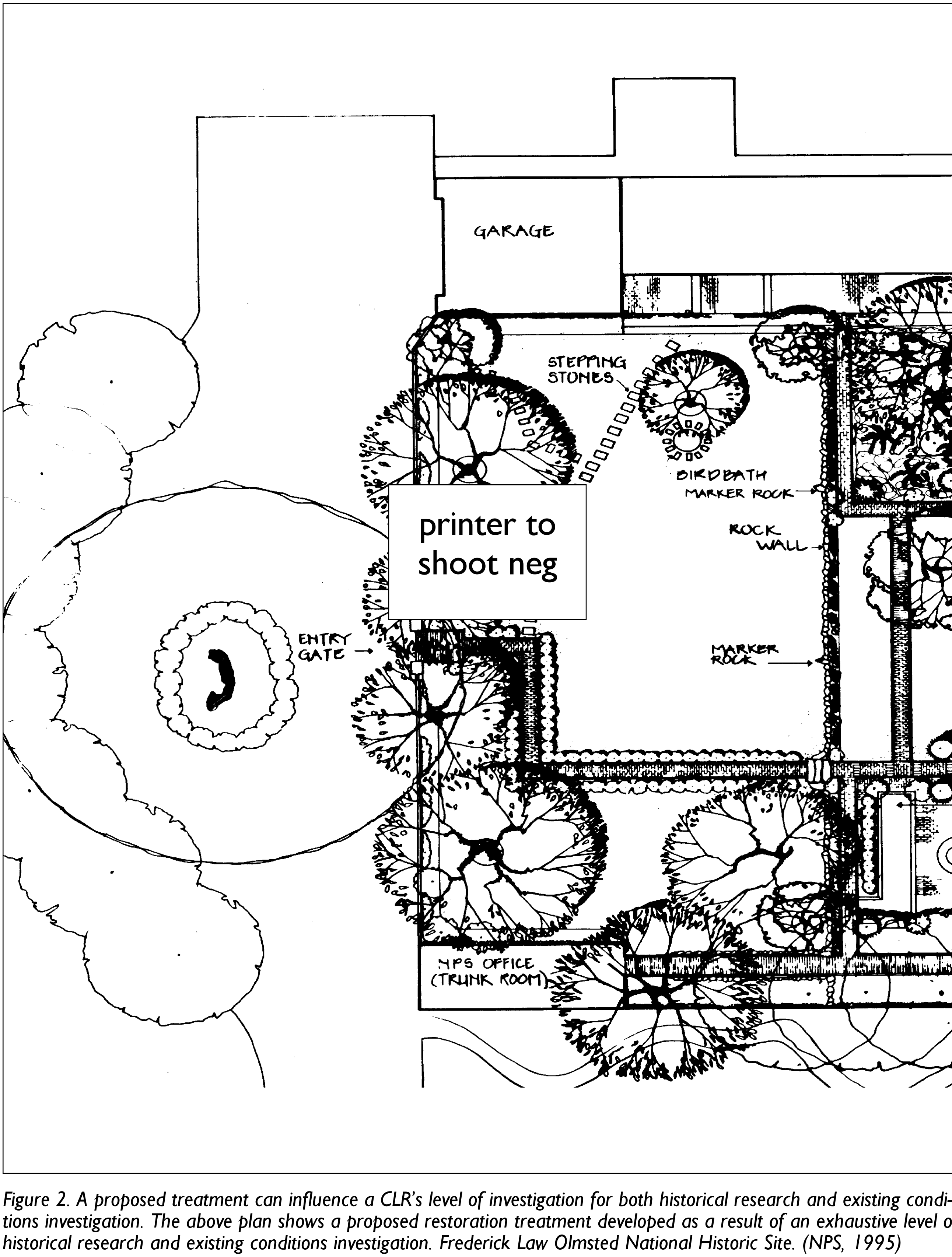


Figure 2. A proposed treatment can influence a CLR's level of investigation for both historical research and existing conditions investigation. The above plan shows a proposed restoration treatment developed as a result of an exhaustive level of historical research and existing conditions investigation. Frederick Law Olmsted National Historic Site. (NPS, 1995)

Limited Historical Research

Limited historical research uses available, selected, and published secondary sources and primary sources, if known. Research may be limited to sources readily accessible within or near a park. Brief interviews are conducted (often by telephone) to answer specific questions. The findings are presented in an illustrated narrative.

Existing Conditions Investigation

Documentation of existing conditions requires a site investigation involving two general activities: site research and a site survey. The purpose of this work is to describe and illustrate the current appearance and condition of a landscape, including all landscape characteristics and associated features. The documentation resulting from a site investigation includes an existing conditions plan, narrative text, and black and white photographs.

Exhaustive Existing Conditions Investigation

An exhaustive existing conditions investigation involves site research, including the collection and review of all available site data from existing sources, including the following:

- natural and cultural resource databases (such as the List of Classified Structures and Cultural Landscapes Inventory)
- park maintenance records
- utility records, zoning, and other political or legal information
- special studies (such as archeological investigations and ethnographic overviews)
- building inventories
- Vegetation Management Plans
- National Register nominations
- Historic Resource Studies
- planning documents (such as the General Management Plan, Statement for Management, Interpretive Prospectus, or Resource Management Plan).
- maps, plans, photographs, etc.

Information on site access, accessibility, land use, visitor services, park operations, and interpretive programs is also reviewed. Other site-related documents from external sources are also examined, including soil surveys, aerial photographs, and United States Geological Survey (USGS) maps.

The site survey involves the extensive identification and recording of existing landscape characteristics and associated features. Their location, appearance, and physical condition are documented in the field using black and white photographs, color slides, sketches, and written observations.

Additional site survey techniques may be used to identify and describe the appearance and condition of landscape characteristics and associated features in the field. These techniques include:

- tree coring to determine the age of historic trees
- aerial photography to identify and record broad patterns of landscape characteristics (such as natural systems and features, circulation, land use, and spatial organization) and associated features

- topographic and hydrographic surveys to obtain accurate location and elevation data for a base map
- archeological techniques, including geophysical surveys and soil analyses to locate and analyze buried ruins and cultural artifacts
- computer technologies to collect and process field survey information, such as the global positioning system datalogger as an inventory tool and geographic information survey as a system for mapping, analyzing, and managing site data

All findings are presented in an existing conditions plan, narrative text, and black and white photographs.

Thorough Existing Conditions Investigation

The availability of recent and reliable site data may make it possible to conduct a thorough, rather than an exhaustive, existing conditions investigation. A thorough investigation differs from an exhaustive investigation in the following ways:

- more existing site data may be used, but less new data will be generated from the site survey
- fewer specialized technologies or techniques will be used in the site survey
- technical and park staff expertise will be used rather than experts from other disciplines
- less labor-intensive techniques will be used to collect site data

A thorough level of investigation may obtain topographic information from an aerial photograph using photogrammetry, whereas an exhaustive level of investigation may use a refined topographic survey with a close contour interval and include the canopy size and d.b.h. (diameter at breast height) of mature trees.

The findings of a thorough existing conditions investigation are presented in an existing conditions plan, narrative text, and black and white photographs. (See Figure 3.)

Limited Existing Conditions Investigation

A limited existing conditions investigation may use available site data and generate less new data through the field survey than the thorough or exhaustive investigations. A limited existing conditions investigation may focus on just one discrete area of a landscape, use only park and technical staff expertise, and use only the sources of site data available in park files.

In a limited investigation, the site survey may be performed from a less intimate vantage point (such as a motorized vehicle) and only discrete areas may be surveyed and documented on foot. A limited investigation may use existing USGS topographic information or a previous topographic survey rather than contract for a topographic survey on the ground or through photogrammetry. The findings are presented in an existing conditions plan, narrative text, and black and white photographs.

Analysis and Evaluation

Analysis and evaluation involves comparing the findings of historical research with the findings of the existing conditions investigation. The purpose of the comparison is twofold:

Figure 3. The Capitol Reef CLR had a thorough level of investigation for both historical research and existing conditions investigation. Capitol Reef National Park. (NPS, c. 1930)

- to determine the landscape characteristics and associated features of a landscape from each significant historic period
- to understand how the landscape characteristics and associated features contribute to and convey the significance of the landscape (based on National Register criteria)

An analysis and evaluation shows how a landscape has changed over time. The analysis and evaluation may also include a statement of significance for the landscape and identify landscape character areas and management zones. The findings of analysis and evaluation are documented in a narrative illustrated with graphics, such as plans, sketches, and photographs.

Exhaustive Analysis and Evaluation

An exhaustive analysis and evaluation uses all historic and contemporary site data from historical research and existing conditions investigation. It may include park operational data, maintenance records, and detailed condition assessments of landscape characteristics and associated features. The analysis and evaluation may involve the collaboration of experts from other disciplines as well as representatives from the public. The gathered information can be used to deal with various issues, such as multiple periods of significance or areas of the landscape that may receive secondary treatments within the primary treatment plan. The findings are documented in a narrative illustrated with graphics, such as plans, sketches, and photographs.

Thorough Analysis and Evaluation

A thorough analysis and evaluation uses relevant findings from historical research and existing conditions investigation. It may involve only park and technical staff expertise and may deal with less complex management issues than an exhaustive analysis. The findings are documented in a narrative illustrated with graphics, such as plans, sketches, and photographs.

Limited Analysis and Evaluation

A limited analysis and evaluation uses findings from historical research and existing conditions investigation that are relevant to specific management concerns. It involves only the resources and staff expertise readily available and deals with less complex management issues than a thorough analysis. The findings are documented in a narrative illustrated with graphics, such as plans, sketches, and photographs.

Summary

The level of investigation is influenced by a number of factors. Ultimately, the level of historical research, existing conditions investigation, and analysis and evaluation, should match the level of decision making to be directed by a CLR. If the proposed level of intervention in a landscape is high, the level of investigation should be thorough or exhaustive. If funding and staffing issues limit the level of investigation for a CLR, the resultant level of decision making should be limited.

Reference

National Park Service. 1997. *Cultural Resource Management Guideline, NPS 28*, no. 5. Washington, DC: USDI, NPS.

Landscape Characteristics

Introduction

As the field of cultural landscape preservation has evolved, a method has been developed to describe the tangible and intangible characteristics of a historically significant landscape. Individually and collectively, the characteristics give a landscape character and aid in understanding its cultural value.

Various classification systems and terms have been used to describe the cultural and natural processes and physical forms that define the appearance of a landscape. The classification systems have originated from several sources within the National Park Service (NPS) for various preservation purposes (such as inventory, documentation, and treatment) and have addressed various cultural landscape types (such as designed and vernacular). Different titles have been given to the classification systems, such as "landscape components," "landscape features," "landscape characteristics," and "character-defining features." Each classification system contains a list of the cultural and natural processes and the physical aspects of a landscape.

In addition to providing methods for describing a landscape's character and physical qualities, the classification systems have introduced new terminology to the cultural landscape preservation field. This has resulted in some confusion about terms with similar, yet slightly different meanings.

The intent of this text is to provide a recommended classification system for describing the character of cultural landscapes in the national park system for use in research, inventory, documentation, analysis and evaluation, and treatment. This classification system is recommended to provide consistency in the terminology used in the NPS Park Cultural Landscape Program, and specifically in the Cultural Landscapes Inventory

(CLI) and Cultural Landscape Report (CLR). The classification system outlined should provide a means for documenting all the cultural and natural processes and physical forms that may exist in a given landscape. The system is flexible and must be applied to each landscape according to the type of landscape and the nature of its historical development. Not all landscapes will have the same physical character.

The recommended classification system presented in this text builds upon, and has many similarities with, earlier efforts. It addresses the diversity and scope of cultural landscapes in the national park system. To give this recommended system context in the cultural landscape preservation field, the text first presents an overview of the classification systems developed to date by the NPS, along with the terminology associated with the systems. The similarities and differences between the systems and the terminology used are described. Finally, based on the recommended classification system and terminology, the application and use of landscape characteristics and associated features in a CLR are described.

Classification Systems and Terminology Used In the Field

A review of the classification systems and their associated terminology indicates many commonalties. The recommended classification system presented in this text builds upon the following studies and publications:

- In 1984, *Cultural Landscapes: Rural Historic Districts in the National Park System*, provided the first classification system. It identified "landscape components" that can be used to identify, evaluate, nominate (to the National Register), and manage rural historic districts.
- In 1987, *National Register Bulletin 18: How to Evaluate and Nominate Designed Historic Landscapes*, presented a detailed list of "landscape features," which focused on describing designed landscapes for nomination to the National Register. The list of features was provided for consideration in describing designed landscapes, but it was not intended to be a comprehensive classification system.
- In 1990, *National Register Bulletin 30: Guidelines for Evaluating and Documenting Rural Historic Landscapes* coined the term "landscape characteristics" as the title for the classification system outlined in the publication. *Bulletin 30* was largely a revision of the 1984 study, *Cultural Landscapes: Rural Historic Districts in the National Park System.* The classification system of landscape characteristics was similar to the original list of "landscape components" in the 1984 study. However, *Bulletin 30* gave an expanded explanation of how various landscape characteristics could be meaningful in understanding the cultural development of rural landscapes, and it provided guidelines for their documentation.
- In 1996, *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes* identified "organizational elements" and "character-defining features" as a classification system for the treatment of cultural

CHRONOLOGY OF CLASSIFICATION SYSTEMS

1984
Landscape Components

Overall Patterns of Spatial Organization

Land Use: Categories and Activities

Response to Natural Features

Circulation Networks

Boundary Demarcations

Vegetation Related to Land Use

Cluster Arrangement

Structure: Type, Function, Materials, Construction

Small-Scale Elements

Historical Views and Other Perceptual Qualities

Source: *Cultural Landscapes: Rural Historic Districts in the National Park System.*

1987
Landscape Features

Spatial Relationships and Orientations

Land Uses

Natural Features

Circulation Systems

Landscape Dividers

Topography and Grading

Vegetation

Buildings, Structures, and Lighting

Drainage and Engineering Structures

Site Furnishings and Small-Scale Elements

Water Bodies, Sculpture, and Signs

Views and Vistas

Source: *National Register Bulletin 18: How to Evaluate and Nominate Designed Historic Landscapes.*

1990
Landscape Characteristics

<u>Processes</u>

Patterns of Spatial Organization

Land Uses and Activities

Response to the Natural Environment

Cultural Traditions

<u>Components</u>

Circulation Networks

Boundary Demarcations

Vegetation Related to Land Use

Buildings, Structures, and Objects

Clusters

Archeological Sites

Small-Scale Elements

Source: *National Register Bulletin 30: Guidelines for Evaluating and Documenting Rural Historic Landscapes.*

1996
Organizational Elements and Character-Defining Features

<u>Organizational Elements</u>

Spatial Organization

Land Patterns

<u>Character-Defining Features</u>

Topography

Vegetation

Circulation

Water Features

Structures, Site Furnishings, and Objects

Source: *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes.*

1997
Landscape Characteristics

Natural Systems and Features

Spatial Organization

Land Use

Cultural Traditions

Cluster Arrangements

Circulation

Topography

Vegetation

Buildings and Structures

Views and Vistas

Constructed Water Features

Small-Scale Features

Circulation

Archeological Sites

Source: *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques* and *Cultural Landscapes Inventory Professional Procedures Guide.*

landscapes. (The term, character-defining feature, dates from the 1978 publication of *The Secretary of the Interior's Standards for Historic Preservation Projects with Guidelines for Applying the Standards*, where the term was used to describe architectural qualities contributing to the character of historic buildings).

In referencing the publications prepared by the National Register, it needs to be noted that the National Register allows a considerable degree of latitude in the way survey information is presented and organized in nominations. The classification systems outlined in the bulletins were presented to facilitate the evaluation process, but did not require that information about cultural landscapes be organized as such.

There is some overlap in the definitions of terms associated with the classification systems, partly because the terms originated at different times by different sources, and for discrete uses. For instance, the term "landscape characteristic" was conceived primarily to apply the National Register criteria to cultural landscapes so they could be evaluated and nominated as sites or districts to the National Register. The term "character-defining feature" was conceived to guide the appropriate treatment and management of historic structures (and later of cultural landscapes), so that features conveying historic character would be retained by treatment activities. The term "contributing or noncontributing feature" was conceived as a specific, quantifiable item that could be identified in the field for the purpose of the CLI and National Register evaluation. In all these efforts, the evolution of terms was influenced by the type(s) of cultural landscape being addressed, along with the range of physical conditions to which the terms apply. (See *A Guide to Cultural Landscape Reports: Appendices,* "Appendix C: National Register Bulletins (nos. 18 and 30)," and "Appendix H: Treatment Policy, Guidelines, and Standards.")

Landscape Characteristics

"Landscape characteristics" is the recommended term associated with the classification system in this text. It refers to the processes and physical forms that characterize the appearance of a landscape and aid in understanding its cultural value. The following general points apply to landscape characteristics and their use in CLRs:

- Landscape characteristic is defined as the tangible and intangible characteristics of a landscape that individually and collectively give a landscape character and aid in understanding its cultural value.
- Landscape characteristic is applied to either culturally derived and naturally occurring processes or to cultural and natural physical forms that have influenced the historical development of a landscape or are the products of its development. The appearance of a cultural landscape, both historically and currently, is a unique web of landscape characteristics that are the tangible evidence of the historic and current uses of the land.

TERMINOLOGY USED IN CULTURAL LANDSCAPE PRESERVATION

Character-Defining Feature

"A prominent or distinctive aspect, quality, or characteristic of a historic property that contributes significantly to its physical character. Structures, objects, vegetation, spatial relationships, views, furnishings, decorative details, and materials may be such features."

—*Cultural Resource Management Guideline, Release No. 5 (*1997*)* and *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes* (1996)

Contributing Feature

"A biotic or abiotic feature associated with a landscape characteristic that contributes to the significance of the cultural landscape."

—*Cultural Landscapes Inventory Professional Procedures Guide* (1998)

Contributing Resource

"A building, site, structure, or object that adds to the historic significance of a property. A contributing building, site, structure, or object adds to the historic associations, historical architectural qualities, or archaeological values for which a property is significant because of the following: it was present during the period of significance; it relates to the documented significance of the property; it possesses historic integrity or is capable of revealing information about the period; or it independently meets the National Register criteria."

—*National Register Bulletin 16A: How to Complete the National Register Registration Form* (1991)

Landscape Characteristic

"The tangible evidence of the activities and habits of the people who occupied, developed, used, and shaped the land to serve human needs. The beliefs, attitudes, traditions, and values of the people and processes that have been instrumental in shaping the land, and the processes are evident as physical components on the land."

—*National Register Bulletin 30: Guidelines for Evaluating and Documenting Rural Historic Landscapes* (1990)

Landscape Feature

"The smallest physical unit that contributes to the significance of a landscape that can be managed as an individual element."

—*Cultural Landscapes Inventory Professional Procedures Guide* (1998)

Landscape Unit

"A discrete portion of the landscape which can be further subdivided into individual features. The landscape unit may contribute to the significance of a National Register property, such as a farmstead in a rural historic district. In some cases the landscape unit may be individually eligible for listing in the National Register of Historic Places, such as a rose garden in a large urban park."

—*The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes (1996)*

Non-Contributing Feature

"A biotic or abiotic feature associated with a landscape characteristic that does not contribute to the significance of the cultural landscape."

—*Cultural Landscapes Inventory Professional Procedures Guide* (1998)

Non-Contributing Resource

"A non-contributing building, site, structure, or object that does not add to the historic architectural qualities, historic associations, or archaeological values for which a property is significant, because: it was not present during the period of significance or does not relate to the documented period of significance of the property; due to alterations, disturbances, additions or other changes, it no longer possesses historic integrity or is capable of yielding important information about the period; or it does not independently meet the National Register criteria."

—*National Register Bulletin 16A: How to Complete the National Register Registration Form* (1991)

- Landscape characteristics are categories under which individual features can be grouped. For example, the landscape characteristic "natural systems and features" may include such individual features as a ravine, valley, wetland, or cliff. The landscape characteristic "topography" may include such features as an earthwork, drainage ditch, or hill. The landscape characteristic "vegetation" may include such individual features as a specimen tree, woodlot, or perennial bed.
- Many landscape characteristics are common among cultural landscapes; however, not all categories of landscape characteristics occur in every landscape. Determining which landscape characteristics exist or did exist within the unique development of each landscape must be made, and only the landscape characteristics that exist or have existed in a particular landscape are identified in CLR.
- Landscape characteristics are valuable in understanding the evolution of a landscape's appearance over time. They may not have retained integrity (that is, existed in a relatively unchanged state since the established period(s) of significance), and therefore may or may not contribute to the significance of a landscape. Some landscape characteristics may be completely lost, some may be recent additions. Understanding what remains and what was lost can influence the treatment of the landscape.
- Landscape characteristics exist primarily within the boundaries of a cultural landscape; however, it is important to identify the natural, cultural, and political context for every landscape. The context provides an understanding of the relationship between the landscape characteristics and the broader environment within which they exist. The natural context includes the naturally occurring physical forms that have influenced the landscape's development, such as dominant landforms, watersheds, native vegetation, water bodies, and wetlands. The cultural and political contexts include land use, zoning, legal restrictions, transportation, utilities, population, and political jurisdiction (state, county, city, village, or town).

Recommended Landscape Characteristics

This section recommends a classification system of landscape characteristics. The list of landscape characteristics does not necessarily apply to all cultural landscapes, but rather provides a basis from which the relevant characteristics for a landscape can be identified.

Landscape characteristics must be uniquely identified for each cultural landscape according to the type of landscape and the nature of its historical development. In addition, it is also important to recognize that the list of characteristics is not mutually exclusive. For example, vegetation, buildings and structures, and views and vistas often assist in defining the spatial organization of a landscape. Determining the relationship among the landscape characteristics identified for a property is important in understanding the history of a landscape and how it should be treated.

Natural Systems and Features

Natural systems and features are the natural aspects that have influenced the development and physical form of a landscape. The following may be included:

- geomorphology: the large-scale patterns of land forms
- geology: the surficial characteristics of the earth
- hydrology: the system of surface and subsurface water
- ecology: the interrelationship among living organisms and their environment
- climate: temperature, wind velocity, and precipitation
- native vegetation: indigenous plant communities and indigenous aggregate and individual plant features

Examples of features associated with natural systems and features include ravines, valleys, watersheds, wetlands, and rock outcrops. (See Figure 1.)

Spatial Organization

Spatial organization is the three-dimensional organization of physical forms and visual associations in a landscape, including the articulation of ground, vertical, and overhead planes that define and create spaces. Examples of features associated with spatial organization include circulation systems, views and vistas, divisions of property, and topography. (See Figure 2.)

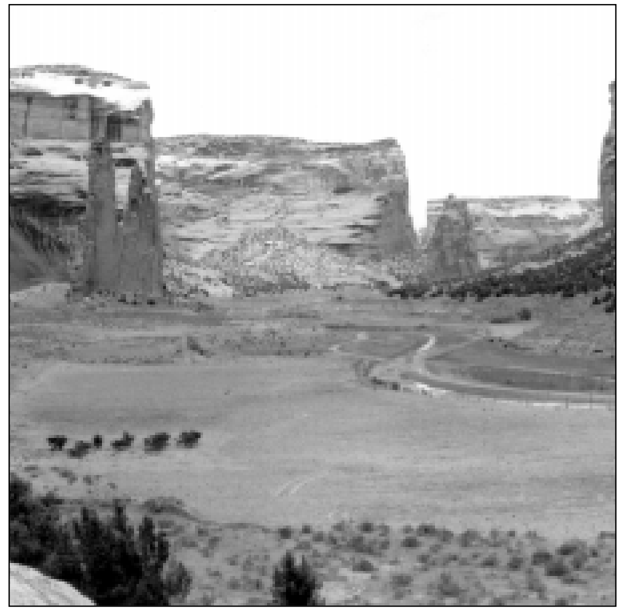


Figure 1. View of natural systems and features. Canyon de Chelly National Monument. (NPS, 1988)

Figure 2. Land use and spatial organization are made visible in part by field and crop patterns. Ebey's Landing National Historical Reserve. (NPS, 1983)

Figure 3. Cluster arrangements are visible in this aerial view of outbuildings in this cattle ranch landscape. Grant-Kohrs Ranch National Historic Site. (NPS, 1970)

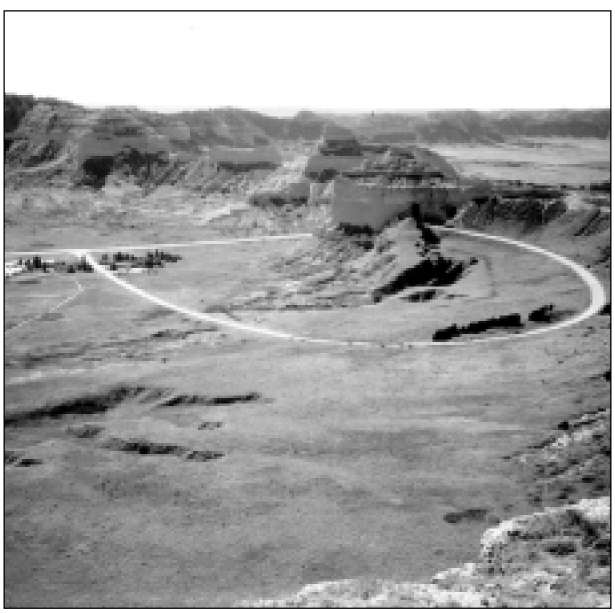


Figure 4. Circulation is a prominent landscape characteristic of this Civilian Conservation Corps development. Scotts Bluff National Monument. (NPS, 1995)

Land Use

Land use describes the principal activities in a landscape that form, shape, and organize the landscape as a result of human interaction. Examples of features associated with land use include agricultural fields, pastures, playing fields, and quarries. (See Figure 2.)

Cultural Traditions

Cultural traditions are the practices that influence the development of a landscape in terms of land use, patterns of land division, building forms, stylistic preferences, and the use of materials. Examples of features associated with cultural traditions include land use practices, methods of construction, buildings, patterns of land division, and use of vegetation.

Cluster Arrangement

Cluster arrangement is the location and pattern of buildings and structures in a landscape and associated outdoor spaces. Examples of features associated with a cluster arrangement include village centers and complexes, mining, agricultural, and residential buildings and structures and the associated spaces they define. (See Figure 3.)

Circulation

Circulation includes the spaces, features, and applied material finishes that constitute the systems of movement in a landscape. Examples of features associated with circulation include paths, sidewalks, roads, and canals. (See Figure 4.)

Topography

Topography is the three-dimensional configuration of a landscape surface characterized by features (such as slope and articulation) and orientation (such as elevation and solar aspect). Examples of features associated with topography include earthworks, drainage ditches, knolls, and terraces. (See Figure 5.)

Figure 5. The reconstructed earthworks that form the Grand French Battery complex of Yorktown Battlefield are a feature of topography. Colonial National Historical Park. (NPS, n.d.)

Vegetation

Vegetation includes the deciduous and evergreen trees, shrubs, vines, ground covers and herbaceous plants, and plant communities, whether indigenous or introduced in a landscape. Examples of features associated with vegetation include specimen trees, allees, woodlots, orchards, and perennial gardens. (See Figure 6.)

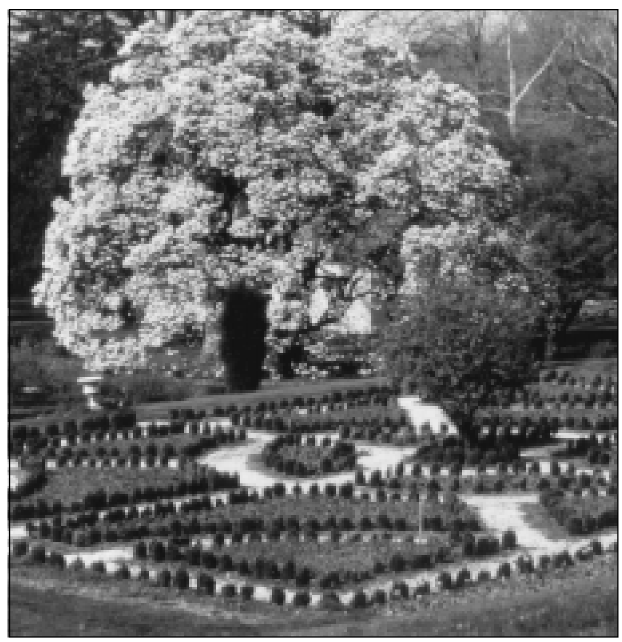


Figure 6. Vegetation includes specimen plant features, such as the nineteenth century Saucer Magnolia in the background, and aggregations of plants, such as the Boxwood hedge outlining the pathways. Hampton National Historic Site. (NPS, n.d.)

Buildings and Structures

Buildings are elements constructed primarily for sheltering any form of human activity in a landscape. Structures are elements constructed for functional purposes other than sheltering human activity in a landscape. Engineering systems are also structures. Mechanical engineering systems may be distinguished from structural engineering systems as follows:

- Mechanical engineering systems conduct utilities within the landscape, such as power lines, hydrants, and culverts.
- Structural engineering systems provide physical stabilization in the landscape, such as retaining walls, dikes, and foundations.

Figure 7. Lover's Lane Footbridge is a feature associated with the landscape characteristics, buildings and structures, and circulation at the Presidio. Golden Gate National Recreation Area. (NPS, 1993)

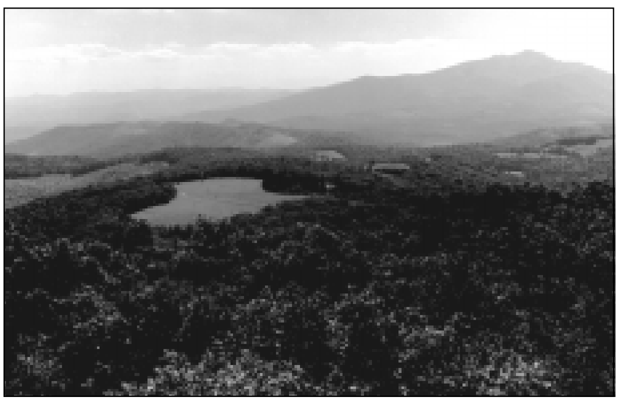


Figure 8. Views are a significant landscape characteristic of the Blue Ridge Parkway. This is the view from Flat Top Mountain toward Grandfather Mountain. Blue Ridge Parkway. (NPS, c. 1940s)

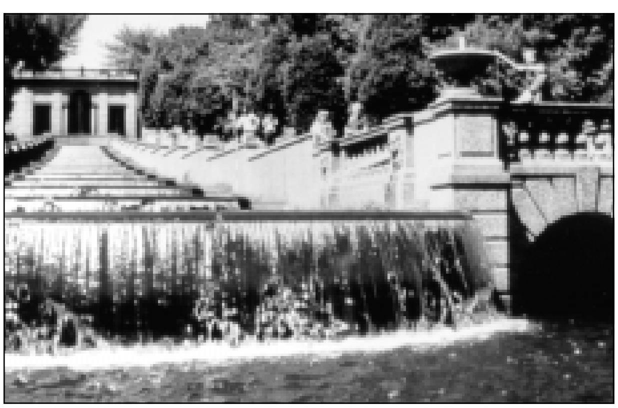


Figure 9. Constructed water features, such as this water cascade, are a landscape characteristic of the historic designed landscape of Meridian Hill Park. Rock Creek Park. (NPS, n.d.)

Examples of features associated with buildings include houses, barns, stables, schools, and factories. Examples of features associated with structures include bridges, windmills, gazebos, silos, and dams. (See Figure 7.)

Views and Vistas

Views and vistas are the prospect created by a range of vision in a landscape, conferred by the composition of other landscape characteristics and associated features. (See Figure 8.) Views and vistas are distinguished as follows:

- Views are the expansive or panoramic prospect of a broad range of vision, which may be naturally occurring or deliberately contrived.
- Vistas are the controlled prospect of a discrete, linear range of vision, which is deliberately contrived.

Constructed Water Features

Constructed water features are the built features and elements that use water for aesthetic or utilitarian functions in a landscape. Examples of features associated with constructed water features include fountains, canals, cascades, pools, and reservoirs. (See Figure 9.)

Small-Scale Features

Small-scale features are the elements providing detail and diversity for both functional needs and aesthetic concerns in a landscape. Examples of small-scale features include fences, benches, monuments, signs, and road markers. (See Figure 10.)

Archeological Sites

Archeological sites are the ruins, traces, or deposited artifacts in a landscape, evidenced by the presence of either surface or subsurface features. Examples of features associated with archeological resources include road traces, structural ruins, irrigation system ruins, and reforested fields.

Use of Landscape Characteristics in Cultural Landscape Reports

Landscape characteristics are a useful framework for preparing CLRs because they provide a system for: 1) gathering, organizing, and understanding information about the site history and existing conditions of a cultural landscape, and 2) documenting the changing appearance of a landscape over time. Landscape characteristics can be used in all sections of a CLR, including the following:

- Site History
- Existing Conditions
- Analysis and Evaluation
- Treatment
- Record of Treatment

The organization of landscape characteristics throughout the sections of a CLR should be considered. A hierarchical or nested arrangement may be useful for organizing and emphasizing the interrelationships of landscape characteristics. The manner in which they are presented in a CLR may not be the order in which landscape characteristics are recognized and identified in the field. For example, it may be necessary to identify which landscape characteristics give structure to spatial organization, such as vegetation and topography, before spatial organization can be recognized and identified as a landscape characteristic.

Figure 10. The gatepost of the Presidio Boulevard Gate is a small-scale feature of the Presidio landscape. Golden Gate National Recreation Area. (NPS, 1993)

Site History

The site history describes the landscape through every relevant historic period until the present. Landscape characteristics are used as a system for organizing the documentation describing the chronological development of the landscape and recording the physical changes, events, and persons integral to the evolution. The appearance of landscape characteristics over time is communicated graphically in a CLR through a series of period plans, in a narrative format, and in historical photographs and other documents.

Existing Conditions

The existing conditions identify and describe the landscape characteristics that define the existing appearance and character of a landscape. Landscape characteristics are identified and documented during field surveys and through the use of site investigation techniques, such as tree coring, archeology, and aerial photograph analysis. Landscape characteristics are geographically located and their physical condition is assessed. Existing landscape characteristics are graphically documented in an existing conditions plan and in the narrative text of a CLR. Landscape characteristics are also documented in black and white photographs and color slides.

Analysis and Evaluation

The analysis and evaluation compares the findings of the site history with the existing conditions to identify the landscape characteristics that retain integrity and contribute to the significance of a landscape. (Landscape characteristics that have existed since an established historic period are determined to retain integrity.) If not already determined, the analysis and evaluation section states the significance of the landscape (according to National Register criteria A-D), and the historic period(s) of significance.

Treatment

Treatment prescribes how the landscape should be treated and managed, based on its significance, existing conditions, and use. Although the treatment of cultural landscapes is directed by policy, guidelines, and standards, knowledge of landscape characteristics as they existed over time influences the selection of a primary treatment and development of a treatment plan for the entire landscape. The extent of written evidence of the historic appearance of landscape characteristics is considered during treatment planning, and the physical condition of characteristics influences specific treatment. A treatment plan may be described in a CLR using narrative guidelines, a schematic drawing, or a detailed plan.

Record of Treatment

The record of treatment is an appendix or addendum to a CLR that describes treatment activities in the landscape as implemented. Landscape characteristics may be used to organize the continued documentation of a landscape during the physical changes involved in implementing the treatment plan. A record of how treatment activities affected landscape characteristics is presented in a narrative description of construction work, "as-built" construction drawings, and photographs. These records become primary sources of the continued evolution of landscape characteristics and add to the archived historic records of a landscape.

In each section of a CLR, landscape characteristics provide a valuable framework for understanding and organizing the chronological development of a landscape, describing the existing conditions, and outlining a treatment plan. Each landscape characteristic represents a broad category of processes or physical forms that interrelate and can be used to illustrate patterns through time.

References

Curry, George, W., Regina Bellavia, and David Uschold. Unpublished report, 1993. Landscape Features: Character-defining Features for the Documentation of Cultural Landscapes. Available from George Curry, Faculty of Landscape Architecture, State University of New York, College of Environmental Science and Forestry, Syracuse, New York.

Other useful references from the SUNY Syracuse, landscape architecture program, using the same classification system of landscape features.

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>
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LANDSCAPE LINES

4

Historic Plant Material Sources

Introduction

In a cultural landscape, a common landscape characteristic is the vegetation that is either associated with the historical development of the landscape or resulted from cultural activities on the land. Vegetation that can be linked to an established period of significance and that has remained relatively unchanged over time adds to the overall significance of the landscape. The features associated with vegetation include individual plants and aggregations of plants and plant communities. (See Figure 1.)

Identifying, documenting, and analyzing vegetation is a prerequisite to preparing a Cultural Landscape Report (CLR). Knowledge of the vegetation allows a site history to be developed, the existing conditions of a landscape to be understood, and a treatment plan to be developed. Plants are identified through a site survey or plant inventory and historic photographs of plants in the landscape. (See Figure 2.) Archeological techniques, such as pollen, phytolith, and macroflora analyses, may be used to identify nonexistent plants that were integral to cultural activities in the landscape. Plant identification data may already be available as a result of a plant inventory conducted prior to a CLR. Historical research on cultivated plants may be necessary to accurately identify and date a particular plant. For example, a historic nursery catalog may contain a description of a plant variety or cultivar and a date of introduction into cultivation. In other cases it may be necessary to use horticulture or botany experts to identify particular plants.

To determine the significance of vegetation to the history of a landscape, other site investigation techniques can be used. Tree coring is a technique used to identify the age of trees to determine whether they date from a historic period. Historical and contemporary field and aerial photographs may be analyzed to understand how vegetation has

Figure 1. This Ginko tree was planted in the early nineteenth century and is an individual plant feature. Vanderbilt Mansion National Historic Site. (NPS, 1995)

changed. Existing conditions investigation data is integrated with historical research data to thoroughly understand the significance and integrity of the vegetation in a landscape.

Intrinsic to the dynamic quality of cultural landscapes is the concept that plants which once existed have died and those that still remain will eventually die. Therefore, in selecting a landscape treatment or describing treatment guidelines in a CLR, it is important to consider the replacement of significant plant material, including the method of replacement and plant availability. The following section addresses in-kind replacement of historic plant material and highlights sources of both historic plant material and historic plant expertise.

In-Kind Replacements of Historic Plants

Depending on a plant's significance in a cultural landscape, it may be replaced with the following:

- Exact genetic clone of the original. This is appropriate for rare plant varieties having a significant association with an individual or event. (See Figures 3 and 4.)
- Exact taxonomic replacement. This is appropriate for plants with a significant cultural use or function in a landscape.
- Comparable substitute for the plant's form and character. This is appropriate to address known diseases or environmental changes in a landscape. (See Figure 5.)

Figure 2. Plant identification is a prerequisite to an analysis and evaluation of vegetation for a CLR and can be performed during a plant inventory. Longfellow National Historic Site. (NPS, 1993)

In-kind replacements of historic plants vary in availability within the nursery trade, from relatively common to rare. Availability depends in part on the particular species of plant being replaced; that is, whether the desired replacement is a straight species or a lower taxon, such as a cultivar (a cultivated variety or a naturally occurring variety). Straight species are identified only by a generic and specific binomial Latin name, whereas man-made cultivars are typically identified by the genus or species name followed by an English name in single quotation marks. Naturally occurring varieties are identified by the species name followed by a Latin name with no quotation marks.

Figure 3. These historic apple trees are associated with Presidents John Adams and John Quincy Adams. Therefore, in-kind, genetic replacement of these old varieties is an appropriate treatment. Adams National Historic Site. (NPS, 1995)

Figure 4. Apple fruit from old varieties of apple trees. Minuteman National Historic Site. (NPS, 1994)

Cultivars

Many cultivated varieties of plants created historically by plant breeders have been rendered extinct either through hybridization (to create “improved” cultivars), or lack of perpetuation through vegetative propagation. Some cultivated plant varieties are highly ephemeral, existing in the nursery trade for several years or a decade and then being

Figure 5. Due to the devastating effects of Dutch Elm Disease, the American Elm is often not replaced in-kind, but instead with a disease resistant cultivar, such as Princeton, or Liberty Bell. The young tree in the foreground is a Liberty Elm cultivar, which replaces a missing American Elm. A mature straight species American Elm can be seen to the left in the background. Longfellow National Historic Site. (NPS, 1989)

superseded by another cultivar. Cultivars have come and gone like fashionable styles throughout the last several centuries of intensive ornamental plant breeding and nursery production. To some extent, the first plant species to be introduced into the United States or collected for cultivation have had the most cultivars created over time. Particularly popular and common genera or species of garden plants are most likely to have been "improved" horticulturally over time, and many cultivars have been created from them.

Cultivars are typically variants on the species of flower and fruit characteristics, plant size, form, and disease resistance. Many cultivars no longer exist, while others are only found in cultivation in a few historic gardens. Some historic ornamental plant cultivars and species can be found in botanical gardens and cultural landscapes, while others are preserved as germplasm in seed banks. Of great concern to ecologists and plant experts is the reduction in plant genetic diversity that results from the extinction of cultivars, varieties, and species. Genetic diversity is viewed favorably in the health of ecosystems, promoting stability and the ability to resist natural and cultural disturbance. In edible plant breeding, thousands of varieties have been lost during the twentieth century in the standardization of crop plants, particularly for their suitability to mechanized production and for increased crop yield.

Straight Species

Straight species of plants (nonhybridized plants) may be among the more difficult to find commercially. This is due to the emphasis on plant breeding in commercial horticulture to improve the visual characteristics of ornamental plants for sale. A nonhybridized American Ash (Fraxinus americana), for example, may not be available from tree nurseries, though numerous cultivars of the species can be found.

Depending on the relative cultural value or importance of a plant and its significance in a cultural landscape, the in-kind replacement of a particular straight species of plant may or may not be important. For straight species of plants that are native to the United States, native plant nurseries may be the best source. For rare and endangered native species, the Center for Plant Conservation (CPC) is a potential source of plant propagules. The CPC is a consortium of 25 United States botanical gardens and arboreta, which conserve listed rare and endangered native plant species. The CPC at Missouri Botanical Garden can be contacted at the following address:

Center for Plant Conservation
Missouri Botanical Garden
P.O. Box 299
St. Louis, MO 63166
343-577-9450

Plant Sources and Plant Expertise

The following list gives sources of both historic plant material and historic plant expertise. Scott Kunst, a landscape historian, is an expert on historic ornamental plant materials. Kunst has compiled a comprehensive list of commercial sources for historic ornamental plants throughout the United States. To obtain the complete *Source List for Historic Seeds and Plants,* contact Scott Kunst at:

Old House Gardens
536 Third Street
Ann Arbor, MI 48103-4957
313-995-1486

The following is an abbreviated list of commercial sources of historic plant material that Kunst recommends. (The focus of the list is on garden ornamentals and not on plants used in kitchen gardens, orchards, or agriculture.)

Flower and Herb Exchange
3076 North Winn
Decorah, IA 52101
319-382-5990

Old Sturbridge Village
1 Sturbridge Village Road
Sturbridge, MA 01566
508-347-3362

Perennial Pleasures
2 Brickhouse Road
E. Hardwick, VT 05836
802-472-5104

Select Seeds
180 Stickney Road
Union, CT 06076
203-684-9310

Thomas Jefferson Center for
Historic Plants—Monticello
P.O. Box 316
Charlottesville, VA 22902
804-984-9816

If a particularly important or culturally valuable historic plant species or cultivar is difficult to identify, the services of a historic plant expert may be necessary. Historic plant experts exist within horticultural and historical societies, botanical gardens and arboreta, research institutions, herbaria, commercial horticulture, and the cultural landscape preservation field. In the National Park Service (NPS), the Olmsted Center for Landscape Preservation may have the botanical or horticultural expertise to identify historic ornamental plant species and cultivars. For more information, contact:

Olmsted Center for
Landscape Preservation
99 Warren Street
Brookline, MA 02146
617-566-1689

Straight species of historic plants may be the easiest to identify, while the most hybridized plants (in which the species lineage is so complex that the cultivar name is given immediately following the genus name) may be the most difficult. However, in some cases old cultivars can be identified using "origination lists" and "cumulative checklists." These lists describe the names, appearances, and commercial dates of old cultivars, and they typically contain all known cultivars of a plant species along with dates of introduction (or registration) and brief descriptions.

To replace a plant with a particular cultivar, it may be necessary to search specialized nurseries, collectors, botanical gardens, and other cultural landscapes. It is advisable to examine nursery plants to determine whether the historic cultivar is what the label claims it to be. Some cultivars have been inadvertently substituted over time and others are simply misidentified. A bibliography of origination lists and cumulative checklists of ornamental plants is included at the end of the text. The reference section is largely derived from an article by Scott Kunst and Arthur Tucker that appeared in the *APT Bulletin*, vol. xxi, no. 2, in "1989: Where Have All the Flowers Gone?"

The Sourcebook of Cultivar Names, an expanded list of cultivars and pertinent information, has been compiled by Scott Kunst. The Sourcebook can be obtained through Arnoldia of the Arnold Arboretum, at the following address:

Arnoldia
Arnold Arboretum
125 Arborway
Jamaica Plain, MA 02130
617-524-1718

The following is a list of sources of further expertise and information on historical plants:

Alliance for Historic
Landscape Preservation
82 Wall Street, # 1105
New York, NY 10005

American Association of
Botanical Gardens and Arboreta
786 Church Road
Wayne, PA 19087
610-688-1120

American Daffodil Society
Mary Lou Gripshover
1686 Grey Fox
Milford, OH 45150

Garden Conservancy
P.O. Box 219
Cold Spring, NY 10516
914-265-2029

Heritage Rose Group
Miriam Wilkins
925 Galvin Drive
El Cerrito, CA 94530
510-526-6960

Historic Iris Preservation Society
Ada Godfrey
9 Bradford Street
Foxborough, MA 02035
508-543-2711

National Council for the Conservation of Plants and Gardens
The Pines—Wisley Garden
Woking, Surrey, GU23 6QB
United Kingdom
44-0483-211-465

New England Garden Society
300 Massachusetts Avenue
Boston, MA 02155
617-536-9280

Southern Garden History Society
Drawer F, Salem Station
Winston-Salem, NC 27108

Wakefield and North of
England Tulip Society
70 Wrethorpe Lane
Wrethorpe, Wakefield
West Yorkshire, WF2 0PT
United Kingdom

Historic Plant References (Origination Lists and Cumulative Checklists)

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The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

U.S. Department of the Interior
National Park Service
Cultural Resources
Park Historic Structures & Cultural Landscapes

Graphic Documentation

INTRODUCTION

Line drawing, photography, and videography are techniques for graphically documenting cultural landscapes. Line drawings, such as measured plans, sections, and elevations, and black and white photographs are the types of graphics used in a Cultural Landscape Report (CLR) to accurately record the appearance of a landscape at a particular time. Other graphics, such as diagrams, sketches, perspectives, maps and charts—reproduced from contemporary or historic materials—may also be used in a CLR. Additional forms of graphic documentation, such as color slides and video, are also valuable tools for recording the landscape and may be used to supplement other documentation.

Throughout a CLR, different formats and various scales of graphics are used to supplement narrative descriptions and documentation of the landscape. In the site history, period plans are used to illustrate landscape change through every relevant historic period. (See Figure 1.) These graphics are created by analyzing historic materials or reproduced from existing historical documents. In the existing conditions, an existing conditions plan is generated based on site research and investigations. This drawing, in addition to photographs, provides a contemporary record of a landscape's appearance and the condition of landscape characteristics and associated features. In the analysis and evaluation, elevations, plans, and schematic diagrams are used to show the relationship between historical research and the findings of existing conditions investigations. In the treatment section, a diagram, schematic, or detailed treatment plan illustrates a proposed treatment as it relates to a whole site, character areas, or management zones.

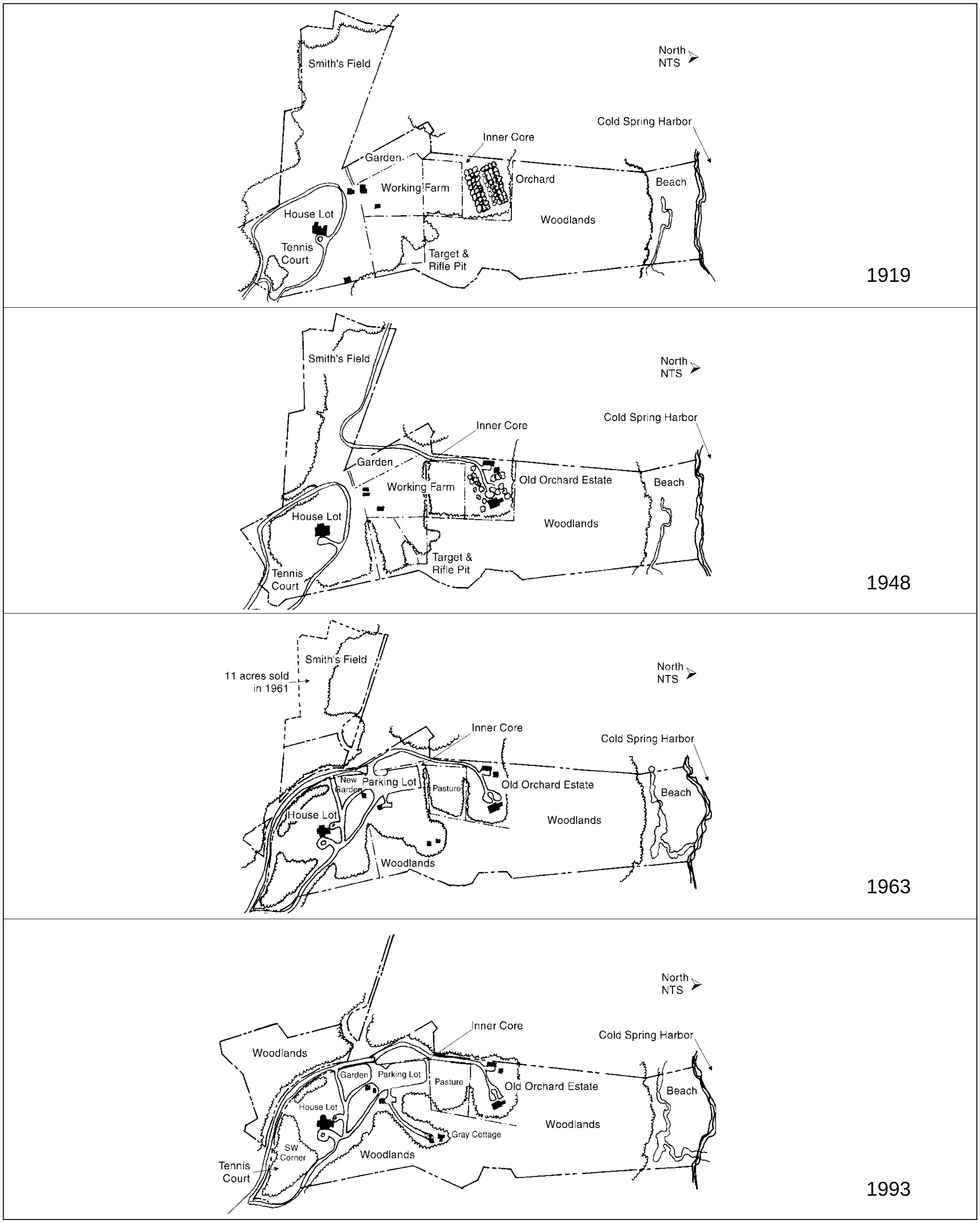

Figure 1. Diagrams are useful for quickly conveying certain types of information. These serial diagrams convey changes in spatial organization from 1919 through 1993. Sagamore Hill National Historic Site. (NPS, 1993)

Line Drawing Documentation

Line drawings, particularly measured plan drawings, are a primary graphic technique used to accurately record the appearance of a landscape at a particular time. Line drawings may be hand-drawn or computer-generated, and in all cases must be accurate, clear, consistent in style, reproducible, and durable.

Accuracy

The purpose of line drawings is to objectively record in a durable medium the appearance of a landscape, and the landscape characteristics and associated features. It is important that line drawings accurately depict cultural landscapes because each graphic will become a historical record and a primary source of information. Accuracy is not, however, absolute; some inaccuracy results from graphically representing three-dimensional spaces. Although line drawings should be as accurate as possible, their accuracy is influenced by the following:

- management objectives for the CLR
- level of investigation required by the project agreement
- proposed treatment of the landscape
- accuracy of available site data, field surveys, and other sources used to prepare the line drawings

Depending on management objectives, park and technical staff should define the acceptable degree of accuracy in line drawings in the project agreement for a CLR.

Clarity

The clarity of a graphic refers to its legibility; that is, how easy it is to see the information presented in the graphic. All plans representing an entire landscape should have the same scale and use the same base map or base plan layer for clarity. (See Figure 2.) For example, a period plan and an existing conditions plan drawing should be generated from the same base plan and at the same scale to allow direct comparison. If a plan represents only an area of a landscape (such as landscape character areas or management zones), it should be clearly referenced to a base map of the entire landscape to indicate its specific location. A diagram key may appear on the drawing to indicate the location of the area represented by the larger plan.

Plans belonging to a series should have the same sheet size, title block, orientation, and scale. To determine the sheet size for a plan, consider the following:

- management objectives for the CLR
- the size and character of the landscape
- the final page size of the plan reproduced in the formatted CLR

For documentation and analysis purposes, a landscape may need to be represented at multiple scales. The following table suggests scales for various uses.

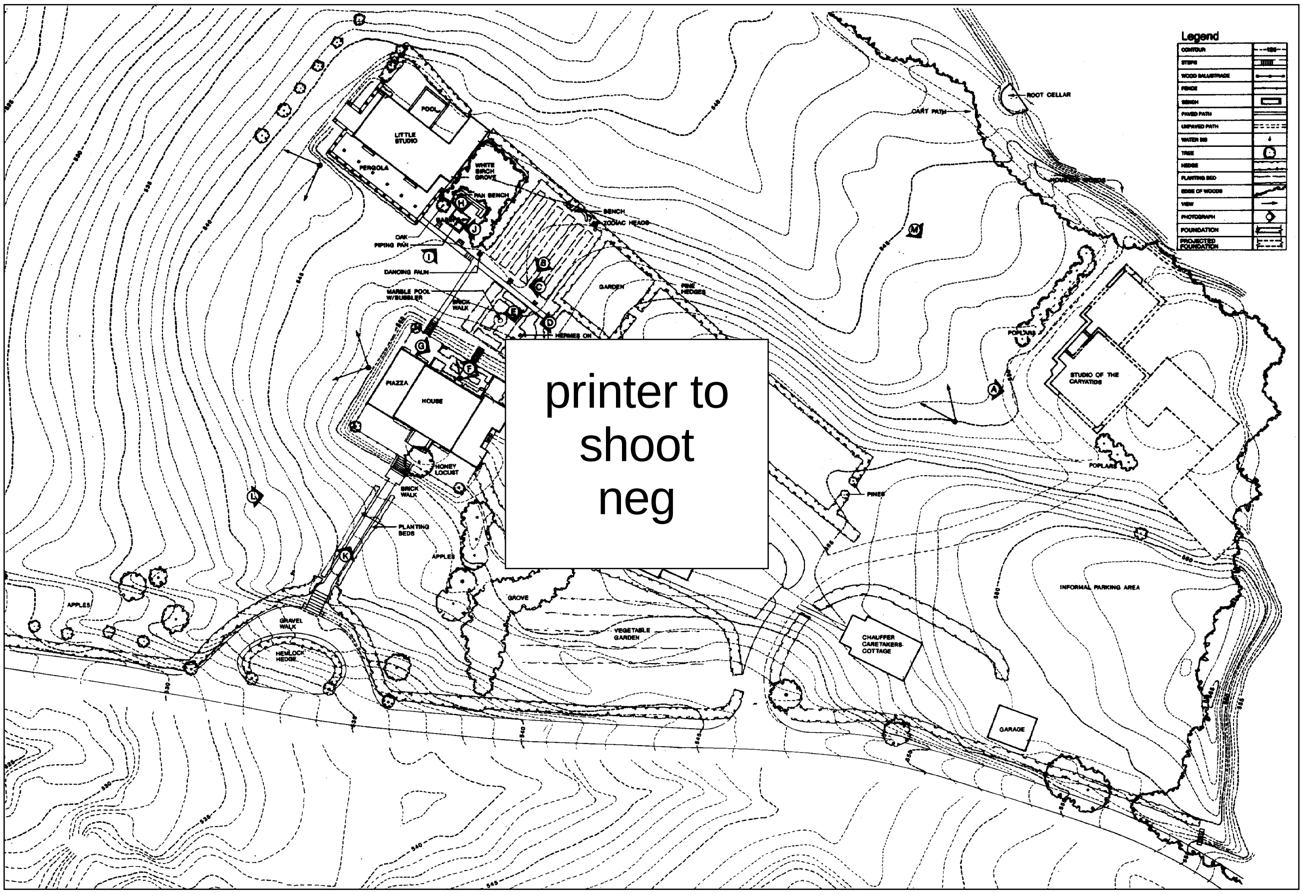

Figure 2. This 1926 period plan is one of a set of five. The plan has clarity and consistency with the other plans so direct comparisons can be made. Saint-Gaudens National Historic Site. (NPS, 1993)

SCALES	USE
1" = 200'	Landscape plans depicting an entire landscape
1" = 400', 1" = 500', or 1" = 1,000'	Large landscapes
A series of 1" = 200' plans with match-lines show connectivity between plans	If a landscape is too large to be represented on one sheet using a 1" = 200' scale
1" = 100' and 1" = 50'	Small landscapes
1" = 20'	Tree and shrub identification and small landscapes (about two acres).
1" = 10' or 1/4" = 1'	Planting plans and construction drawings

Current National Park Service (NPS) policy regarding the use of metric or English scales is given by *Preparation of Design and Construction Drawings, NPS-10*. It requires only that metric and English scale conversions are indicated on a cover sheet to a set of drawings. Either metric or English scales can be used for individual drawings, but only one scale convention should be used throughout a CLR.

Contours should appear on all plans. A contour interval that clearly depicts the landscape topography and serves the CLR's management objectives should be used. The desired contour interval may vary in different areas of the landscape, depending

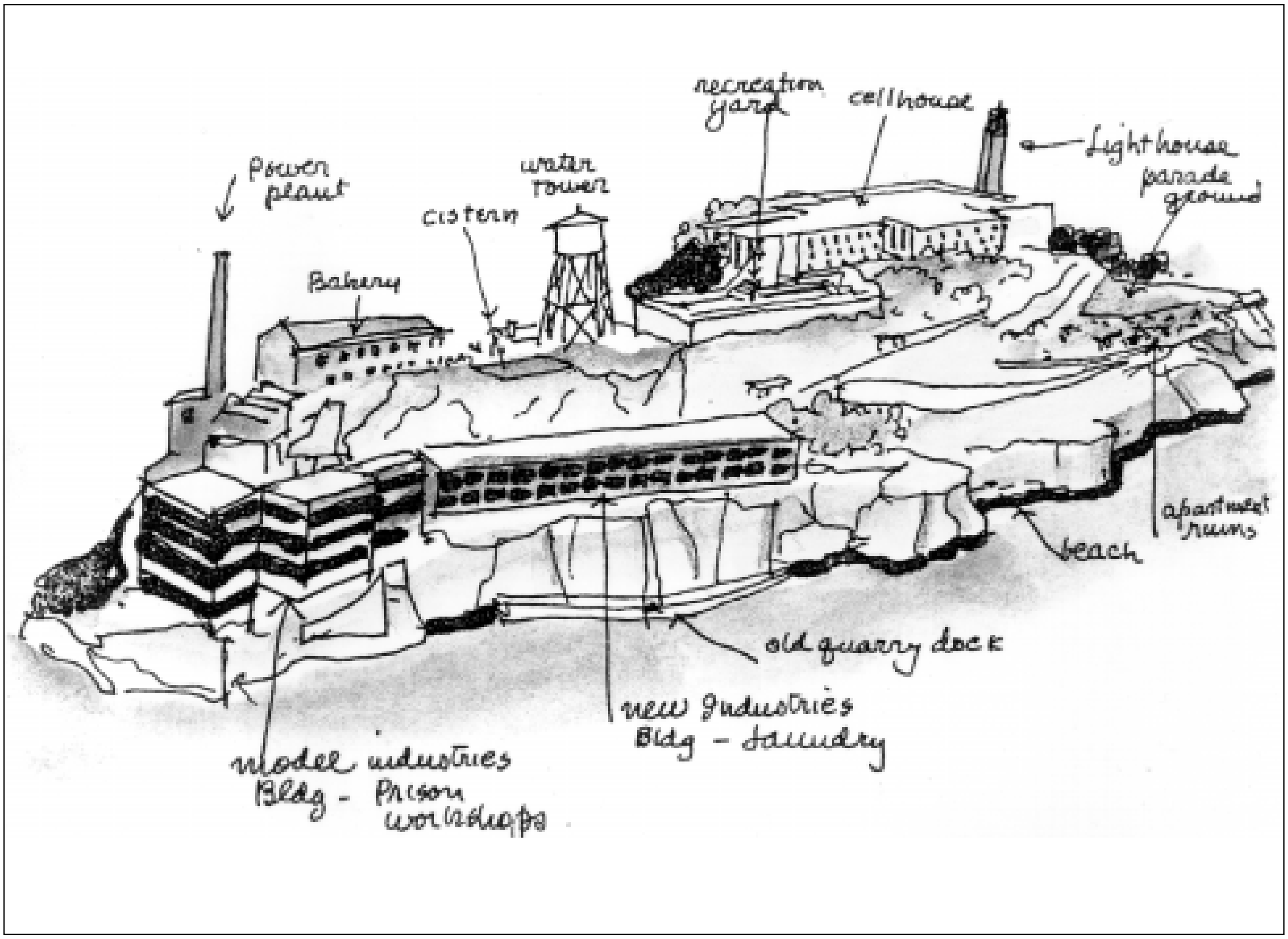

Figure 3. Loose sketches are useful for quickly recording field observations or conceptual ideas. This perspective sketch of Alcatraz Island conveys a concept plan for the future use of this historic site. Golden Gate National Recreation Area. (Sketch by Lawrence Halprin, NPS, 1988)

on the range of topographic relief, the complexity of landscape characteristics and associated features, or specific management objectives in different areas. The contour interval used on line drawings may be increased or decreased in particular areas of the landscape as long as the change makes the plan more readable or enhances the information. (See *Landscape Lines 9: Surveys*.) For information on contracting computer-generated topographic plans from aerial photographs, see the section titled "Photogrammetry," later in this document.

Consistency

Numerous references exist for landscape architectural graphic standards, many of which are identified in the reference section of this text. Preferably, one graphic standard should be used throughout a CLR, but it may be necessary to use more than one standard where omissions exist. For example, *Preparation of Design and Construction Drawings, NPS-10* does not have a symbol for a property line. For consistency and clarity, all symbols should be identified in a legend on each drawing. The legend should show the symbol and define its meaning.

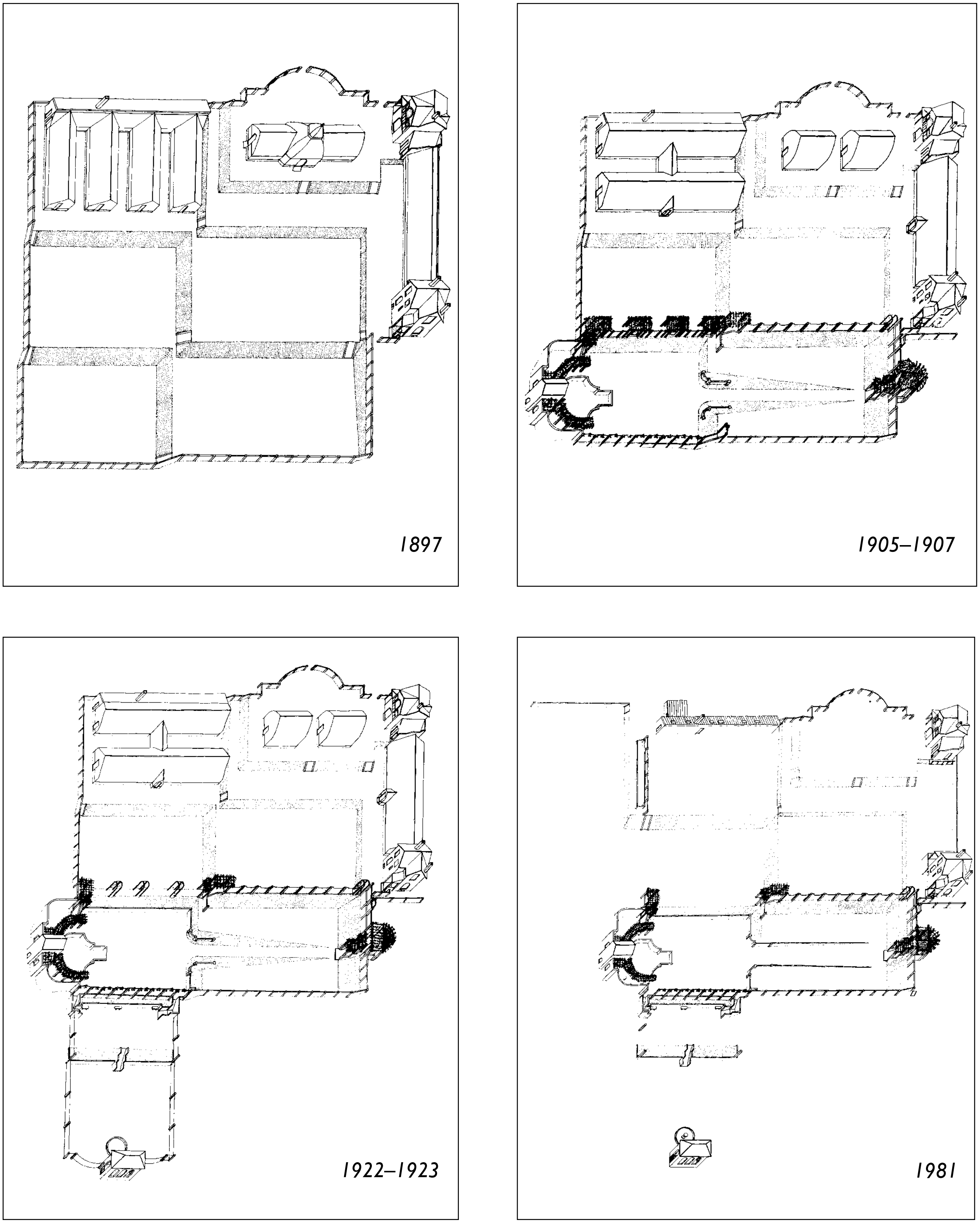

Figure 4. These serial axonometric perspective drawings were useful in documenting the evolution of the formal gardens from 1897 through 1981. Vanderbilt Mansion National Historic Site. (NPS, 1981)

The following list of standards and guidelines is arranged in descending order of comprehension and refinement:

- The American Institute of Architects' Architectural Graphic Standards and Guidelines
- Historic American Building Survey and Historic American Engineering Record Standards and Guidelines
- NPS Design and Construction Documents Guideline
- National Register Documentation Guidelines
- United States Geological Survey, Topographic Map Symbols

For computer aided design (CAD) drawings it may be necessary to use graphic standards established by an NPS Region or Support office. Regardless of the level of refinement, acceptable degree of accuracy, or graphic conventions used for line drawings, the style of each CLR drawing should be consistent. The following list gives the information required to appear on each plan. Examples are given in parenthesis.

- project title ("Cultural Landscape Report: Lower Town, Harper's Ferry National Historic Park")
- project location ("Harper's Ferry National Historical Park, West Virginia")
- drawing title ("Period Plan: 1815-1865")
- NPS drawing number: numbers are used and controlled by designated offices, and consist of the park code plus a number assigned by a NPS Region or Support office (see *Drawing and Map Numbers Guideline, NPS 29*, revised edition)
- graphic bar scale and statement of scale
- north arrow oriented towards the top of the sheet
- date of drawing
- illustrator's name and title
- legend of symbols
- sources of information (metadata) used to prepare drawing ("Based on CLI field survey, 3/4/96, not a measured drawing")

Computer-generated drawings should include all the above information. If multiple layers are used (such as topography, boundaries, and structures), they should be individually classified within the drawings. Standards for graphic file formats may exist within an NPS Region or Support office, and these should be used when naming and saving computer-generated graphics files.

Geographic Information Systems (GIS) may be an alternative computer technology to computer graphic programs (such as CAD). For many years the quality of cartographic output available through GIS software could not equal that achieved with manual methods or computer graphic programs. But this is no longer the case. Numerous mapping tools are now available in most GIS packages, including desktop systems, which offer the added benefit of being easy enough to learn and use for novice GIS users. (See *Landscape Lines 10: Geographic Information Systems*.)

Reproducibility

The preferred media for hand-generated drawings is waterproof black ink on 3mm or 4mm polyester film, such as mylar. Double-sided, rather than single-sided film, with texture on both sides of the sheet, may be useful for particular visual effects, such as shading on the back side. Pin-bar registered multiple sheets of film may be used to separate layers of information. Film sheets can be obtained in the following precut sizes: 18" x 24", 24" x 36", and 34" x 44".

When deciding what film sheet size to use, consider both the final image size of the reduced original in the CLR and the preferred scale of the plan. An early decision (preferably during the project agreement phase) should be made about whether 8½" x 11," or 11" x 17" pages of reduced drawings will be placed within the body of the CLR or whether full-sized drawings will be folded into a pocket at the back. The page size of graphic images depends on the scale or complexity of site information to be conveyed. Greater landscape scale and greater complexity of information (such as close contour intervals and dense or diverse plantings) limits the extent to which an image can be reduced and still be legible. Full-size, folded drawings have the disadvantage of being bulky at the back of the document and the possibility of being lost, but have the advantage of being useful for easy access and reference alongside the CLR text.

The printing cost of a CLR with a back pocket for folded plans tends to be more expensive than a CLR with reduced plans integrated within the body of the document. Pages that are 11" x 17" can be folded to create a pull-out page with a larger image size than the 8½" x 11" page.

A graphic bar scale is required on any plan or section drawing so that the scale of the plan can be understood regardless of the percent reduction. The following guidelines apply to legibility of text for reduced plans.

- For a 34" x 44" original plan to be reduced to an 8½" x 11" page, the minimum font size on the original plan should be no less than 18 point (3/16" high).
- For an 18" x 24" or 24" x 36" original plan to be reduced to a 8½" x 11" page, the minimum font size on the original plan should be no less than 14 point (1/8" high).
- The minimum font size on any reduced plan (8½" x 11" or 11" x 17") should be no less than 9 point.

Computer drawing programs allow for excellent line quality at almost any scale on many types of paper (limited by the capability of the printer). The preferred paper for computer-generated, line drawing originals is acid-free bond paper. The legibility of the text needs to be considered when reducing computer-generated drawings. Consideration should be given to preparing two sets of computer-generated drawings: one for full-scale and one for reduced-scale production.

Durability

Waterproof, black ink on polyester film is the most durable media for hand-generated drawings. Other media, such as graphite pencil or ink pen on vellum, reproduce well, but are less durable. All graphic images used in a CLR—whether line drawings, diagrams, or charts—should be equally durable. The use of sticky-back or adhesive lettering is not recommended on hand-generated drawings; these media tend to bubble up or flake off over time. (Where sticky-backs are used, photomylars of the originals should be created to insure durability of text in archival conditions.) Drawing text is most durable as ink on film, hand lettered, or traced with a Leroy template.

In processing a camera-ready copy of a CLR, the United States Government Printing Office (GPO) or printer may photograph each page of the document to create proofs from which the document will be printed. Ideally, all line drawings that are part of a CLR should be supplied to the printer as photometallic transfers or PMTs (a photographic reduction process). PMTs are highly durable and are produced on 8½" x 11" or 11" x 17" size paper. Copies of full-size line drawings can be supplied to the printer as original artwork with special instructions, such as location, position, and percent reduction.

Full-size drawings larger than 11" x 17", which are to be folded into a pocket at the back of the document, are directly photocopied onto acid-free bond paper by the printer. Blueprints, which are created through the diazo process, are not recommended for full-size drawings because they become unstable with prolonged light exposure.

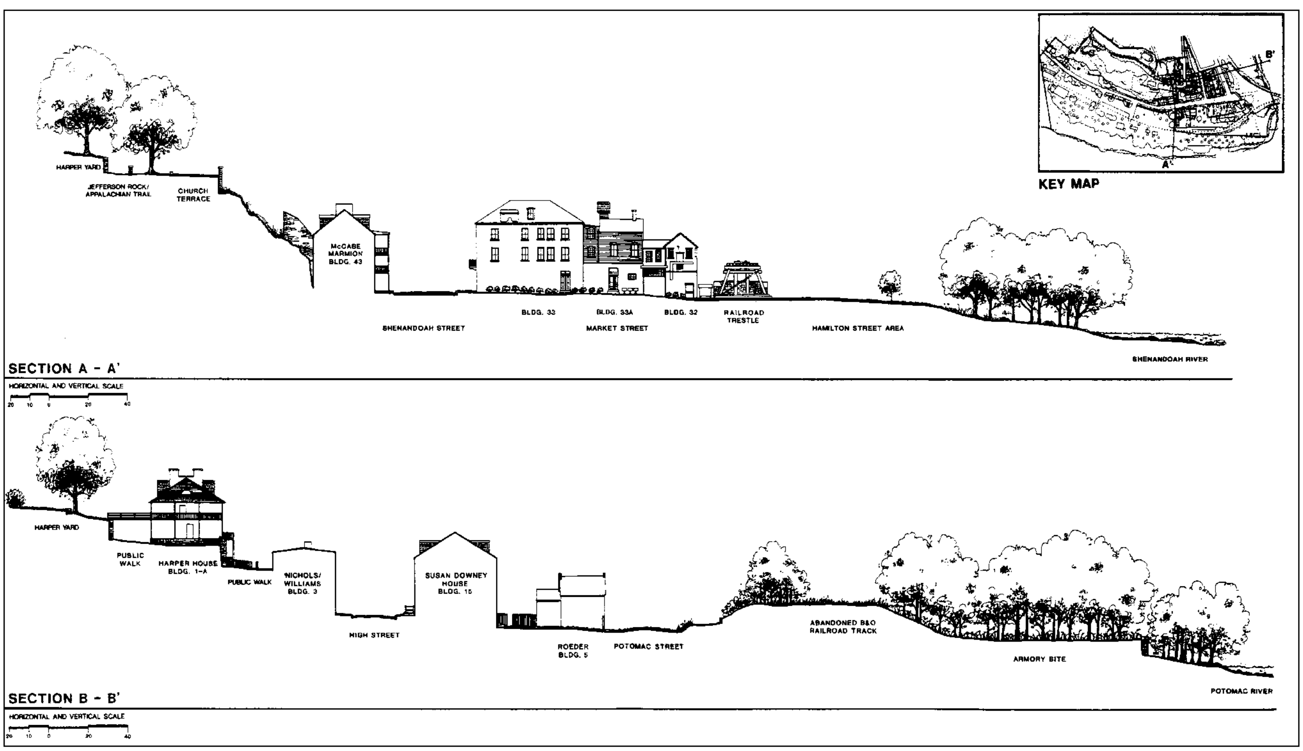

Figure 5. These section drawings show the existing topography, vegetation, circulation, and character of buildings and structures in Lower Town. Harpers Ferry National Historical Park. (NPS, 1991)

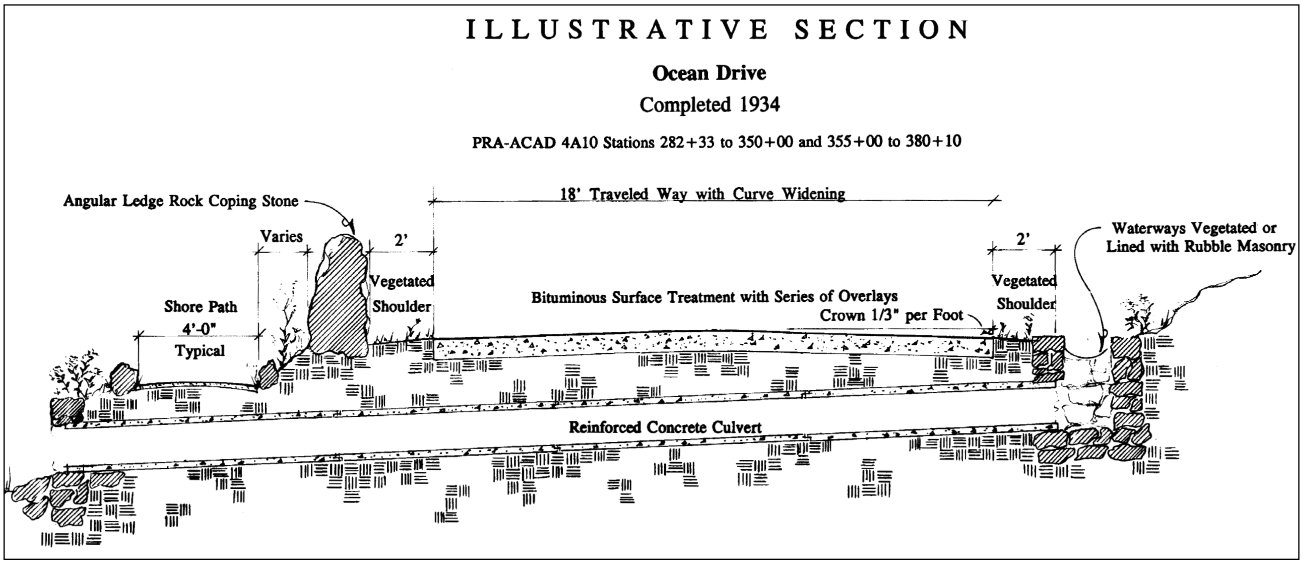

Figure 6. This illustrative section drawing of the historic roadbed at Ocean Drive illustrates a typical construction detail of the road in 1934. Arcadia National Park. (NPS, 1993)

Computer-generated drawings can be archived as electronic files on disks, compact disks (CDs) and tapes. Since the durability of these storage media has yet to be established, some archivists believe acid-free paper is still the most durable medium for storing information. Other archivists believe electronic files on disks, CDs, and tapes are durable for 100 years, under climate-controlled conditions.

Upon completing a CLR project, original line drawings, other graphic materials, including electronic files, and film negatives and positives, should be submitted to the park for inclusion in park archives. (See *Landscape Lines 14: Preparing, Cataloging, Printing, and Distribution.)*

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Photographic Documentation and Analysis

Contemporary and historical photographs and slides are used in preparing a CLR. Photographs are graphic documents used to:

- document a landscape at a particular time
- analyze and evaluate the chronological development of a landscape

The technical considerations for using photography for the above purposes are described in the following text.

Photographic Documentation

Photography is a rapid technique for graphically documenting a cultural landscape. Black and white photographs are used to illustrate the appearance of a cultural landscape over time, to update the graphic documentation of a landscape, and to record treatment activities in the landscape.

Because photographs can capture fine textures and realistic contexts, photographs have an advantage over line drawings of conveying an experiential understanding of a landscape. However, photographs also have the potential to portray a landscape with greater subjectivity than line drawings. This subjectivity may be exploited to convey experiential qualities (such as those conferred by diurnal, seasonal, or climatic changes), to describe the articulation and quality of space (such as complexity, density, or vacancy) and to emphasize the current state of condition (from well maintained to derelict). Without a clear understanding of the primary intent of a photograph, the subjectivity inherent in the process of making the photograph may lead to inaccurate, misleading, or unrepresentational photographs.

The Purpose

The art and science of photography involves many variables, including cameras, lenses, filters, lighting, film, camera position, and the creativity of the photographer. For cultural landscape research, the purpose of photography is to objectively record, in a durable medium, the physical and visual qualities of a landscape. Photography should not try to evoke emotional reaction through special effects; this may lead to misinterpretation.

The value of photographic documentation depends largely on how well informed the photographer is about the subject and purpose of the project. Additionally, photographic documentation is made more meaningful if the photographer keeps an accurate record of subject, location, and vantage points. Photographs used in a CLR should have captions and both should be included in the park archives.

Durability

Black and white photography (small, medium, or large format) is the most durable medium for photographic documentation in a CLR. Color film is less stable photochemically over time. Due to the visual limitation of black and white images, color slides are often taken to supplement the data provided by black and white photographs (Kodachrome is the most stable color film). Black and white infrared, and color infrared films are very useful for analysis and evaluation because these films reveal information beyond the surficial appearance of landscape characteristics.

Color image processing has been advanced through photo-CD technology to allow color slides to be digitally incorporated into desktop publishing. Although not definite, color photographic images may be more durable as digital files on photo-CDs or disks than as color film negatives or positives. The color hard copy (paper printout) produced by color printers is currently not as durable as archival quality black and white photographs.

Archival quality photographic negatives are those that have undergone an extended washing process to completely remove processing chemicals. The addition of Selenium toner to the rinse solution allows complete removal of processing chemicals. Archival quality prints are also printed on fibrous contact paper rather than resin-coated paper. Giving negatives and prints archival quality increases developing and printing costs by about 25 percent. (See "Archiving Photographs" later in this section for more information on storage.)

Forms of Photography

Landscape photography may be broadly divided into two categories: aerial and field (terrestrial). For both aerial and field photography, the orientation of the camera can be perpendicular or oblique.

Perpendicular orientation achieves orthographic elevation in field photography and plan shots in aerial photography. Perpendicular field photography is used to record structures, objects, and landscapes with axial arrangements of spaces or formal geometry (for example, bilateral or radial symmetry). (See Figure 7.)

Oblique orientation achieves perspective shots in both aerial and field photography. Oblique field photography and perpendicular aerial photography are most commonly used in the graphic documentation of cultural landscapes. (See Figures 8, 9, and 10.)

Small, Medium and Large Format Cameras

Oblique and perpendicular field photography can be performed using small, medium, or large format cameras. Generally speaking, small format cameras use 35mm wide film, medium format cameras use 220-size (6cm x 7cm) or 120-size (6cm x 6cm, or 2¼" x 2¼") film, and large format cameras use 4" x 5," 5" x 7," and 8" x 10" size negatives. The cost of these various sizes of film is directly proportional to a unit price of film. A single 5" x 7" exposure of film within a large format camera is approximately equivalent in price to a 36 exposure roll of 35mm film.

Small format, 35mm cameras are the least expensive and most portable cameras to operate. They are particularly useful in capturing multiple black and white photographs and color slides of cultural landscapes for reference material. Once enlarged, 35mm negatives can become grainy, and as a consequence may have inadequate clarity for use in a publication.

Figure 7. A perpendicular field photograph of a curb and retaining wall. Blue Ridge Parkway. (NPS, n.d.)

Figure 8. An oblique field photograph. Frederick Law Olmsted National Historic Site. (NPS, 1995)

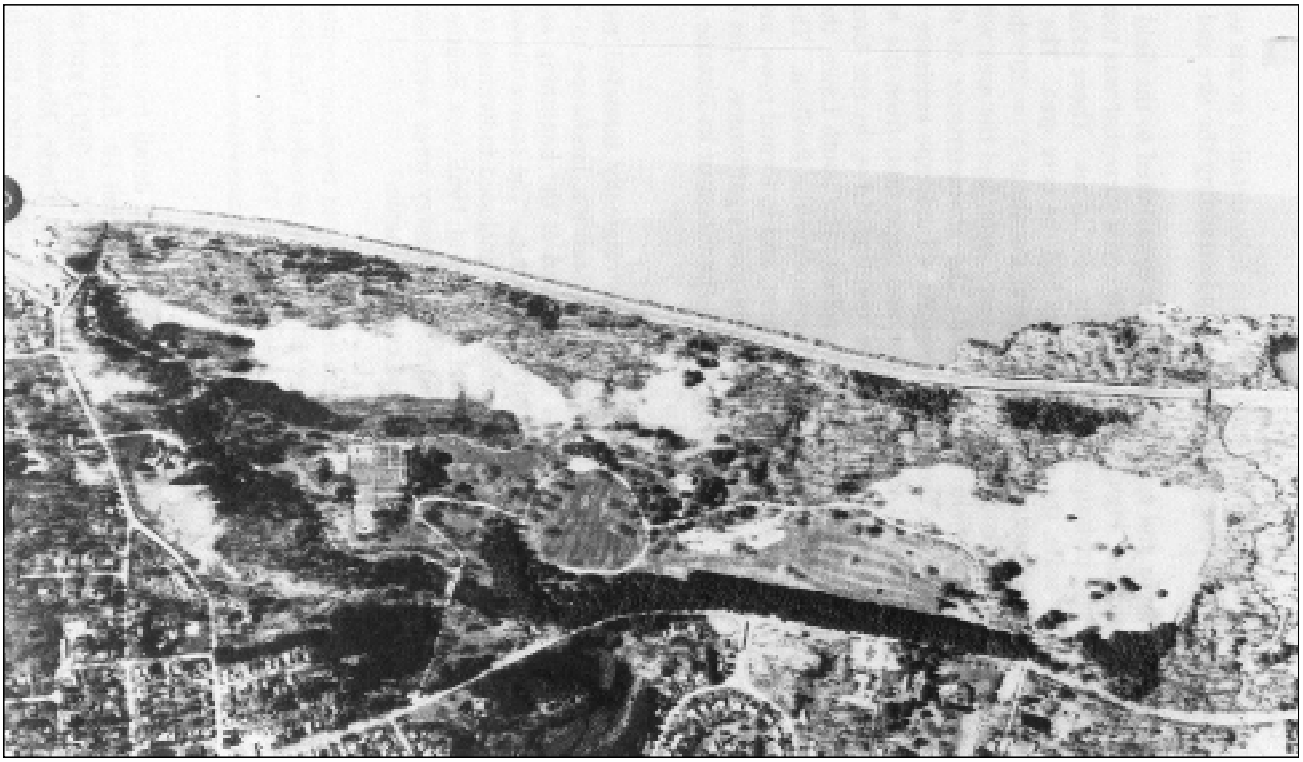

Figure 9. A perpendicular aerial photograph. Vanderbilt Mansion National Historic Site. (Photograph courtesy of Dutchess County Offices, 1990)

Figure 10. An oblique aerial photograph. Perry's Victory and International Peace Memorial. (NPS, c. 1925)

Figure 11. Large format photograph showing Sherrick Farm. Note the high resolution of detail in the photograph. Antietam National Battlefield. (Jack Boucher, HABS, NPS, 1992)

Medium format cameras have greater portability and are less expensive to use than large format cameras. They also provide a large negative (6cm x 7cm) that can be proportionately enlarged from a contact print directly to a 8" x 10" image without cropping.

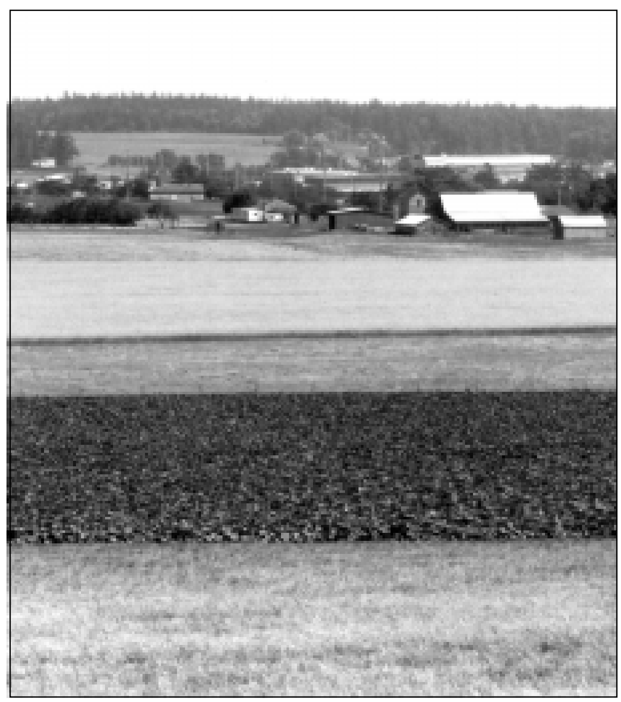

Figure 12. Small format photograph of Ebey's Landing National Historical Reserve. Note the lower resolution of detail in the photograph. (NPS, 1983)

Large format cameras record images in much greater detail and their photographs are well suited for publication because they can be enlarged without clarity degradation. (See Figures 11 and 12.) Large format cameras also allow for parallax adjustment because the lens can be tilted to correct for perspective. On the down side, large format cameras are bulky and heavy to transport and require considerable expertise to operate. In most cases, contracting the services of a professional photographer is recommended for large format photographic documentation.

Digital Cameras

Digital cameras are a recent photographic technology. A digital camera can produce color and black and white digital images. One advantage to using a digital camera is that the photographs can be more easily integrated into desktop publishing. The images are screened (composed of dots, like a newsprint photograph) and can be transferred via cable from the camera to a computer. There is no need to scan the photographic image before moving it to the computer. Using image processing software, the photographic images can be manipulated and inserted into a document.

Digital cameras are compact and convenient to use, but they have the following disadvantages, which should be considered when preparing to use a digital camera for field survey:

- The photographic quality produced by a digital camera may be lower than a 35mm camera and the images may not be clear enough to convey details well.
- Some digital cameras may not accept as many lenses or filters as a 35mm camera.
- There is a limit to the number of photographs that can be stored in a digital camera before they must be downloaded to a computer. Typically, digital cameras can store 36 photographs at a lower level of resolution (that is, fewer dots per inch) or 18 photographs at a higher level of resolution (more dots per inch).

Digital images must be archived as electronic files on computer disks, photo-CDs, or tapes. The durability of these media is undetermined.

Lenses, Filters, and Tripods

The standard lens on a 35mm camera is 50mm. The focal length (the magnification) of a 50mm lens is approximately the same as the human eye and is suitable for graphic documentation of cultural landscapes. In addition to the standard 50mm lens, wide-angle lenses, telephoto and zoom lenses, and filters can be used for specific purposes.

Wide-angle Lenses

A wide-angle lens with a 24mm-35mm focal length is less magnifying than a 50mm lens and provides the photographer a broader view of the landscape from a given vantage point. Wide-angle lenses are particularly useful when space is limited and the photographer must position the camera close to the subject of the photograph. However, wide-angle lenses cause distortion, and the wider the angle the greater the distortion (straight lines tend to curve, and parallel lines converge). Perspective-correcting lenses (PC lenses), also called architectural lenses, can be used to remedy the parallax distortion of wide-angle lenses. PC lenses are moderate wide-angle lenses (28mm or 35mm) that shift side to side or up and down. Some perspective correcting lenses also tilt, like a large format camera. PC lenses are available for small and medium format cameras and should be used with a tripod for best results.

Telephoto and Zoom Lenses

A moderate to long telephoto or zoom lens is useful for photographic documentation of landscapes when access near the subject is restricted or limited by physical obstacles. Telephoto lenses with a focal length between 100mm-400mm are more magnifying than a 50mm lens. Telephoto lenses have minimal distortion, yet their depth of field is small (that is, telephoto lenses tend to flatten the resultant image). Telephoto lenses also reduce light interception through the lens. To compensate for the lower light level, the f/stop may need to be manually adjusted (some cameras automatically make this adjustment). Zoom lenses are a common feature on 35mm cameras, and have focal length that can be adjusted from 20-60mm through 200-500mm. (The most common are 35-70mm and 70-200mm.) The versatility of zoom lenses makes them convenient for field photography.

Filters

High quality filters improve black and white photographic documentation by enhancing details that may otherwise be undiscernible. One of the most useful filters for black and white photography is a medium yellow. This filter eliminates the presence of blue in natural light and enhances contrasting values of grey tones, black and white. Orange and deep yellow filters enhance contrast and differentiate textures even more. Green filters emphasize foliage, while a red filter dramatically enhances the contrast between dark and light areas. A polarizing filter reduces or eliminates refraction of light in situations of considerable glare, which may be encountered in photographing water features on a sunny day, or shooting through the windows of a car or light aircraft. A polarizing filter increases contrast and can darken blue skies in black and white photography.

Filters are mounted over the camera lens, reducing light interception through the lens. Better quality filters cause less light reduction, but all filters require exposure compensation. Cameras with built-in light meters automatically make aperture adjustments for a filter. Cameras with hand-held light meters must be manually adjusted to compensate for light reduction. The "filter factor" (light reduction factor of a filter) is usually engraved on the metal filter ring. A filter factor of 2X (such as that of a medium yellow filter) means the f/stop must be increased by two stops, from f/8 to f/4 (that is, the aperture size and shutter speed are increased).

Tripods

A tripod stabilizes the camera, allowing a sharper image to be captured. It also enables the photographer to create a variety of stable camera orientations and carefully plan the composition before taking the shot. Tripods are useful in the following situations:

- When photographing with a telephoto lens of focal length greater than 135mm. The tripod will reduce camera shake and produce a clearer photograph.
- To correct for image distortion from a tilting camera plane taking a perpendicular shot. A trapezoid is one result of a perpendicular shot of a structure taken with an upwardly tilting

camera (perspective correcting lenses, as formerly mentioned, make a similar adjustment).

- When photographing historic maps, photos, and other historic documents. The camera lens needs to be positioned parallel to the plane of the document to avoid image distortion. A light standard can also be used to position a camera lens in parallel alignment to a historic document (a magnifying lens should be used when photographing historic documents).

A tripod is essential to the technique of repeat field photography, where an earlier or historic photograph is re-shot from the same vantage point. (See "Repeat Photography" later in this section for further information on this analytical technique.)

Further Considerations

Field photography should be timed with respect to the altitude (elevation above the horizon) and azimuth (cardinal position) of the sun to avoid deep, obscuring shadows. A light meter is essential for accurate exposures. Large format cameras require the use of a hand-held light meter. If the scale of the subject in the photograph is important, a scale-stick painted with alternating black and white foot increments may be positioned within the frame. A more refined method for scaling the subject of a photograph is to use a scaled grid situated in front of the camera lens. This is particularly useful for planar features (without using photogrammetry). Regardless of how much the image size of the photograph is subsequently enlarged or reduced, the scale of the subject can be calculated from the imposed grid. (See *A Guide to Cultural Landscape Reports: Appendices,* "Appendix C: National Register Bulletins.")

Archiving Photographs

Photographs provide a record of a cultural landscape's appearance at a particular moment in time and they become primary sources for future reference and historical research. It is important, therefore, to ensure the longevity of photographs by archiving them properly.

All photographs printed in a CLR should be archived, but not all photographs taken during CLR preparation need to be archived. The expense of archival materials and equipment may preclude all photographs being archived, and it may not be necessary to archive the photographs taken as supplemental records. The decision to render certain film and prints archival quality can be made at the time of film processing. Contact sheets are a useful tool for reviewing all the photographs and selecting which ones to be developed as archival quality.

Special processing techniques are applied to photographs selected for archiving. The negatives and prints are washed for a longer period of time to ensure that the chemicals that develop and fix the image are completely removed so that the image does not continue to develop. Negatives and fiber-based contact prints (as opposed to resin-coated prints) are washed with hyporemover as one of the last steps in darkroom processing. Selenium toner is added to the hyporemover to increase archival stability.

Archival quality negatives and prints should be deposited with the park upon completion of a CLR. Negatives should be stored in archival plastic sleeves and clearly labeled with location name and the date shot. Field records are used to create a descriptive caption list, classified according to the numbers on the negatives. The caption list should be printed on acid-free bond paper and attached to the negative sleeve for storage. Large and medium format negative sleeves are large enough to be captioned directly on the sleeve. The Library of Congress' standards for archiving contact prints require prints to be inserted into photo mount cards, which are labeled and captioned. Each photo mount card is separated from its neighbor by a sheet of acid-free (neutral pH) bond paper. They are then housed in acid-free, lignin-free, high alpha cellulose folders stored horizontally inside map cases or flat file boxes. Vertical storage is not recommended, as this may lead to curling. The archival storage containers are then kept in a climate-controlled environment.

Aerial Photographs

Aerial photographs are used for graphic documentation and analysis and evaluation of cultural landscapes. (See Figure 13.) Aerial photography makes use of large lens cameras mounted on aircraft or orbiting satellites to shoot images of the earth surface. If aerial photography is used in the analysis and evaluation of a landscape, black and white and color infrared films may be used to elicit more information from the photograph. As a graphic documentation tool, aerial photographs provide objective records of the appearance of a landscape at a specific moment. Aerial photographs are particularly effective in documenting broad landscape patterns, such as land use, spacial organization, settlement, vegetation, and circulation networks.

Figure 13. High-altitude, oblique aerial photograph of Fort Scott in the Presidio, indicating broad patterns of spatial organization, topography, land use, and vegetation. Golden Gate National Recreation Area. (NPS, 1993)

The graphic record of aerial photographs may be important in the documentation of landscapes for which a topographic survey is not available. Graphic information from an aerial photograph may be transferred by hand to a plan drawing of the landscape or captured digitally by using computer aerial photogrammetry to produce a computer-generated plan. Relatively low altitude, aerial photographs can be flown and shot at a scale as detailed as 1 inch = 200 feet, depending upon the scale of the landscape and the type of information to be recorded. Clear skies are essential for shooting effective aerial photographs. Depending on documentation objectives, other factors may be important in scheduling aerial photography services, such as the amount of leaf coverage on vegetation and minimal shadow length. Exact location and timing may be important where an aerial photograph is taken as a repeat photograph; that is, to serve as a matched pair with a historic photograph for direct comparison of landscape characteristics and associated features.

See "Aerial Photography Analysis" later in this text for more information on aerial photography. For more information on computer-generated plans from aerial photographs, see "Computer Aerial Photogrammetry." For more information on taking a contemporary photograph to match a historic photograph for analysis and evaluation of landscape change, see "Repeat Photography."

Photogrammetry

Photogrammetry combines perpendicular photography, either field or aerial, with geometry. Photogrammetry makes use of stereophotograph pairs to create orthographically rectified, measured drawings (perpendicular to the plane of the subject). These drawings may be in the form of elevations (terrestrial) or plans (aerial).

Traditional drawings are created by hand-tracing the "optical model" produced by overlapping paired stereophotographs within a plotting instrument. These stereophotographs are developed from plate glass negatives and printed on resin-coated contact paper. The durability of fibrous contact paper is substituted for measurable accuracy (resin-coated contact paper is not subject to the stretching or distortion possible with fibrous paper). However, plate glass negatives, especially when prepared with extra washing, are the most durable photographic media. Photogrammetry can now be performed by computer technology using digitizing equipment and CAD. Photogrammetric stereophotographs can be archived as digital files on disks, photo-CDs, or tapes. The durability of these storage media is yet to be established.

Computer Aerial Photogrammetry

Perpendicular aerial photographs can be transformed into accurately georeferenced base maps using photogrammetry. A photogrammetric camera lens corrects radial distortion to produce an orthographically rectified photograph. Traditionally, photogrammetry involved tracing an ortho-rectified photograph to obtain a scaled drawing. Current photogrammetric technology consists of digitizing equipment and CAD software that turns photographic images into CAD drawings. (See Figure 14.)

In geographic regions with predominantly deciduous vegetation, the most revealing time of the year to perform aerial photogrammetry is during the dormant season. At this time more of the earth's surface is exposed due to the absence of vegetation canopies and a higher resolution is possible. Generally, the window of opportunity is from early December to early April, with mid-March often being the optimal time for clarity. In March, shadows are smaller and dead leaves are no longer clinging to trees. A quality photogrammetry product is also dependent on clear, sunny weather conditions.

Contracting Computer Aerial Photogrammetry Services

Commercial photogrammetry services can be contracted. The end product is delivered in the form of a digital file on disk or as a hard copy on paper or other media. Preparing a project agreement (scope of work) for contracting aerial photogrammetry services to create a base map may require knowledge of the following:

- Location of base map. The location is preferably given by Universal Transerve Mercator (UTM) coordinates or latitude and longitude

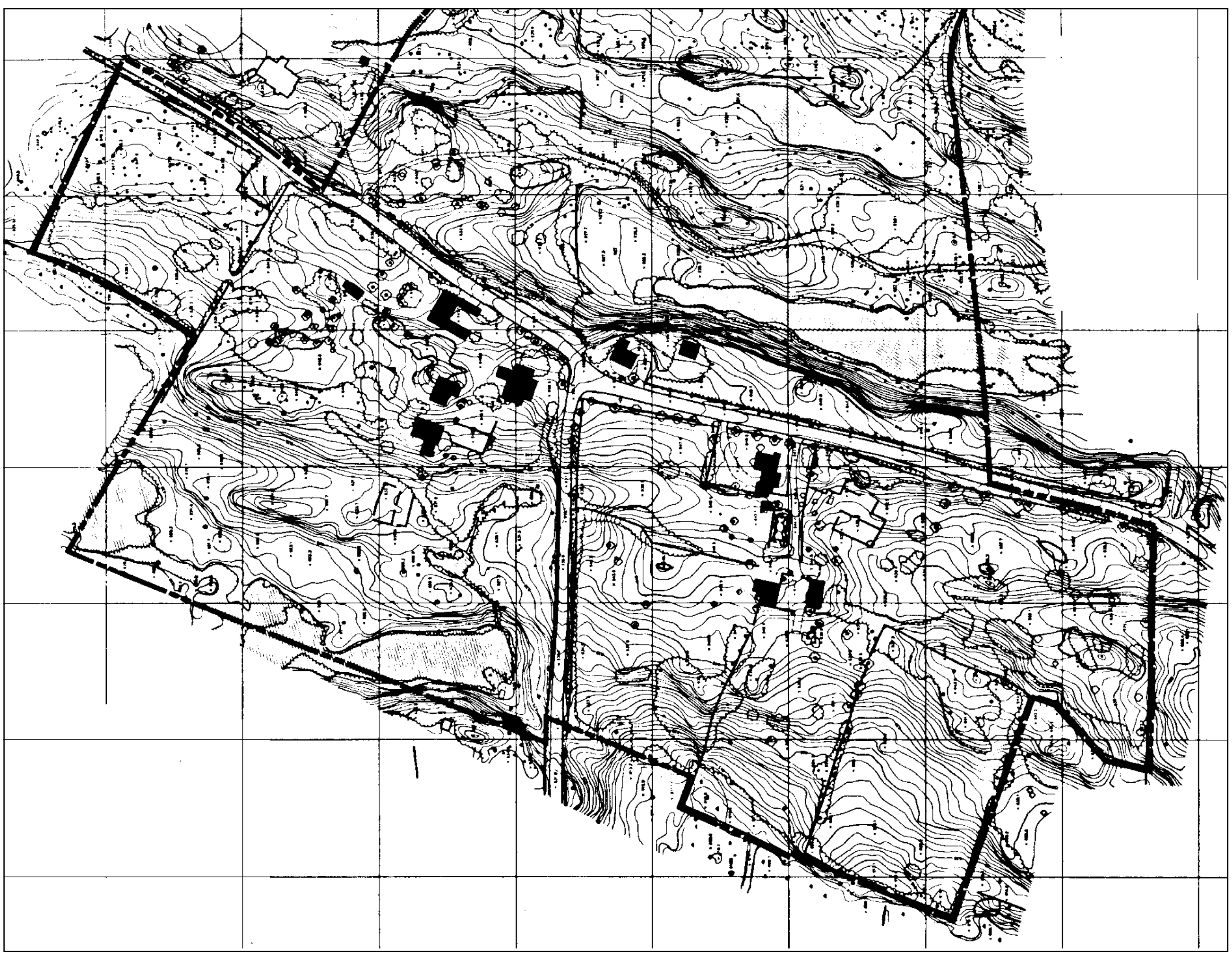

Figure 14. Topographic survey map generated by computer aerial photogrammetry. Weir Farm National Historic Site. (NPS, 1992)

coordinates with a vertical reference point (that is, a control point of known elevation). The requirement for a vertical reference point may not be necessary for aerial photography, but is essential to photogrammetry. Vertical reference points can be white crosses painted on the ground, utility poles, or even traffic arrows on roads of known elevation.

- Scale of base map. It may not be necessary to specify the scale of the aerial photograph for the base map, or the flight altitude to the contractor. The contractor should have the expertise to determine the most efficient method to produce a base map of the desired scale.
- Contour interval. This is determined according to the scale and extent of topographic relief of a landscape and the potential use of the information (for example, the management objectives of a CLR).
- Additional information to be mapped. Additional information required, such as property boundaries, structure footprints, roads, drives and footpaths, hydrologic features, vegetation types, trees over 6-inch caliper, and major shrubs may be indicated.
- Product format. The base map-product should be in hard copy form or as a digital file on CAD. If CAD is used, the contractor will need further information about the configuration of layers and layer classification (for example, vegetation, topography, hydrology, boundaries, and structures may be organized as different CAD layers). In either case, the degree of vertical and horizontal accuracy should be specified.

Photographic Analysis and Evaluation

Photographs are used in cultural landscape research to analyze and evaluate a cultural landscape's chronological development and to graphically document its appearance. (See Figure 15.) In analysis and evaluation, photographs are used for comparison, to verify other data, to understand the influences that have shaped a landscape, and to measure the extent to which change has taken place. Other sources of data, such as historic records, maps, and other photographs, are used with contemporary or historic photographs to interpret the history of a landscape.

Both field and aerial photographs are useful in photographic analysis and evaluation. Contemporary aerial and field photographs can be shot from the same vantage point as a dated historic photograph, thereby serving as a matched pair of repeat photographs for direct comparison of changes since a known period.

Figure 15. National Park Service staff person, Troy Siefert, examining an aerial photograph. (NPS, 1993)

Repeat Photography

Repeat photography is the technique of locating the site of a dated, historic photograph, reoccupying the original camera position, and shooting a contemporary photograph of the landscape, landscape characteristics and associated features from the same vantage point. Preferably, the photographer uses the same focal length camera lens and shoots the photo at the same time of day as the original photograph. This provides the best conditions for comparing the contemporary and historic photographs.

The pair of photographs is referred to as a matched pair of repeat photographs. Depending on the objectives of the analysis and evaluation, the time interval between matched photographs may be decades, seasons, or even seconds (as in the case of photographing landscape change during a volcanic eruption). Matched pairs of photographs are more directly comparable when the direction and length of shadows in each photograph is similar, though valid interpretations can be made from photographs that are matched less closely. (See Figures 16 and 17.)

Repeat photographs can be used to interpret the nature, rate, and direction of change in a cultural landscape, to evaluate the cause(s) of perceived change, and to establish new photographic records for future analysis of change.

Sources of Inaccuracy

Old photographs can be misleading and should be used cautiously for analysis and evaluation. Photographs taken before the advent of panchromatic film in the 1930s can be unrealistic in depicting the conditions of the time. Early films were not sensitive to red light and overly sensitive to blue light. As a result, red is not distinguished from black, and the sky in historic photographs may appear white, with the distant landscape appearing faint, or not being represented at all.

Historic photographs taken with artistic motives may also be misleading due to tricks in the use of perspective or depth of field, or the creative use of lighting. Historic photographs may also be unrepresentative of the typical condition of the time, which may have been the photographer's motive in taking the photograph. To counter the effects of inaccuracy due to the personal biases of photographers, it is best to use historic photographs from a variety of sources.

Performing the Technique

Matched pairs of repeat photographs are most directly comparable if they are taken at the same time of year, at the same time of day, are the same size photograph, and encompass the same area. Matched photographs taken with the same focal length of lenses will encompass the same area with the same resolution. If a different focal length lens is used for the contemporary photograph, the photographs may be rendered similar by enlarging or reducing and cropping during the printing process.

To repeat a historic photograph, position the camera lens at the same location as the historic lens and aim the lens at the same subject. (See Figures

Figure 16. A nineteenth century photograph. John Day Fossil Beds National Monument. (NPS, 1893)

Figure 17. A repeat photograph of the landscape shown in Figure 16. John Day Fossil Beds National Monument. (NPS, 1992)

Figure 18. A photograph of the lower meadows of Vanderbilt Mansion National Historic Site. (NPS, c. 1950s)

Figure 19. A repeat photograph of the landscape in shown Figure 18. This later photograph indicates some encroachment of woody growth into the meadow. Vanderbilt Mansion National Historic Site. (NPS, 1991)

18 and 19.) Do not attempt to frame the new photograph to match the outline of the old; this will result in error in the position of the camera lens. The correct position and aim of the camera lens is found by using the parallax apparent in the historic photograph (that is, the apparent distortion due to the effect of perspective). A copy of the historic photograph must be taken into the field. The foreground features that exist in the center of the field of view of the historic photograph can be used to align the camera. Near and distant features in the center of the field of view are aligned through the camera as in the historic photograph. The photographer then moves the camera toward or away from the field of view, so that peripheral features are aligned and parallax is correct with their appearance in the historic photograph. If no foreground features exist or none are close enough to use the parallax method, the historic camera position must be found by comparing the ratios of horizontal and vertical distances in the historic photograph with the image through the camera lens. To make the comparison more direct, a negative of the historic photograph may be placed beneath the mirror of a 35mm camera so that the historic image can be seen through the viewfinder.

If it is important to reproduce the historic conditions as closely as possible, astronomical tables can be used to estimate the altitude and azimuth of the sun in historic photographs. The altitude and azimuth of the sun affect the character of shadows and highlights in historic photographs. Therefore, when taking repeat photographs of structures, geologic formations, landscape architectural details, and topographic relief, it may be important to match the length and direction of shadows in the historic image. This may be unimportant for historic photographs taken on a cloudy day, or at noon on a sunny day.

It is useful to create a permanent record of the camera station for future repeat photograph analysis. The camera station is directly below the camera lens and is determined by suspending a plumb bob beneath the camera tripod. Photographers use steel rods driven into the ground, or star-shaped drill holes in rocks to mark camera stations. A record of the camera station should be noted on the archival sleeve of the negatives of repeat photographs, along with captions. This should include the angle and inclination of the camera lens at the camera station.

Aerial Photograph Analysis

Aerial photograph analysis is a well-developed discipline. Experts can be found in the professions of landscape architecture, geography, forestry, anthropology, and archeology. Aerial photography has been used for observation of earth processes and environmental analysis for more than 60 years. It is a technologically advanced form of photography that uses large-lens cameras mounted on either low or high altitude aircraft or orbiting satellites to shoot images of the earth surface.

Aerial photography analysis is a form of remote sensing, examining earth features from a distant platform situated above a target area. Aerial photographs are also valuable research tools for providing a graphic record of the appearance of a cultural landscape during a particular period. In analysis and evaluation, aerial photographs from known, successive periods can be compared and interpreted to verify and expand on the historical record.

An expert in aerial photograph analysis can derive highly refined information on natural resources (such as soils, geology, geomorphology, hydrologic patterns, climate, and vegetation), as well as cultural resources. (See Figure 20.) Current aerial photographs may be used to create a base map of existing conditions. (See Figures 21 and 22.) If an aerial photograph is used to create a base map, a lower altitude photograph (that is, larger scale, such as 1 inch = 200 feet) is usually flown. If aerial photographs are used to analyze changing physical conditions over time, higher altitude, archival photographs obtained from the United States Geological Survey Earth Resource Observation Systems (EROS) Data Center may be useful.

Computer aided technologies that build on traditional aerial photography include computer aerial photogrammetry and geographic information systems (GIS). Computer aerial photogrammetry represents the most current technology in deriving base maps from aerial photographs. (Refer to "Computer Aerial Photogrammetry" earlier in this text for more information). As a form of spatial data, aerial photographs are now implicitly related to the development of geographic information systems. GIS takes aerial photograph analysis to a new level of resolution in which aerial photographs are scanned into a computer and georeferenced with other layers of data sources, such as traditional cartographic maps, geology maps, soil surveys, and historic property maps. Direct comparison of multiple spatial data layers enables a more comprehensive understanding of the physical nature of cultural landscapes and the change that has occurred over time. (See *Landscape Lines 10: Geographic Information Systems*.)

Figure 20. Aerial photograph of land near the Black Hills, South Dakota. Analysis of the photograph reveals information about drainage patterns, geology, geomorphology and climate. (NPS)

Aerial photographs may reveal the dynamics of change in landscape characteristics, such as the manipulation of topography, change in hydrologic patterns, the introduction of a particular land use, the settlement and development of a landscape, and modifications to a historic designed landscape throughout the twentieth century. Aerial photographs can also reveal patterns of physical disturbance and evidence of former human occupation that may not be apparent in the field, such as road traces, tree locations, and field patterns. Information derived from the analysis and evaluation of historic aerial photographs may be transcribed on a base map to create a sequence of period plans. (Refer to "Line Drawing Documentation" earlier in this text for guidelines on plan drawing.)

Obtaining Archival Aerial Photographs for Cultural Landscape Analysis and Evaluation

The Earth Resources Observation Systems (EROS) Data Center in Sioux Falls, South Dakota, is the United States Geological Survey (USGS) archive center for federal agency aerial photographs. The photographs, dating from 1940, represent the collection of twenty federal agencies and programs.

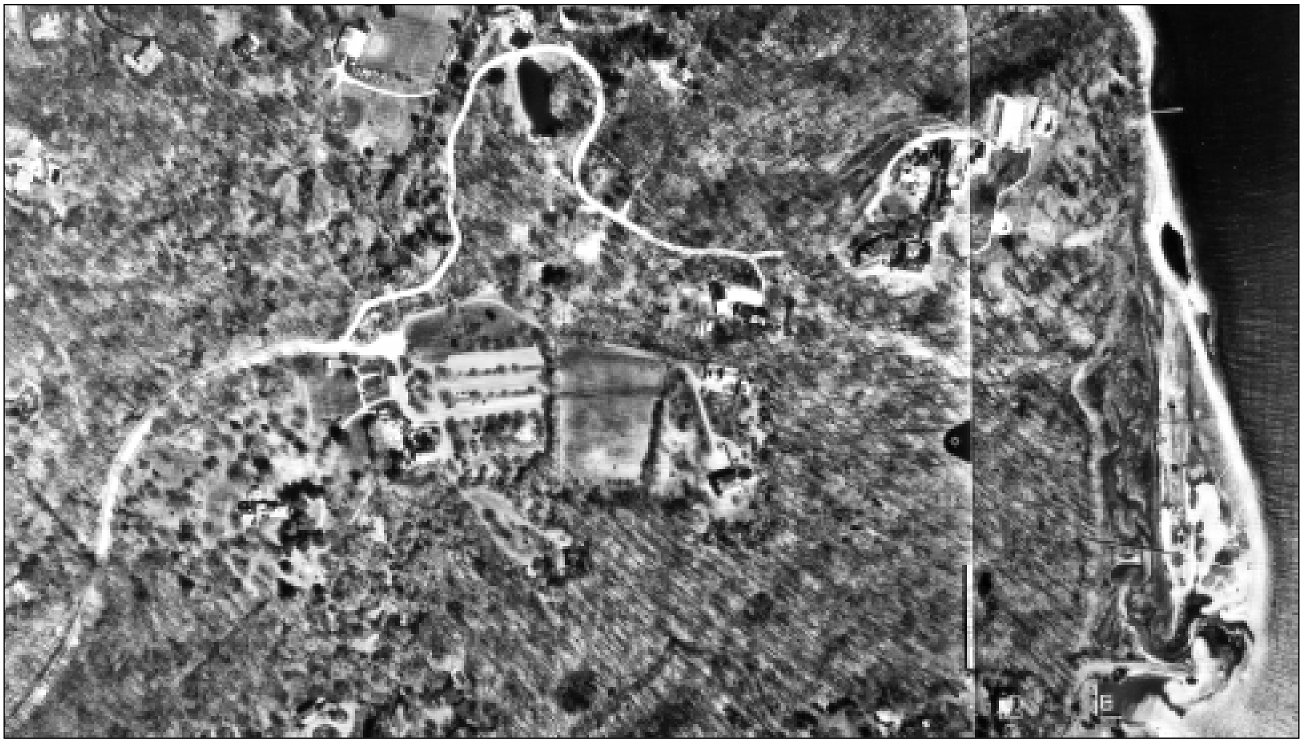

Figure 21. Aerial photograph documenting President Theodore Roosevelt's home in 1992 during leaf-off conditions. Sagamore Hill National Historic Site. (NPS, 1992)

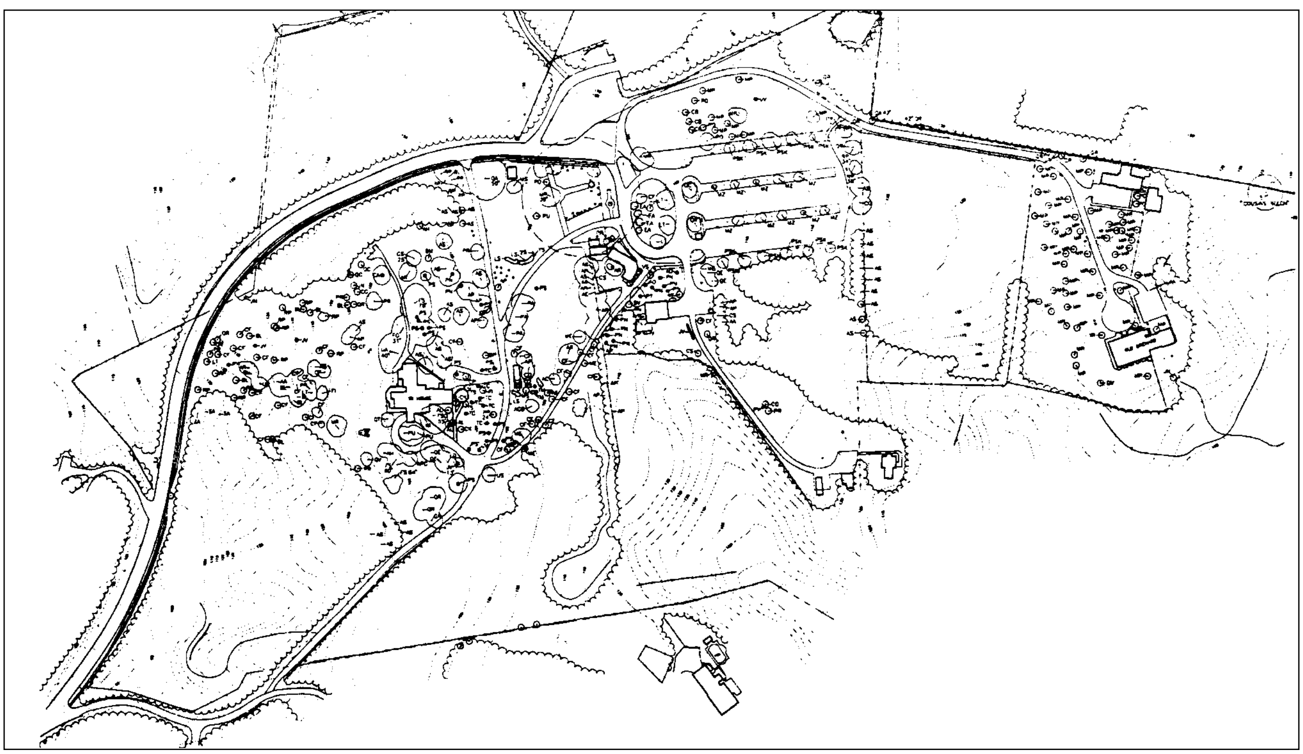

Figure 22. Existing conditions plan (1 inch = 200 feet scale) generated in AutoCAD using the 1992 aerial photograph of the property. Sagamore Hill National Historic Site. (NPS, 1993)

The photographs range in film type from color-infrared, black and white, and natural color, to black and white infrared. The federal government recently standardized aerial surveys to avoid repetition and achieve uniform quality and coverage. Before federal aerial surveys were standardized, photographs were shot in geographic locations where studies were being conducted. Photographs were taken from different altitudes using various types of film. As a result, coverage of the states is uneven among the older acquisitions in the collection.

The 1987-1991 National Aerial Photography Program (NAPP) produced cloud-free aerial photographs with color infrared film of the 48 contiguous states at a scale of 1:40,000 (1 inch = 0.6 miles). Each photograph shows an area of 5 x 5 miles. Black and white photographs, derived from the color-infrared film, can be ordered. Prior to the NAPP program, between 1981 and 1987, the National High Altitude Photography Program (NHAP) generated most aerial photographs for the USGS. The NHAP program shot black and white aerial photographs at a scale of 1:80,000 (1 inch = 1.26 miles), with each photograph showing an area of 11 x 11 miles. The NHAP program also shot color-infrared film with a scale of 1:58,000 (1 inch = 0.9 miles). Each photograph shows an area of 8 x 8 miles.

The EROS Data Center also receives, processes, and distributes data images from the National Atmospheric and Space Administration (NASA) Landsat satellites. These data include aerial photos in the scale range of 1:30,000 to 1:120,000. The film coverage varies from color-infrared to black and white. These Landsat photographs can also be purchased from the center.

The availability of specific NAPP and NHAP photography can be determined using a microfiche-based indexing system keyed to areas of USGS 1:250,000-scale maps. Either microfiche or enlarged paper copies of the microfiche are available for the particular geographic area of interest.

Sources of Archival Aerial Photographs

Customer Services - NAPP
USGS - EROS Data Center
Sioux Falls, SD 57198

Aerial Photography Division (East)
U.S. Department of Agriculture
45 French Broad Avenue
Asheville, NC 28802

Aerial Photography Division (West)
U.S. Department of Agriculture
2505 Parley's Way
Salt Lake City, UT 84102

Aerial Photography Field Office
Agricultural Stabilization and Conservation Service
U.S. Department of Agriculture
2222 West 2300 South
Salt Lake City, UT 84125

Cartographic Archives Division
National Archives
Washington, DC 20408

The National Archives contains federal aerial surveys conducted by the Agricultural Stabilization and Conservation Service, Soil Conservation Service, Forest Service, Geological Survey, and Bureau of Reclamation between 1935 and 1942. The guide, titled *Aerial Photographs in the National Archives* (Special List No. 25). 1973, is available from the National Archives.

Contracting Aerial Photography Services

In preparing a project agreement (scope of work) for contracting aerial photography services, the following information may be required.

- Scale of aerial photograph. 1" = 200' is approximately the largest scale—the lowest altitude—that an aircraft can fly (due to aviation law). Although the level of resolution of the image is set by the scale at which the original photograph is taken, the scale of the image can be subsequently enlarged.
- Location of the aerial photograph. The location is most accurately denoted by UTM boundary coordinates. A contractor may accept boundaries drawn on a USGS 7.5 minute topographic quadrangle as an adequate guide to location.
- Lens size. The frame size of the photograph is determined by the camera lens size. Lens sizes in common use range from 6 to 12 inches, with 12 inches producing the larger frame. A 12-inch lens may be more appropriate for a large scale photograph.
- Type of film. Aerial photography film ranges from color-infrared, black and white, and natural color, to black and white-infrared. Natural color photographs are grayer than natural color is ordinarily perceived. Color infrared and black and white infrared photos may be more revealing for environmental analyses than natural color. Infrared photographs may reveal different ecosystem or vegetation types more clearly than natural color photographs, and infrared can provide additional information on biomass production and ecosystem health.
- Type of shot—stereo or spot shot. If a relatively small landscape or area of a landscape can fit within a single aerial photograph frame, a spot shot may be most appropriate. However, for large landscapes, a series of photographs may be taken. A series of stereophotographs have the additional benefit of being useful for analysis purposes. Stereophotographs have 58-65 percent overlap between frames. Consequently, paired stereo frames can be observed through stereo glasses for three-dimensional analysis of the aerial photographs.
- Orientation of shot—vertical or oblique. It is assumed that aerial photographs are taken vertically (that is, oriented perpendicular to the earth's surface) unless otherwise specified. Vertical shots have the least horizontal distortion of the earth's surface. Oblique shots are taken for illustrative effects to expose the verticality of such elements as building facades and trees.
- Product format. Aerial photographs can be delivered as film negatives, film positives, contact prints, or as electronic files on computer disk or photo CD, and reproduced or enlarged onto mylar, blueprint, or bond paper

media. The form of product may depend on management objectives (that is, how the aerial photograph will be used) and archive considerations.

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Geophysical Survey Techniques

Introduction

Geophysical survey techniques indirectly measure the presence of resources concealed within the earth's subsurface as a result of geologic processes or human disturbances. Geophysical survey techniques detect subsurface contrasts, including mass-density relationships, ionic or electrical potentials, magnetic susceptibilities, and elemental decay. The surveys can reveal the location of archeological resources and lead to their identification.

Geophysical survey equipment is used to investigate buried prehistoric and historic structures and artifacts. The use of geophysical survey equipment and computer aided interpretation has increased the accuracy of archeological surveys to the point where potentially destructive, random excavations can be minimized.

Geophysical survey techniques cannot positively identify a buried cultural resource, but they can provide data for interpretation from which strong inferences can be made. Geophysical surveys use remote sensing techniques, which examine earth features from a distant platform situated above a target area and usually employ high altitude aircraft or satellites. From a platform situated on or just above the earth's surface, geophysical survey equipment remotely sense earth features in a target area located beneath the earth's surface.

Applying Geophysical Survey Techniques to Cultural Landscape Research

Geophysical survey techniques are either passive or active. Passive techniques measure naturally occurring earth-related processes, such as the earth's electromagnetic or gravitational field. Magnetometry is a passive geophysical survey technique. Active techniques involve transmitting an electrical, electromagnetic, or acoustic signal into the subsurface. Interaction of the input signal with subsurface materials produces a modified return signal that can be measured. A familiar, amateur active technique is the metal detector. Other active geophysical techniques include ground penetrating radar, electrical resistivity, and electromagnetic conductivity.

Geophysical techniques were used in an archeological survey of Virginius Island, a nonextant, nineteenth century industrial community in Harpers Ferry National Historical Park. (See Figure 1.) Geophysical services were contracted to determine the location of twelve, nineteenth century residential structures and their associated outbuildings, buried within four acres of river terrace landscape. (See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix J: Project Agreements.") The general location of these residences was derived from historical documentation, maps, and photographs, but the precise location of the outbuildings and their yards was unknown. The project agreement for the geophysical survey specified ground penetrating radar and electromagnetic conductivity, but allowed for the possibility of using additional techniques to verify the location of a feature. The results of the geophysical survey led to the excavation or "ground-truthing" of specific sites to produce an accurate site plan of Virginius Island. Results of the survey facilitated development of a treatment plan, which included an interpretive program. (See Figures 2 and 3.)

Passive Geophysical Survey Techniques

Passive geophysical survey techniques measure naturally occurring, local, or planetary fields created by earth processes. Passive techniques include magnetic surveying with a magnetometer and gravity surveying using a gravitometer. A magnetometer measures the earth's total magnetic field. It is useful for detecting buried ferrous objects or magnetic anomalies in soils. A gravitometer measures the anomalous acceleration of gravity due to mass/density relationships of buried features. Currently, the technique has limited use because detection is very subtle.

Implementation and Limitations of a Geophysical Survey

Successful implementation of a geophysical survey depends on the following:

- **A comprehensive survey design that specifies the set of techniques chosen for a survey (multiple techniques are requisite for a thorough site investigation), the order in which the techniques are implemented, the size and location of the survey grid applied, and the compatibility of the techniques with the site (that is, compatible with geology and physical access).**
- **An experienced geophysicist contractor who is skilled in multiple geophysical methods and knowledgeable about the physical and historic context of the survey and the nature of the expected results.**

Possible limitations of geophysical surveys include the following:

- **Geophysical surveys are equipment-intensive and may be expensive to conduct.**
- **Geophysical survey equipment cannot distinguish between cultural and geologic anomalies.**
- **Geophysical survey techniques are limited to near-surface detection. There are limits to the depth and scale of resolution.**
- **Geophysical survey equipment may not detect subtle contrasts or weak signals. If the contrast between the sought-after archeological material and incubating soil is small, detection is hindered.**
- **Erroneous readings may occur as a result of distortion from nearby cultural entities with physical or electromagnetic properties, such as subterranean utilities, powerlines, metal fences, transmission towers, buildings, roads, railroads, aircraft, and two-way radios.**

Figure 1. This photograph of Virginius Island shows the proximity of the former industrial community to the Shenandoah River. The nineteenth century buildings were largely destroyed by successive floods by the turn of the century. A geophysical survey of selected areas of the island yielded information about the location of ruined residences and outbuildings. This information was used in developing a treatment plan for the cultural landscape. Harpers Ferry National Historical Park. (NPS, 1865)

Magnetometry

Magnetometry is used within a large landscape area to detect the presence and location of archeological resources with magnetic properties. It is useful for a preliminary level of a subsurface investigation and is particularly suitable for detecting brick structures and metallic artifacts.

Magnetometry, or magnetic surveying, uses the proton magnetometer to measure the magnetic susceptibility of buried materials. The earth's total geomagnetic field can be measured and used as a control point of reference to compare local magnetic interferences. When compared to the total geomagnetic field, local disturbances or anomalies can indicate the position of ferrous objects, displaced soils, and earthen structures.

The magnetometer is a highly sensitive instrument, capable of measuring perturbations or anomalies with an accuracy of one part in 100,000. The proton magnetometer is one of the simpler, less expensive, and more accurate geophysical instruments, and consequently is used frequently for geophysical surveys. Acquisition of spatial data over large areas is relatively easy, and qualitative interpretations can be made rapidly with relatively less geophysical experience. (See Figure 4.)

Active Geophysical Survey Techniques

Active geophysical survey techniques involve transmitting electrical currents, electromagnetic, or acoustic energies into the earth's surface.

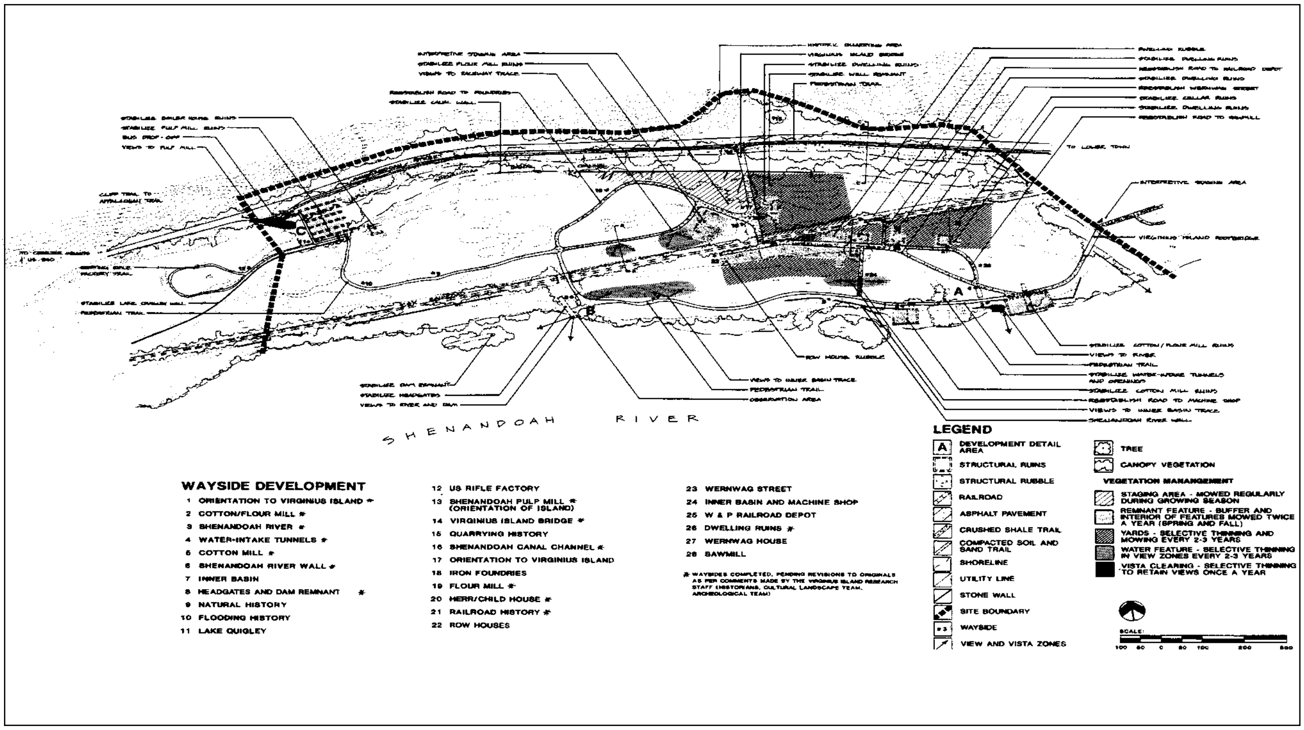

Figure 2. Proposed treatment plan for the cultural landscape of Virginius Island. Data from geological surveys, archeological site investigations, and historical research contributed to the development of this plan. Harpers Ferry National Historical Park. (NPS, 1992)

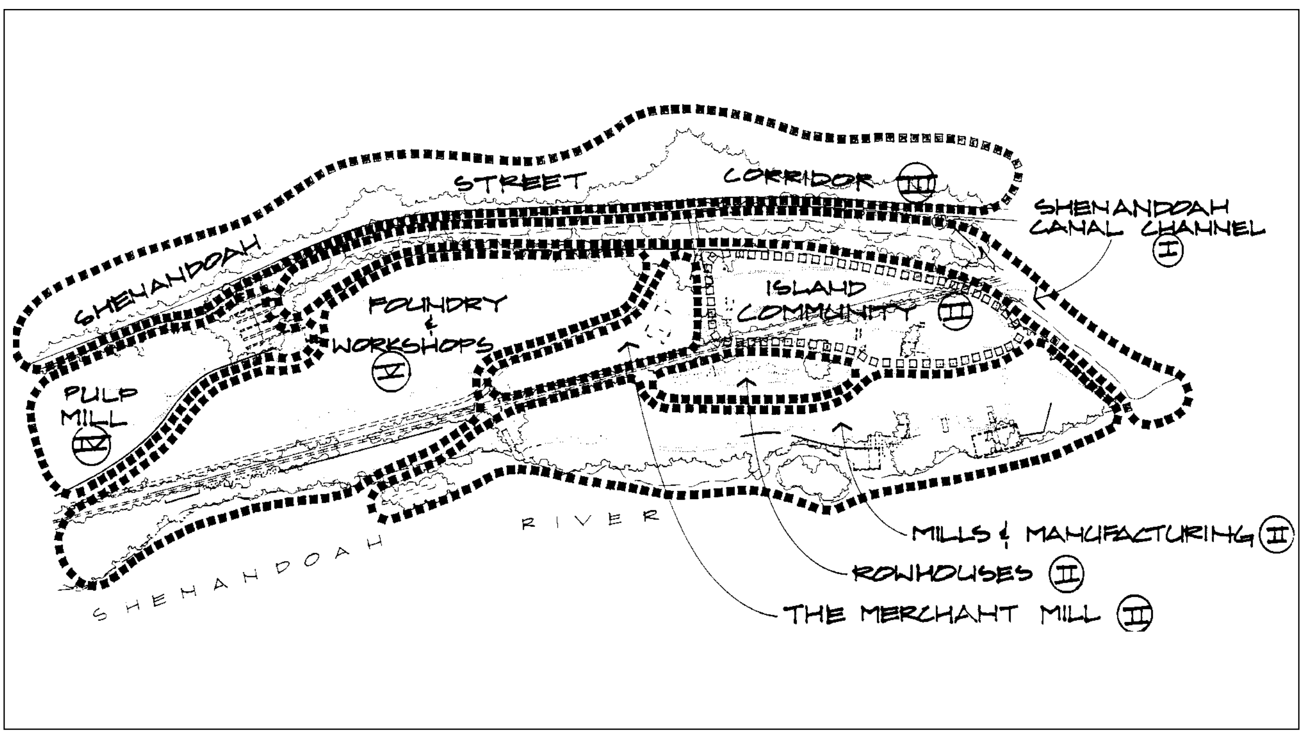

Figure 3. Proposed management zones for Virginius Island. The management zones are based upon historic land uses on the island, which were identified through historical research and archeological site investigation. Harpers Ferry National Historical Park. (NPS, 1992)

Active techniques include ground penetrating radar, electrical resistivity, and electromagnetic conductivity. Earthen material, such as soil or rock, are generally considered to be relatively poor conductors of energy. Much of the energy that geophysical equipment introduces is dissipated into the subsurface. Often geophysical receivers magnify the return signal to compensate for the poor conduction of energy. A comparison of amplitude, frequency, wavelength, and time delay between the input and return signals leads to the detection of buried cultural resources.

Ground Penetrating Radar

Ground penetrating radar (GPR) is used to determine the depth and physical properties of buried cultural and geologic features. It can effectively map soil layers, depth to bedrock, cavities, buried stream channels, burial sites, underground utilities, structures (including concrete structures), and metallic objects.

GPR is most often used to measure reflected low frequency electromagnetic energy, which is introduced into the subsurface via a surface-contact, transmitting antenna. (See Figure 5.) As the energy passes through the earth, it may encounter buried materials of varying electrical properties. At these electrical interfaces, energy may be either reflected or attenuated. A receiving antenna on the earth's surface detects reflected energy. The receiving antenna is positioned in close proximity to the transmitting antenna. Comparison of the return signal time delay with the input signal (in billionths of a second) is a function of the speed of the signal as it passes through the buried material. This comparison can be used indirectly to calculate the depth of the buried material. A comparison of the amplitude and frequency of the reflected signal with the input signal provides information about the physical properties of the buried material.

Figure 4. A magnetic survey using a GEM 19 magnetometer. Fort Laramie National Historic Site. (NPS, 1993)

Site-specific conditions may limit the success of GPR in geophysical surveys. The presence of highly conductive clay soils in proportions of 10 percent or more is probably the greatest limiting factor affecting radar signals. Highly conductive soil conditions result in the attenuation of electromagnetic energy, a reduction in signal velocity, and a decrease in depth of signal penetration. Water-saturated soils also produce a highly conductive environment. Seasonal groundwater level variations may be relevant in timing a ground penetrating radar survey.

Figure 5. A ground penetrating radar being pulled across the ground. Lockwood Stage Stop, Pinon Canon Maneuver Site, Colorado. (NPS, 1991)

Electrical Resistivity

Electrical resistivity uses electrical resistance (poor conductivity) properties to identify buried cultural resources. A highly refined electrical resistivity survey may be the most revealing geophysical technique, but it is expensive to perform because it requires a high number of readings per unit area.

Resistivity experts interpret electrical resistivity patterns to identify the presence of nearly all forms of constructed features, such as foundations, paths, and roads. The technique can also reveal compacted soils, indicative of a former pathway, and disturbed soils, such as those found at burial sites and cultivated fields. Electrical resistivity is useful for measuring depth to bedrock and is often performed before GPR in geophysical surveys involving multiple techniques. Depth to bedrock measurements are useful in calibrating GPR equipment.

Electrical resistivity uses current electrodes to introduce into the soil an electrical current of known amplitude (amps) and frequency (volts), and potential electrodes with an ohmmeter to measure resistance changes in the soil, vertically and horizontally. (See Figure 6.) Measurements of vertical changes in resistivity are called "soundings" and measurements of horizontal changes in resistivity are called "profiling." The technique requires at least three individuals to move two current electrodes and two potential electrodes along a survey grid. It is assumed that the incubating soil has a homogeneous resistivity (due to an assumed even distribution of soil and water) and that buried cultural resources can be identified as anomalous readings of resistance.

Along survey gridlines, changes in resistance readings are used to create "contour maps" of soil resistivity. On the map, concentric contours emanating from a location (called a "spot elevation") represent material of lowest conductivity,

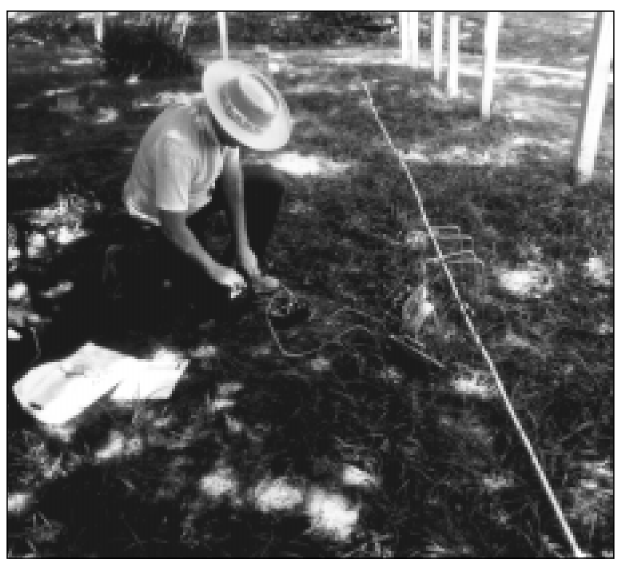

Figure 6. An electrical resistivity survey using a Gossen resistivity meter. Scott Air Force Base. (NPS, n.d.)

or conversely, greatest resistance. Because soil conductivity is directly related to the presence of water, locations measuring the greatest resistance will have a lower soil-water content. Nonsaturated soil conditions reveal more contrasts between potentially buried cultural resources (that have lower water content) and native soil material (having higher water content).

Ideally, electrical resistivity tests should be performed in more than one season with varying soil-water conditions. In some geologic conditions the native soil may have a lower water content and therefore higher resistivity than buried cultural resources. Because resistivity is directly related to permeability, degree of saturation, and the chemical nature of entrapped fluids, prior knowledge of indigenous geologic conditions is requisite to accurately interpret resistivity data.

Electromagnetic Conductivity

Electromagnetic conductivity, also called EM and induction, is used to detect and differentiate metallic artifacts buried near the earth's surface. The technique locates near-surface cultural features (structures, compaction, excavation, and habitation sites) by their various water saturations (their conductivity). A conductivity measurement is the reciprocal of resistivity, so in theory the results of a lateral conductivity survey should mirror the results of a resistivity profile.

The main advantage to using conductivity over resistivity is that the measuring instrument does not require surface contact. Two individuals are required to perform the technique, but the conductivity instrument can be moved from station to station by one operator. Resistivity requires a crew of at least three to move and place electrodes in the ground along a survey line. (See Figure 7.)

Electromagnetic conductivity uses a nonsurface contacting radio transmitter and receiver. The transmitter induces an electromagnetic field in the earth, causing an electrical current to flow. The electrical current generates a secondary magnetic field that causes the flow of an electrical current signal in the receiver. The receiver signal is measured for conductivity by a voltmeter incorporated in the EM instrument. The voltmeter is calibrated to measure the soil as having a homogeneous level of conductivity. It is assumed that buried cultural resources cause anomalies in the homogenous level of conductivity detected along survey lines. Large fluctuations in conductivity are indications of highly conductive subsurface materials, such as buried

Figure 7. An electromagnetic conductivity survey using a Geonics EM38 soil conductivity meter. Fort Laramie National Historic Site. (NPS, 1993)

utilities. Observing the physical extent and orientation of the anomaly can provide clues to its identification.

Sources of Geophysical Prospecting Equipment and Surveyors

United States Governmental Agencies

United States Geological Survey

United States Bureau of Reclamation

United States Bureau of Mines

Environmental Protection Agency

State Agencies

Geologic Surveys

Health & Environmental Agencies

Universities and Colleges

Geological Departments

Geophysical Departments

Engineering Departments

Private and Nonprofit Organizations

Private Concerned Citizens

Geophysical Equipment Manufacturers

Geophysical Equipment Rental Companies

Geophysical Consultants

For access to the last five groups, acquire a copy of the Geophysical Directory, published each March. This directory provides the most comprehensive listing of sources of equipment and geophysical survey experts available.

The Geophysical Directory
2200 Welch Avenue
P.O. Box 130508
Houston, TX 77219
Phone 713-529-8789
Fax 713-529-3646

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Pollen, Phytolith, and Macroflora Analyses

INTRODUCTION

Pollen, phytolith, and macrofloral analyses are archeological techniques used to investigate the prehistory and history of vegetation types within a landscape. Data from these analyses provides information about former land use and changes in cultural activities over time. (See Figure 1.) Archeological and ethnobotanical expertise is required to analyze pollen, phytoliths, and macroflora.

The potential for pollen, phytolith, and macrofloral analyses to yield data about vegetation is highest when a site is undisturbed (for example, a site that has not received fill material or been inundated by flooding). In addition, information about a site is enhanced when the three techniques are conducted together. (The three analyses also complement other archeological techniques, such as the analysis of material artifacts.)

A pollen grain is the microscopic, single-celled male gamete of a flowering plant and a phytolith is a mineral fossil cast of a plant. The term, macroflora, refers to seeds and other macroscopic plant remains, such as wood, leaves, tubers, and flowers, that are preserved within an incubating sediment, such as soil. The remains of pollen, phytoliths, and macroflora can be collected from soil samples of a known deposition level within a soil profile. Based on their taxonomic classification and the soil strata in which they exist, the extant plant community of a prehistoric or historic period can be determined. In addition, the extent to which the pollen, phytolith, and macroflora remains are corroded or degraded can indicate the relative age of the sample.

Pollen Analysis

The Technique

To analyze pollen, a small soil sample is taken from each stratigraphic layer that has been excavated by an archeologist. Systematic excavations allow for classification of soils by temporal sequence, which creates reference points for analyzing the changes in a landscape over time. The classified soil samples are sent to a palynologist for pollen analysis. Because there are not many archaelogical palynologists in the United States, the analysis may take three to six months. Currently, the cost of analysis ranges from $85.00 to $150.00 per soil sample.

The pollen analysis of sediment taken from sample cores in wetlands may reveal more than soil samples taken from an archaeological excavation. There are two reasons for this: first, pollen grains are better preserved in wetland cores because there is less microbiotic activity, and second, wetland cores reveal more about the intervals between human and natural disturbances, such as fire, pathogens, and climate. (The occurrence of fire is determined by counting charcoal particles found in pollen samples.)

Preserved pollen grains are extracted from an incubating sediment, such as soil, by chemical and mechanical separation treatments. Then the grains

Figure 1. Photograph of Boott Cotton Mills and Yard, the site of numerous archeological investigations that included pollen and phytolith analyses. Lowell National Historical Park. (Photograph courtesy of the University of Massachusetts at Lowell, 1890)

are examined under a microscope to identify characteristics of the parent plant. Although some pollen can be classified at the subgenus or species level, most pollen cannot be identified below the level of genus. Some plant taxa have similar pollen characteristics, making it difficult to identify the plant below the level of family. For instance, chenopod and amaranth grass families are difficult to distinguish from just their pollen grains. Nearly every family of flowering plant has been investigated palynologically, though the accuracy of pollen information varies with each family. Palynologists can identify both dicotyledonous and monocotyledonous plants from their pollen, as well as fern spores, fungal spores, and algal cysts and spores.

Pollen can persist in soils for a long time, although its longevity is determined by such factors as exposure to oxygen, grain size, the initial abundance of pollen from a particular species, and durability of the pollen grain wall. The percentages of different taxa, determined by identifying pollen, does not necessarily represent the relative composition of vegetation in a particular period; rather, it indicates the presence of a particular plant community or taxa. While pollen preservation is generally poor in prehistoric sites, recent work indicates that pollen preservation in historic sites is generally adequate enough to yield valuable information about plant communities.

Applying Pollen Analysis to Cultural Landscape Research

Pollen analysis was originally used by paleoecologists to reconstruct the prehistoric environment. In recent years, archeologists have used pollen analysis to identify the plant communities that were extant in particular historic periods and relate vegetation changes over time to land use. Pollen data can also reveal information about climatic and ecological conditions within a particular period.

Pollen analysis has been used to chronicle the introduction of European flora with increased mercantile trade into the early colonies. For example, changing land use patterns in seventeenth century Jamestown, Virginia have been identified from preserved pollen. Similar patterns were identified at Lowell National Historical Park in Massachusetts and Harpers Ferry National Historical Park in West Virginia. In both of these landscapes, the pollen record indicated a transition from well maintained yards around dwellings at the turn of the nineteenth century to more unkempt, weedy environments corresponding with the period of the industrial revolution.

The presence of pollen in a soil sample indicates that a particular genus of plant was historically present in the vicinity, but it does not indicate the precise location of a particular plant taxa. This is due to the natural forces of wind and water that can affect the deposition and incubation of pollen. To determine the historical location of a plant taxa, soil samples must be analyzed for phytoliths, the mineral fossil casts of plants.

Phytolith Analysis

The Technique

Phytolith analysis is most often used to reconstruct vegetation cover over time. Phytoliths are released into the soil by plant decay, deposits of plant tissue in the soil through waste, and through cultural processing of plant tissue as fuel, food, fiber, or building material. The presence of phytoliths indicates the location of a plant, animal, or cultural activity, and can be used to reconstruct the microdistribution—the relative historic locations—of plants.

Phytoliths are formed when hydrated silicon dioxide precipitates out within plant cells and is deposited along cell walls, where it forms a hard, opaline microfossil cast. The phytoliths remain within the living plant and are released into the soil when the tissue is digested by decay organisms. Phytoliths are known to be very stable in the soil (typically more decay-resistant than pollen) and therefore may yield information about prehistoric conditions of a landscape. Phytoliths occur mostly in stems and leaves, though they may also form in root, flower, and fruit cells. Unlike pollen, phytoliths are associated with more than just flowering plants, so they have the potential to provide more information about the plant kingdom in a particular period.

Phytolith and pollen analysis are complementary techniques, with their relative strengths in monocotyledon and dicotyledon identification, respectively. Like pollen, phytoliths are identified through their morphological characteristics. A paleobotanist may perform the pollen and phytolith analyses concurrently. For the benefit of integrating pollen and phytolith data, pollen and phytoliths should be derived from the same soil samples.

Applying Phytolith Analysis to Cultural Landscape Research

Phytolith analysis is particularly revealing for monocotyledonous plants, especially the grass family. Many genera of grasses can be identified, yielding valuable ethnobotanical information about the cultural importance of grasses as food crops, building materials, and ornamental plants. For example, the presence of turf-grass phytoliths may indicate lawns in cultural landscapes.

At Lowell National Historical Park in Massachusetts and at Harpers Ferry National Historical Park in West Virginia, phytolith analysis was used in conjunction with pollen and artifact analysis to document change in land use during the industrial revolution of the nineteenth century. (See Figures 2 and 3.) At Hampton, Virginia, archeological investigations within the early city recovered teeth from domestic livestock. Phytoliths were extracted from the deposits on the teeth, providing a physical record of the eighteenth and nineteenth century diets of livestock and domestic animals. This information has been used to interpret 150 years of change in husbandry practices and land use at the household and community levels. The analysis of phytoliths was also used to identify historic field crop patterns at Monticello in Virginia, garden flora at the Moravian Gardens in North Carolina, Bacon's Castle in Virginia, and Morvan Gardens in New Jersey.

Figure 2. The Harper Yard is the site of numerous archeological investigations that included phytolith analysis. Information yielded in part through phytolith analysis contributed to a treatment plan proposing rehabilitation of the yard to reflect its nineteenth century character as a residential garden. Harpers Ferry National Historical Park. (NPS, 1991)

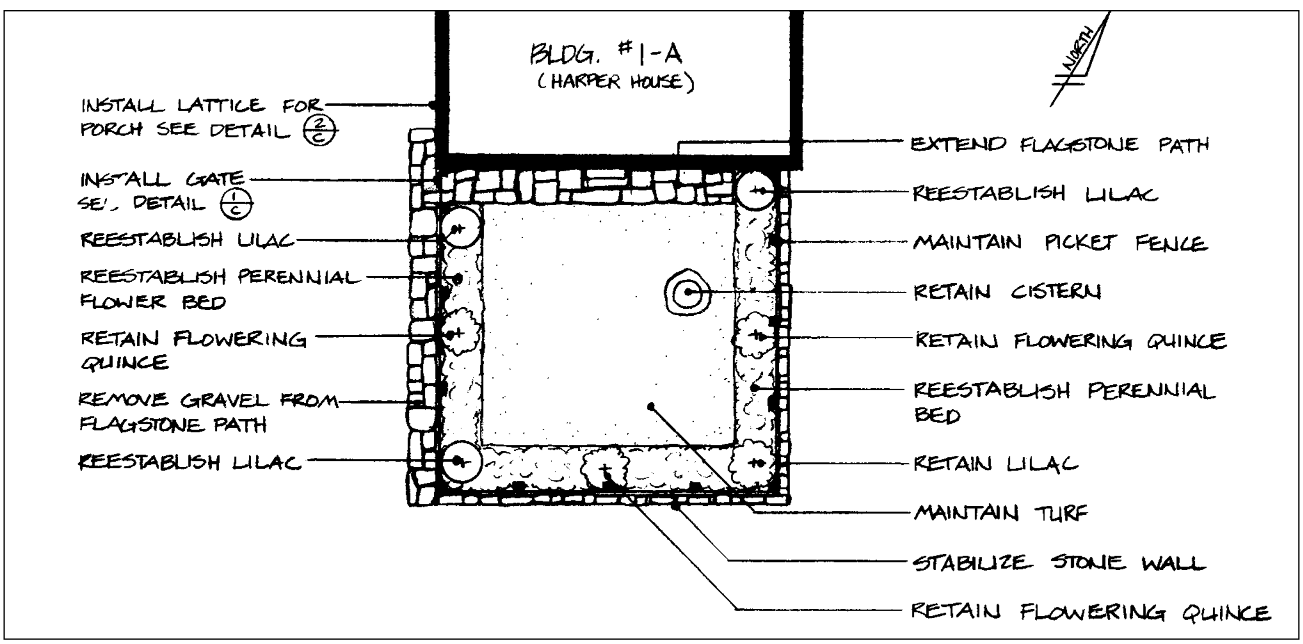

Figure 3. The proposed treatment plan for the Harper Yard. Information for the rehabilitation plan was partly derived from phytolith and pollen analyses of the yard. Harpers Ferry National Historical Park. (NPS, 1991)

Macroflora Analysis

The Technique

Macroflora analysis refers to the investigation of the macroscopic, buried remains of plants. These macroscopic remains include seeds, fruits, wood, leaves, roots, and tubers. Macroflora are identified according to their parent taxa and used to construct a history of indigenous and introduced vegetation. Macroflora are also a source of ethnobotanical information, which indicates the relationship between the plants and cultural activities of a landscape.

Macroflora are preserved for the longest duration in charcoalified form, caused by charring through human activities or naturally occurring fires. Charcoal (carbon) is a relatively inert substance that is not further decomposed by microorganisms. Few seeds live longer than a century and those persisting longer are usually charred. Carbon dating can be used to determine the relative age of charcoalified macroflora.

In the absence of charring, macroflora are best preserved in incubating conditions that are least favorable to the growth of decomposing microorganisms. Such conditions include arid, dry environments and conditions with a pH either more acid or alkaline than neutral. Most living organisms occupy a narrow pH range from slightly acid to neutral. More acid conditions, such as found in bogs and privies, retard the decomposition of organic material (macroflora) because the pH inhibits the growth of microorganisms. Anaerobic, waterlogged conditions are conducive to the carbonization of macroflora, a process similar to lignification (development of wood), which also retards decomposition.

Macroflora are derived from soil samples that have been classified according to their strata. Seeds may be incubated within human or mammalian waste (where they can provide dietary information), or directly within soil as a result of dispersal by wind, animals, and water. The macroflora analyst separates the seeds, leaves, fruits, or wood from the incubating sediment and observes the tissue under a light microscope to identify the parent taxa. Seeds and whole leaves can often be identified to the species level through examination of morphological characteristics. Certain dry fruits or succulent fruits, such as cherries and peaches, are identifiable to species. Wood must be diagnosed through the microscopic examination of conductive tissues and generally cannot be identified below the taxonomic level of genus.

Applying Macroflora Analysis to Cultural Landscape Research

Macroflora analysis is used with other archeological techniques to reconstruct the historic appearance of a cultural landscape. Charcoalified macroflora may be used to reconstruct vegetation cover in prehistoric periods. The analysis may indicate the presence of plant species in a particular period and also provide a temporal sequence of species change through successive periods. The pattern of vegetation change may be critical to understanding how a cultural landscape evolved as a result of human intervention and natural disturbances. (See Figure 4.)

Figure 4. Soil samples are collected during an archeological excavation, organized according to their respective soil strata, and analyzed for the presence of pollen, phytoliths, and macroflora. San Juan Island National Historical Park. (NPS, 1985)

Macroflora analysis can also contribute to the reconstruction of a landscape at a particular period. For example, at Monticello in Virginia, charcoalified seeds found in the ash of a servant's kitchen fireplace on Mulberry Row were identified as sorghum, watermelon, corn, peaches, and pokeberry. Here, macroflora analysis indicated some of the crops grown on the farm during Thomas Jefferson's occupation, and also contributed dietary information.

In New England, more general changes in vegetation over the past 2,000 years are being investigated using the record of macroflora and pollen deposited in lake beds in central Massachusetts. The identification of historically existing species and the study of vegetation dynamics will contribute to a land use and fire history.

A very large macroflora analysis was used to reconstruct the landscape of Pompeii, Italy. In A.D. 79, Mount Vesuvius erupted, destroying Pompeii and Heraculaneum. Vegetation incinerated during the eruption was preserved as charcoalified macroflora under a layer of pumice and ash many meters deep. Much of Pompeii has been excavated back to the level of the soil in A.D. 79. At the soil level, charcoalified roots are excavated and identified, or concrete casts are made of root cavities, leading to plant identification by shape or size. Charcoalified seeds, roots and branches of olives, peaches, almonds, grapes, and other woody plants are contributing information to the reconstruction of formal gardens and vineyards within the ancient city.

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Tree Coring

Introduction

Tree coring is used to determine the age of trees and reveal information about structural health, growth rate, growth patterns, and previous wounding or disease. Annual growth rings visible on a core sample can be counted to determine tree age. The relative spacing of the rings indicates growth rate and growth patterns.

A dendrochronologist is required to analyze tree cores in detail. The analysis can reveal historic information about climate change. For example, rings are spaced farther apart when sunlight and water are abundant, when physical wounding occurs (such as fire damage), and when competition changes occur (such as the death of an overstory tree, which allows more sunlight to penetrate).

Some consider tree coring to be potentially harmful to trees. The coring technique used to take a sample wounds the tree and may introduce pathogens or open up existing pockets of infection within the wood tissue that had been successfully compartmentalized by the tree. Use of tree coring assumes that the tree is healthy enough to seal off pathogens both chemically and physically before the organisms have a chance to spread and possibly cause systemic infection.

Applying Tree Coring to Cultural Landscape Research

Tree coring is a valuable investigative technique in cultural landscape research when a mature tree appears to date from a known period of significance, but historic documentation about the tree is lacking. For example, in cultural landscapes where the period of significance is recent, questionable trees may have a caliper size of only six inches.

In addition, different growing conditions affect the size of trees from an assumed average, making age estimation difficult without coring. The decision to core must consider physiological and morphological characteristics of a particular species, health status, potential vulnerability, such as genetic susceptibility or local presence of pathogens, management objectives, and the proposed treatment for the landscape.

Tree coring was used as a research tool at Weir Farm National Historic Site in Connecticut to develop a restoration treatment plan for the site. Historical research had not revealed whether particular trees dated from the period of significance. The trees were cored and the data helped planners decide whether to keep or remove the trees in question.

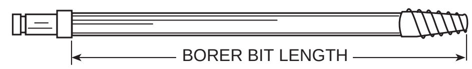
Performing the Technique

Equipment

When coring a tree, it is best to use the smallest diameter bit possible for the increment borer. (See Figure 1.) Borer bits range in diameter from 0.169 inches (4.3 mm) to 0.5 inches (12 mm). A bit diameter of 0.169 inches is adequate for determining age, but larger sizes are more typically used for quantitative analysis in silviculture research. The bit length used depends on the radius of the tree with some extra length to ensure the borer reaches the center of the trunk. Bit lengths range from approximately 6 to 30 inches. The increment borer bit should be sharp (a 3-thread bit penetrates more easily than a 2-thread bit) and sterilized with rubbing alcohol.

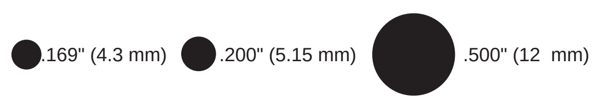
Selecting an Increment Borer

Three things to consider when ordering an increment borer are length, diameter, and style.



Borer bit length depends on the size of the trees you will be boring. Length is measured from the tip of the threads to the end of the round section of the borer bit. This is the maximum depth the bit will penetrate.

Core Diameter for the wood sample is determined by the inside diameter of the opening at the threaded end of the bit. .169 inches is commonly used for general forestry use, .200 inches for wood preserving testing, and .500 inches for large amounts of wood for quantitative analysis.



2- or 3-Thread Style is a matter of personal preference. A 2-thread borer has two threads on the cutting edge of the bit, each originating 180° apart. A 3-thread borer has three threads, each originating 120° apart. The 3-thread borer, due to its higher pitch, will penetrate the wood deeper per revolution than a 2-thread and also produce less friction because more threads are pushing against the wood. It is important to remember that the ease at which a borer penetrates wood depends on wood hardness, friction properties, and capability/strength of the user.

Figure 1. Photograph of an increment borer and extractor and a diagram indicating how to select an appropriate increment borer size. (Photograph courtesy of Forestry Suppliers, Inc., 1996)

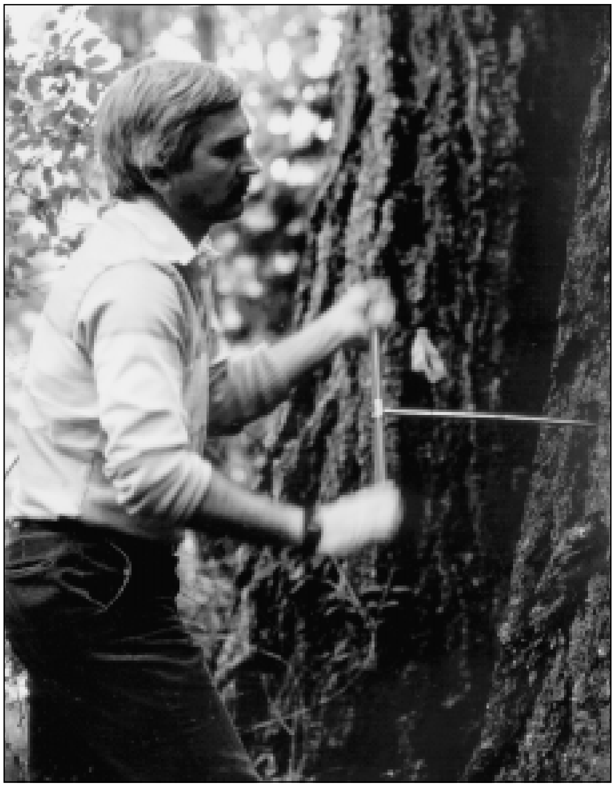


Figure 2. An increment borer is used to core a Douglas Fir (Pseudotsuga menziesii) tree. San Juan Island National Historical Park. (NPS, 1987)

Sterilization should be repeated between successive cores to prevent disease transmission between trees. After sterilization, the increment borer is lubricated with a natural wax, such as beeswax. If beeswax is coated along the borer to the same length as the radius of the tree, the end point of the wax can be used as a gauge of when the centerpoint of the trunk is reached.

Drilling the Core

The best position for drilling is the one that allows for the operator's optimum leverage and control. Tree coring is a strenuous activity, so the preferred working position for the operator is at stomach or chest height.

Coring involves removing a core sample from the trunk of a living tree using the increment borer. (See Figure 2.) The core is a segment of the cylindrical trunk, corresponding in length to the trunk radius (the core extends from the outer bark to the center of the trunk). To obtain the core that is best for aging the tree, drilling should occur at the lowest point on the trunk before the transition to the root zone (just above the root flair). This location contains the greatest number of rings because it is the oldest part of the tree. The higher up the tree trunk, the fewer the number of growth rings. If the core is taken too low in the root flair, the core will be difficult to read. In this transition zone, stem cells are modified as root cells and the signature of rings becomes diffused. Approximately three to four feet above ground level is ideal.

Once the drilling location is determined, the increment borer is positioned so it can reach the center of the trunk. After drilling, just beyond the center (or up to the end of the beeswax), the drill is reversed through one revolution to loosen the core. An extractor is then inserted to remove the core. The borer should be backed-out immediately so that proximate tissues will not swell. If swelling occurs, removing the borer will be difficult, if not impossible. The drill hole in the tree trunk should be left untreated.

If the tree radius is larger than the bit length of the increment borer, the center of the trunk cannot be reached in a single core. The age of the tree then must be interpolated. Age interpolation is done by determining what percentage of the radius the borer can penetrate, calculating the number of rings per inch in the extracted core, then interpolating how many rings the remaining uncored tissue will bear. The same interpolation must be applied when a tree trunk is hollow and a complete core cannot be extracted. It may be very difficult or impossible to remove the increment borer from a hollow tree trunk.

Determining Age

A core should extend a little beyond the center of the trunk to ensure that the centerpoint can be visually identified. Wetting the core with water or applying core dye may make the rings more legible. Consecutive growth rings at the center of the trunk (at the end of the core) appear as increasingly acute single "parentheses," which become inverted beyond the centerpoint. The midway point between the only "paired parentheses" marks the centerpoint; this is the reference point to either begin or end counting. Each growth ring represents one year of life.

Some species are easier to read than others, due to ring size, porosity of cells, presence of tannin, or chemical discoloration. In the more difficult cases it may be necessary to use staining treatments or dyes, magnifying lenses, and microscopes to visually enhance the rings for counting. These procedures may demand the expertise of a dendrochronologist.

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U.S. Department of the Interior
National Park Service
Cultural Resources
Park Historic Structures & Cultural Landscapes

Surveys

Introduction

To conduct the historical research and existing conditions investigations for a Cultural Landscape Report (CLR), several types of surveys may be needed. Generally, the two primary surveys required are a site survey and a topographic survey. The site survey graphically documents the findings of a site investigation. The topographic survey accurately records existing conditions and is often used to prepare a base plan. Other types of surveys provide site-specific information, such as legal boundaries and the location of utilities, and are conducted as needed, based on a CLR's project agreement. The following sections briefly describe relevant types of surveys, their purpose in a CLR, and the expertise required to perform them.

Site Survey

Documentation of the existing conditions of a cultural landscape requires both site research and a site survey. Site surveys are usually conducted by a historical landscape architect and require the recording of as much information as is pertinent to, and defined by, the project agreement.

Site surveys range from general reconnaissance and windshield surveys to detailed condition assessments for individual features. Site surveys require on-the-ground fieldwork to inventory and document existing landscape characteristics and associated features, such as vegetation, circulation, and land use. Also recorded are contemporary site functions and detailed technical information, as appropriate. The goal of the site survey is to record the landscape as objectively as possible.

The findings from the existing conditions investigation and site history are compared to identify the landscape characteristics and associated features that have significance based on National Register criteria. Significant landscape characteristics and associated features are those that have existed since a period of significance and have retained integrity.

Ideally, a site survey should be preceded by historical research so that the history and historic context of the landscape are understood. With this information, the type of landscape characteristics and associated features likely to be found can be anticipated. In preparing for a site survey, landscape boundaries should also be determined. If legal property lines are not known, a boundary or cadastral survey may be required before the site survey. During the site survey it is useful to have copies of a United States Geological Survey (USGS) map, a historic site map, an aerial photograph, historical photographs, and a topographic survey map.

The appearance of landscape characteristics and associated features, their physical condition, and visible changes that have occurred since the period(s) of significance, should be recorded in a format that is easily used for analysis and evaluation. A standard form may be prepared for recording observations, including a map for geographically referencing landscape characteristics and associated features, and space for writing notes and making sketches. Field work should include taking black and white photographs and color slides, as well as detailed notes and sketches.

A datalogger, a type of hand-held computer used as a part of a Global Positioning System, may be used to expedite the recording of site survey data. A datalogger can be digitally programmed with a “data-dictionary” or standard inventory form before the survey begins, allowing responses to be entered in the field. The recorded information can then be downloaded to a computer. (See *Landscape Lines 11: Global Positioning Systems*.)

The scheduling and number of site surveys is determined by park operational and program functions, and the management objectives and level of investigation outlined in the CLR project agreement. For example, management objectives may require more than one site survey to investigate the effect of seasonal changes in the existing conditions of a landscape. Operational or program functions may require site surveys to be scheduled at only off-season times of the year. A limited level of investigation may restrict the site investigation to one site survey. A site survey must be scheduled during the most revealing conditions for information gathering; for example, when wetlands are submerged rather than dry, when deciduous trees, shrubs, and herbaceous plants have foliage, when steep topography is traversable, or when the daily altitude and azimuth of the sun best reveals geologic formations in black and white photography.

Topographic Survey

A topographic survey (also called a location ground survey) is an accurate technique for recording the positions of all detectable landscape characteristics and associated features on or above grade (ground elevation). Landscape characteristics and associated features are recorded on a topographic survey map, which is then used to create a base plan for subsequent plan drawings, including period plans and existing conditions plans.

The topographic survey map shows contours at a prescribed interval and indicates spot elevations of peaks (high-points), depressions (low-points), and selected features. (See Figures 1 and 2.) To determine the position of landscape characteristics and associated features, the survey uses the horizontal and vertical position relative to an established "ground control" point. (See "Ground Control Survey" later in this text.) The types of features identified include building foundation outlines, edges of paving materials, fence and wall lines, surface utilities (poles, wires, transformers, and manhole covers), water features, vegetation masses and individual plants, roadway centerlines, top and bottom of walls, curbs, gutters, and steps.

The level of detail desired in a topographic survey, such as the contour interval and accuracy of spot elevations, must be specified. The specifications should indicate that a registered land surveyor or civil engineer will perform the topographic survey.

Unlike a site survey, a topographic survey does not record qualitative information about the appearance, physical condition, or relative

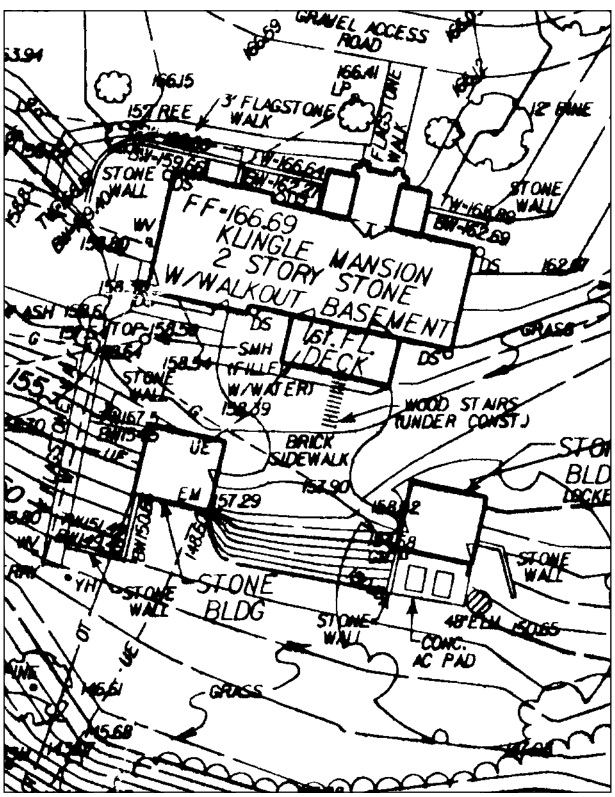

Figure 1. Typical portion of a topographic and utility survey for Klingle Mansion. Rock Creek Park. (NPS, 1995)

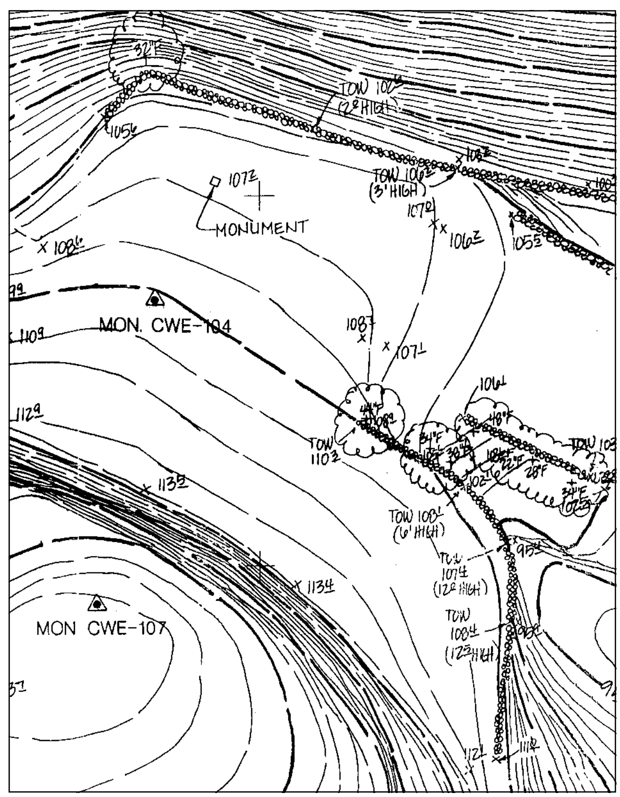

Figure 2. Typical portion of a topographic survey of English Camp. San Juan Island National Historical Park. (NPS, 1987)

importance of a cultural landscape. A site survey performed before a topographic survey can aid in selecting features to be recorded in a topographic survey. If a topographic survey is performed before a site survey, the resultant topographic survey map can be used during a site survey to document landscape characteristics and associated features.

Aerial photogrammetry is an alternative technique for obtaining topographic information through the use of ortho-rectified (horizontally and vertically georeferenced), aerial photographs. (See Figure 3.) However, because the topographic information is derived from a specialized photograph taken above ground level, the information is less refined than the information based on a traditional topographic survey. Aerial photogrammetry may be used to derive the overall topography of a large landscape, whereas a traditional topographic survey may be performed in landscape areas with a greater density of features. (See *Landscape Lines 5: Graphic Documentation*.)

The need and scope of a topographic survey and its scale depend on the type and size of the landscape, and the density of existing features. Also influencing the survey's scale are the

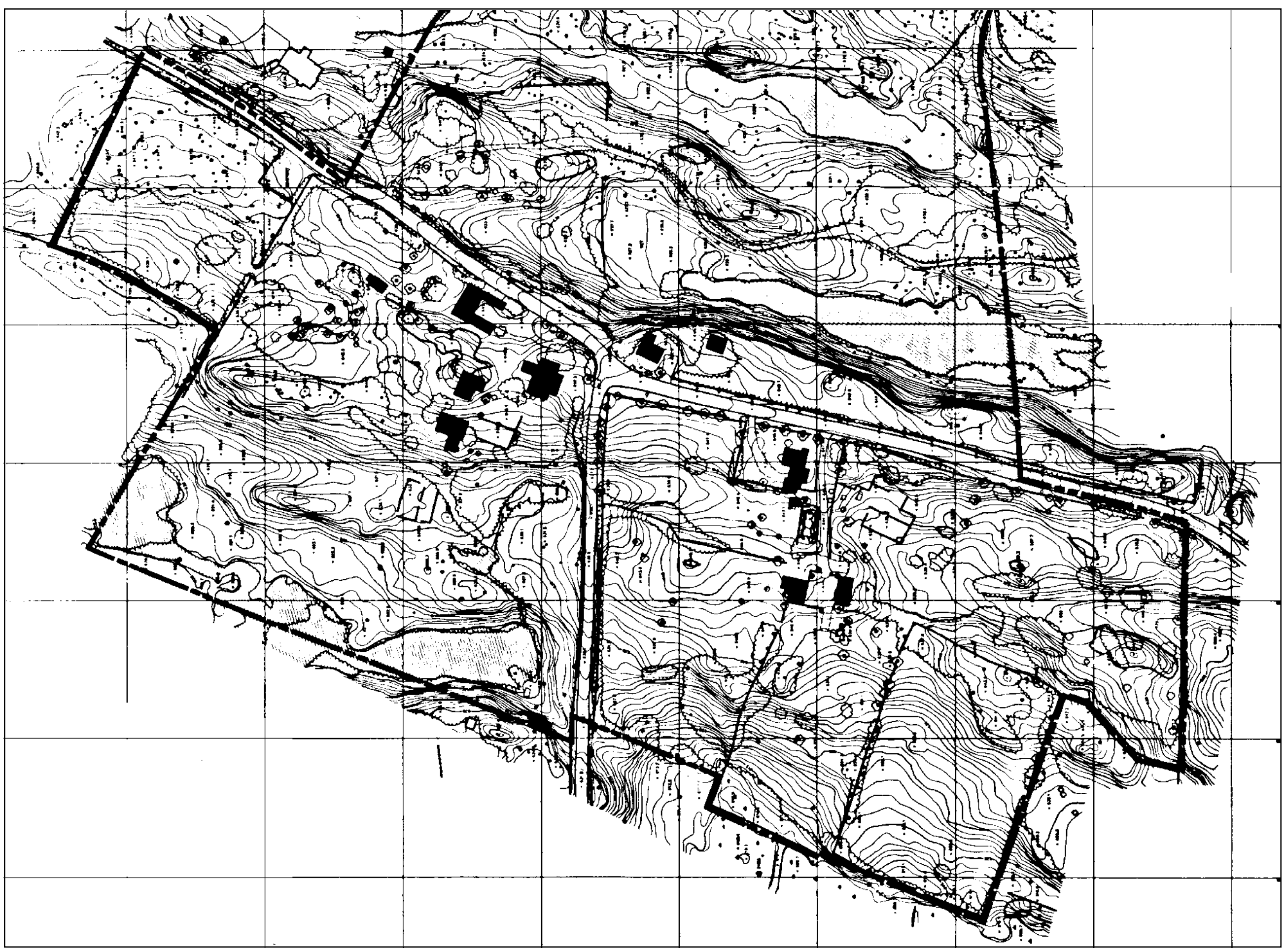

Figure 3. Topographic survey generated using computer aerial photogrammetry. Weir Farm National Historic Site. (NPS, 1992)

management objectives and the level of investigation for the CLR. Typically the scale of resolution of a USGS topographic quadrangle map at 1: 2400 is too small to accurately depict topographic contours on a 1: 200 base plan. For larger landscapes, a survey derived from aerial photogrammetry may be satisfactory and less expensive than a traditional topographic survey for obtaining landscape topographic data. If traditional methods are used to record the topography of an entire landscape, the costs can be reduced by using a larger contour interval for the overall landscape and a smaller (more detailed) contour interval for areas with a greater density of features.

Topographic information may be delivered as either a print document or electronic files (on disk). If the graphic documentation of a CLR is produced using computer aided design (CAD), it is best to receive that information from the surveyor as electronic files saved as a specified CAD format. This will make it easier to create a CAD base plan.

Ground Control Survey

A ground control survey establishes geographic control points, or benchmarks, to which all surveyed coordinates relate. The survey records horizontal and vertical ground control monuments already in place, or positions new ground control monuments where none exist.

A ground control survey is performed concurrently with other types of surveys to provide points of reference. If no benchmarks exist or their coordinates are unknown, establishing a ground control may be necessary before topographic, utility, or hydrographic surveys are conducted. Traditional survey equipment, such as a transit, theodolite, electronic distance meter, level, and measuring tape is used in this technique. (See Figure 4.) A survey grid is established from either the ground control monument or benchmark.

Utility Survey

A utility survey identifies and locates existing or abandoned utilities, above and below ground, and documents their horizontal and vertical positions relative to a ground control. A utility

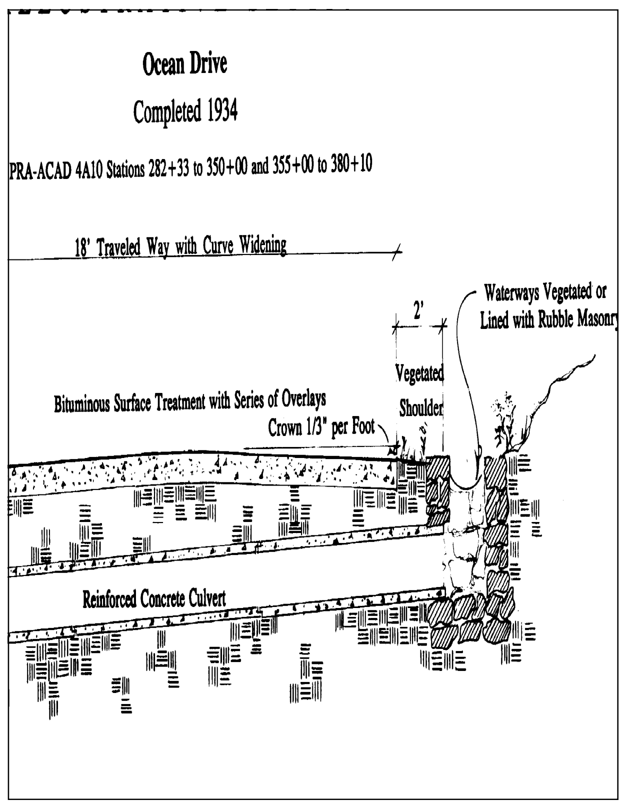

Figure 4. Surveyors using laser transits to perform a topographic survey. San Juan National Historical Park. (NPS, 1987)

survey is performed by a certified geophysical survey contractor and may involve identifying all utilities or just specified utilities.

Types of information recorded during a utility survey may include the type of utility, line diameter and location, materials of construction, and related structures or mechanical features. Geophysical survey equipment, such as ground penetrating radar, is used to detect the utilities. A utility survey also requires collection of all existing documentation from utility companies, although the documentation does not always include all site improvements that have occurred over time, such as the installation of, or modifications to, drainage, irrigation, and lighting systems.

Utility surveys contribute information to the development of the site history of a landscape, but the information is more likely to be useful in preparing construction drawings for work to be done as a result of a treatment plan. It may be more efficient to combine a utility survey with a topographic survey rather than contracting the two surveys separately.

Cadastral Survey

A cadastral survey, which can include and may be referred to as a property title search, involves researching the legal description of a property, including easements, former surveys and permits, and all other legal records related to the property through successive ownership. Such documents are found at the local courthouse, recorder of deeds office, tax assessors office, and any other jurisdictional offices.

The product of a cadastral survey may be a reference file containing copies of all legal documents related to the property, or a composite map that graphically presents legal information about the property. The survey may include a narrative or graphic description of the property in metes and bounds, a copy of the property plat, deeds, previous plats, permits or easements (such as utility easements), and ground control monuments. This information can be used to understand the historic and contemporary legal status of the property, to date certain features of the landscape shown or described in legal documents, and to identify any legal restrictions associated with the preservation and management of the landscape. (See Figure 5.) A historian, historical landscape architect, or other technical staff members can perform the survey.

Boundary Survey

A boundary survey establishes legal property lines by locating and identifying coordinates for the boundaries of a cultural landscape. Knowledge of property boundaries is important for performing other kinds of surveys, such as topographic and utility surveys. Ideally, the location of property boundaries should be known before a site survey is performed.

A registered land surveyor or civil engineer will conduct a boundary survey when no record of property lines exists, or when no legal boundary markers are found on the property. Boundary surveys are performed using traditional survey equipment and they are often conducted with topographic and cadastral

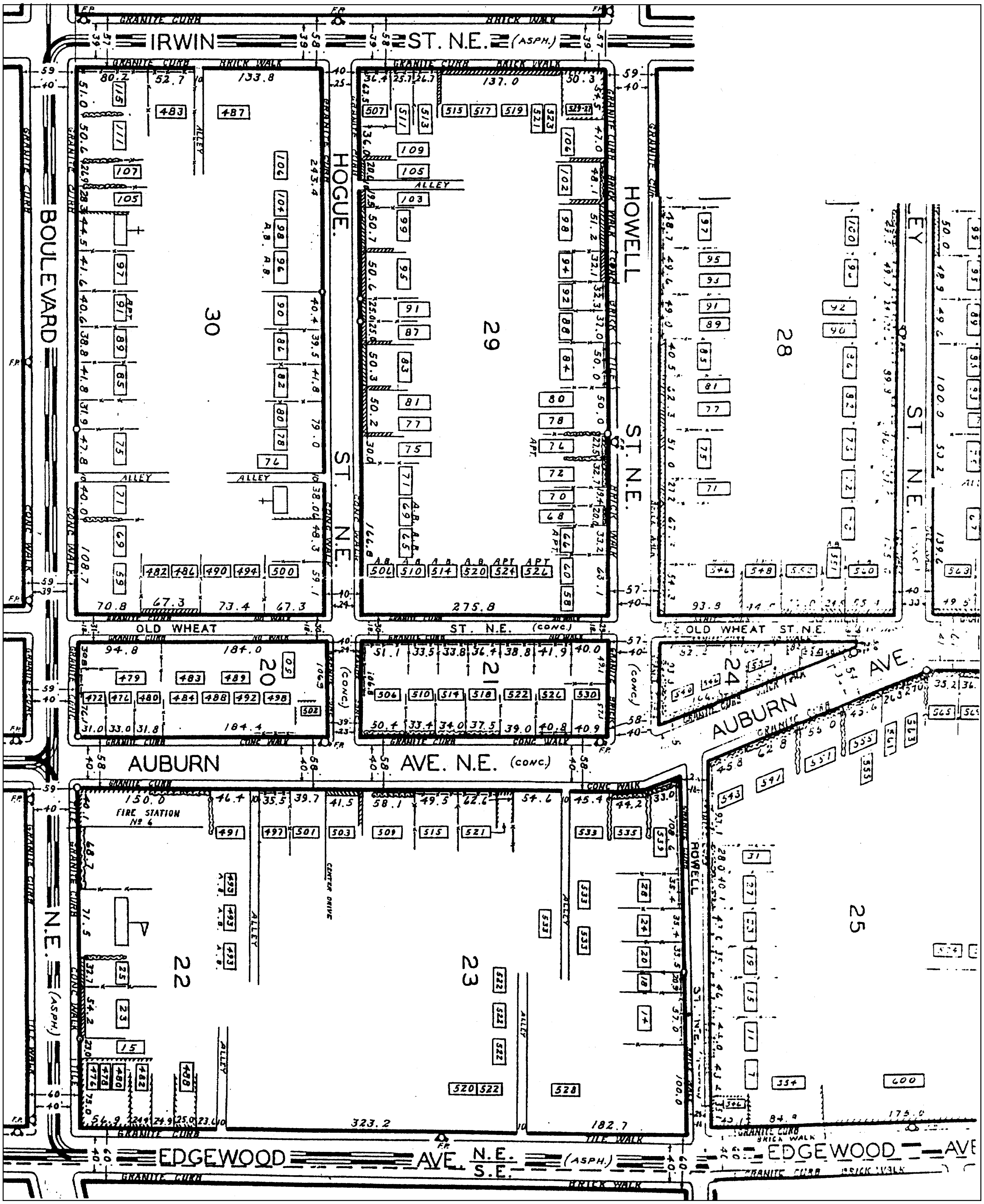

Figure 5. A historic cadastral survey map, performed by the Works Progress Administration in Atlanta. Map indicates the dwellings, property frontage, street width and alignment, and sidewalk conditions along Auburn Avenue. Martin Luther King, Jr., National Historic Site. (NPS, 1937)

surveys. The boundary survey may locate boundary markers and produce a narrative or graphic description of the property boundaries.

Hydrographic Survey

A hydrographic survey maps the submerged topography and configuration of natural or constructed water features and locates and identifies underwater objects. A certified geophysicist contractor often performs this survey with an archeologist.

Geophysical survey equipment mounted on a floating vessel is used to conduct the soundings of a hydrographic survey. A side scan sonar uses reflected acoustic energy to record topography and locate submerged objects. Soundings are taken at regular intervals along survey lines perpendicular to the shore line. Supplementary soundings are taken of objects or features of particular interest, which may include sewer outfalls, sedimentation areas, spillways, dams, and rock outcroppings. The horizontal and vertical location of soundings is based on established ground control points.

Topographic and location information is received by a recorder and can be printed as a survey map or stored as an electronic file.

A hydrographic survey may be limited to investigating to a specified depth of sediment or surface geology beneath certain water features. Sediment cores or rock samples are taken from the bottom of the water feature using boring equipment. Archeologists, geologists, geophysicists, and archeobotanists may analyze the samples to better understand the cultural and natural history of the water feature and its environment.

A hydrographic survey may be necessary as part of an existing conditions investigation to better understand the underwater qualities of a water feature. This may be particularly important when a water feature contributes to the significance of a landscape, when the presence of submerged cultural artifacts is suspected, and when the size, shape, or depth of a water feature has changed since a historic period and the cause or effect of this change needs to be understood.

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

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Geographic Information Systems

Introduction

Geographic Information Systems (GIS) are used to input, store, manipulate, analyze, and map spatial data. Although GIS is often considered a type of computer system, the first GIS systems involved manual techniques to perform some of the same functions now performed by computers. In the late 1960s, the noted landscape architect Ian McHarg popularized the technique of using transparent film map overlays to perform landscape analysis, about the time when computers were being configured with software for rudimentary mapping. Computers and GIS software have become much more sophisticated and can generate new data and maps far faster than is possible by hand. The utility of GIS in cultural landscape management is now universally recognized.

Perhaps because of its roots in landscape analysis, the analytical capabilities of GIS are considered among the most important uses of the technology. Given the necessary historic data, GIS can be a powerful tool for examining cultural landscape changes over time. For example, if a park has digitized historic land use maps that are appropriately georeferenced, GIS can overlay the historic data on current land use data to determine the magnitude and spatial extent of the changes. GIS can also model or predict various outcomes of different treatment alternatives presented in a Cultural Landscape Report (CLR).

Mapping, or cartographic output, is another important use of GIS, and is often valuable for more intuitive, less explicit, visual analysis. (See Figure 1.) For many years the quality of cartographic output available through GIS software could not equal that achieved with manual methods or computer aided drafting (CAD) systems. But this is no longer the case. Numerous mapping tools are now available in most GIS packages, including desktop systems, which offer the added benefit of being easy enough to learn and use for even non-GIS specialists.

GIS also offers an efficient method for storing and retrieving cultural landscape data. Unlike hardcopy maps, digital data does not decay over time (although the storage media may need to be updated), is easily copied with no loss of data quality, and requires little physical space. And while CAD systems may be just as effective in storing and retrieving spatial data, GIS is far superior for managing attribute information; that is, data describing spatial features, such as the year in which a building was constructed.

Applying GIS to Cultural Landscape Management

The National Park Service (NPS) has used GIS extensively to document and analyze cultural landscapes. The system can provide cartographic models analyzing the effect of visitor use and assist planners in developing alternatives for a visitor facility or placing roads and trails. GIS can also be used for viewshed analysis in which the computer, using a digital elevation model, generates a data layer of all areas visible from critical points within a park. This data layer can then be used in conjunction with data about neighboring properties to predict how local planning, zoning, and development proposals might impact park views.

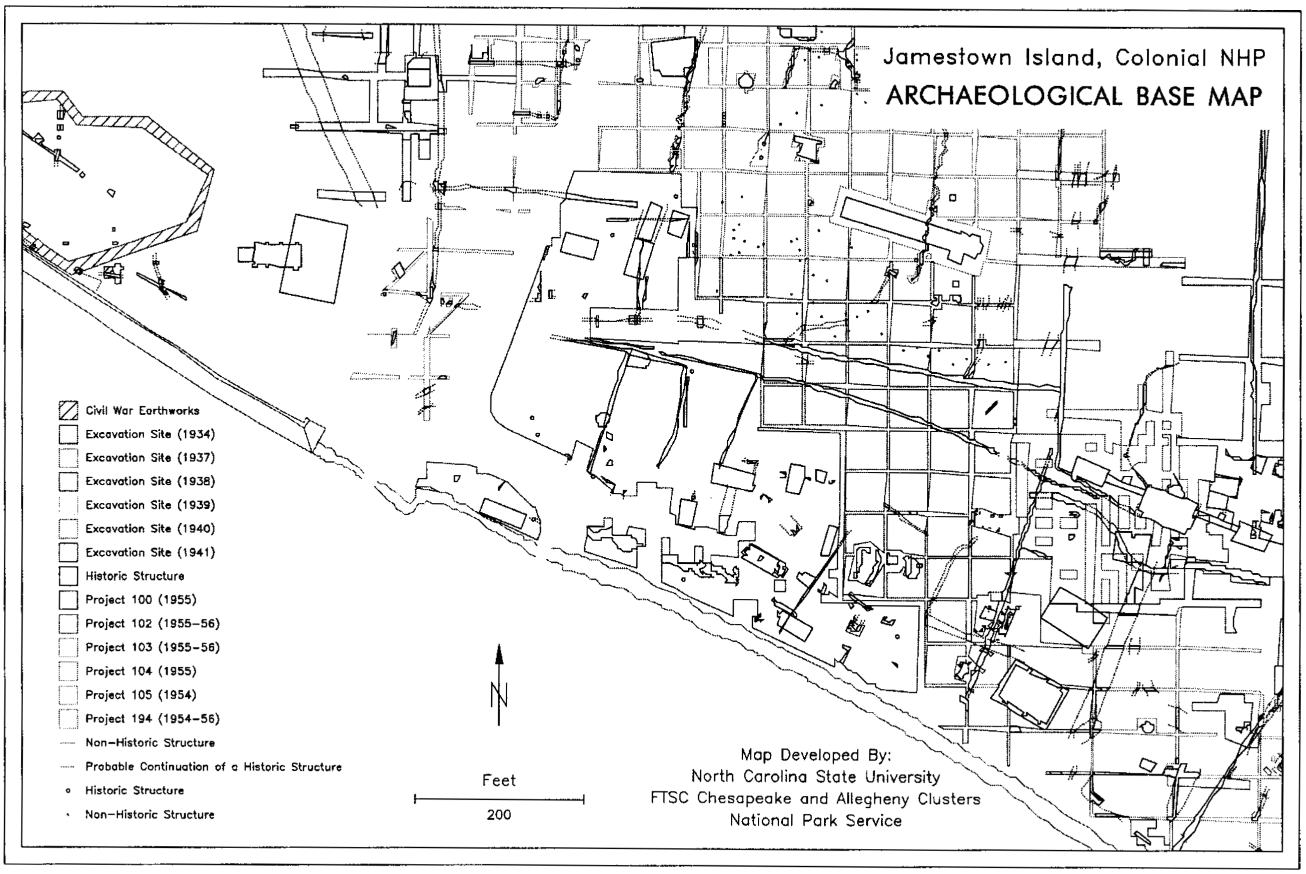

Figure 1. GIS map of an archeological survey. Jamestown National Historic Site. (Map courtesy of North Carolina State University, n.d.)

For example, Manassas National Battlefield Park used GIS to protect its viewshed. The park was able to simulate the effects of a proposed shopping mall and office development within view of the battlefield. This helped the NPS garner public support to oppose the development and eventually stop the project.

Inventories of park cultural features have often been facilitated by the use of GIS. (See Figure 2.) Using Global Positioning System (GPS) receivers, Richmond National Battlefield collected locations of all earthworks inside the park. The digital data was then entered directly into the park's database. The park also used GIS to inventory and monitor every tree in its historic orchard. Similar databases have been developed at many parks throughout the national park system.

Technical Considerations

Data

Data is a critical element in GIS and it represents the biggest investment of resources. None of the previously mentioned implementations of GIS in cultural landscape management would have been possible without good data. Poor or inadequate data can lead to erroneous results, which is often

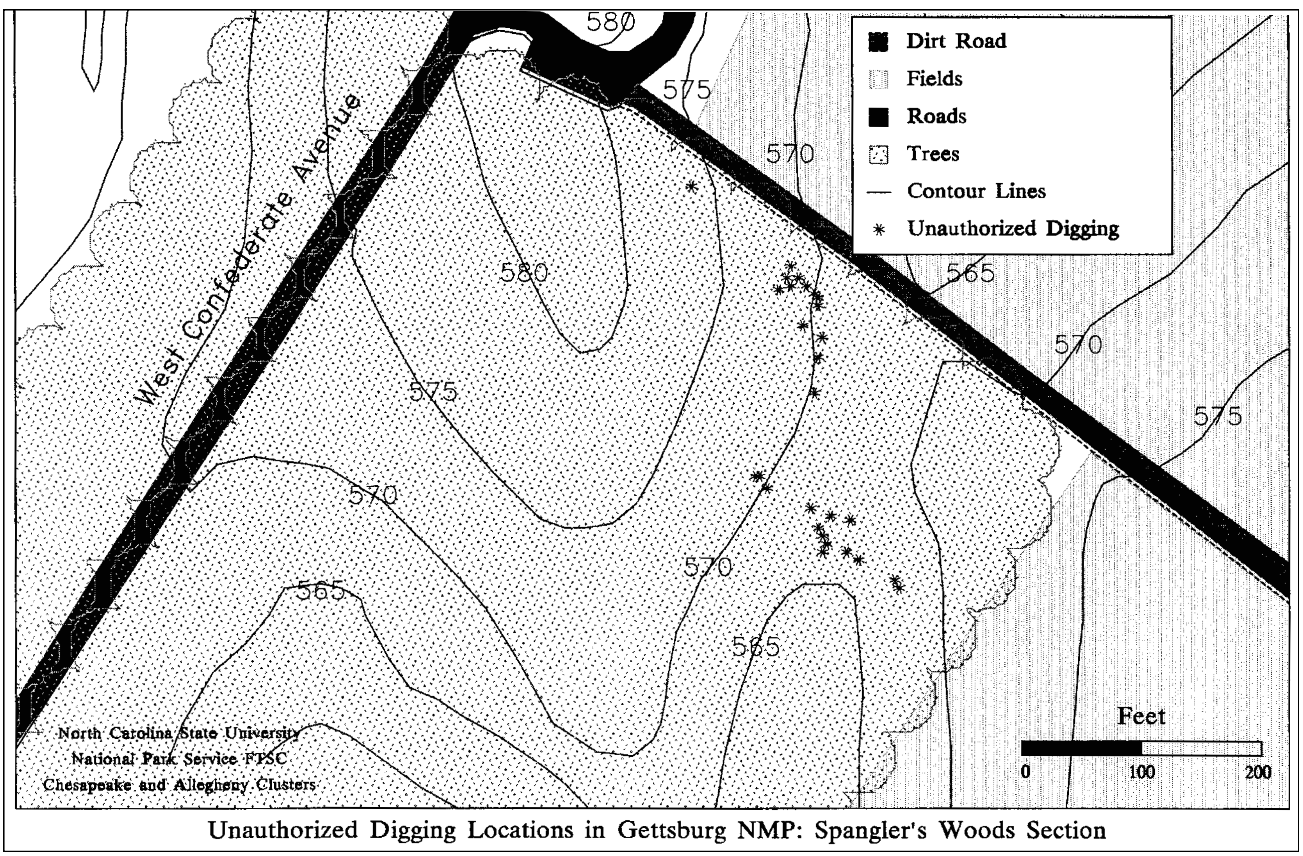

Figure 2. GIS plan of unauthorized digging in Spangler's Woods. The plan indicates topography, circulation, and vegetation, along with the location of digging. The plan was created using Atlas GIS and AutoCAD. Gettysburg National Military Park. (Plan courtesy of North Carolina State University, n.d.)

worse than having no data at all. Care must always be taken to use data that is appropriate for the task at hand.

Types of Data

There are two basic types of data used in GIS: vector and raster. Vector data includes points, lines, or polygons and has one set of attributes associated with each feature. Raster data is a continuous area broken into a regular grid of cells, each cell having a value (attribute) associated with it. For example, a soil grid might have the soil type found at each cell location. The main difference between vector and raster data is that vectors are feature-oriented and rasters are landscape-oriented. Discrete data, such as a structure, is better suited to a vector format, while continuous data, such as slope, is better suited to a raster format.

Spatial data is usually separated into layers. A layer represents a group of features with a common set of attributes. For instance, roads, trails, soils, and terrain aspect are all possible data layers. In some cases, seemingly different features can be combined into one layer if the attributes are general enough. For example, roads and trails can be combined into a single layer called transportation, with an attribute describing whether the feature is a road or a trail.

Obtaining Data

Although obtaining data has always been, and remains the single largest roadblock to developing successful GIS applications, the tools available for collecting data are more numerous and easier to use than ever before. Some of the more popular methods for cultural landscape data collection include the following:

- Global Positioning Systems (GPS). This involves the use of hand-held receivers that receive signals from satellites to determine the user's location on the ground. (See *Landscape Lines 11: Global Positioning Systems*.)
- Map scanning. Scanners have become a quick and efficient method for entering data from old maps and are much faster than hand-digitizing on a digitizing table, although sometimes the latter method must still be used. (See Figures 3 and 4.) A scanned image is converted from a raster format to a line format through vectoring software.
- Digital orthophotography. This is aerial imagery in which all the distortion due to terrain, camera angle, etc., is removed so that it is essentially a photo map. Many software packages allow "heads up" digitizing on a computer monitor with the digital orthophoto image displayed as a backdrop.

In the next few years the development of very detailed satellite imagery may become a useful source of data for cultural landscape management.

Storing Data

All georeferenced data must be stored in a coordinate system and datum. Furthermore, to use two or more data sets together, they must be stored in the same coordinate system and datum. There are many coordinate systems available, including latitude/longitude and state plane, but the one most commonly employed within the NPS is the Universal Transverse Mercator (UTM) system. This coordinate system is based on a series of Transverse

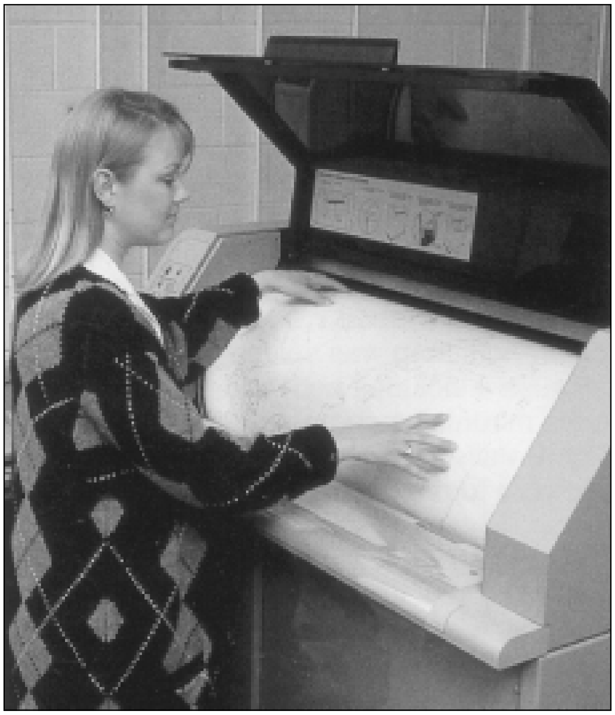

Figure 3. A large scanning device converts map information to digital form. (USGS, 1995)

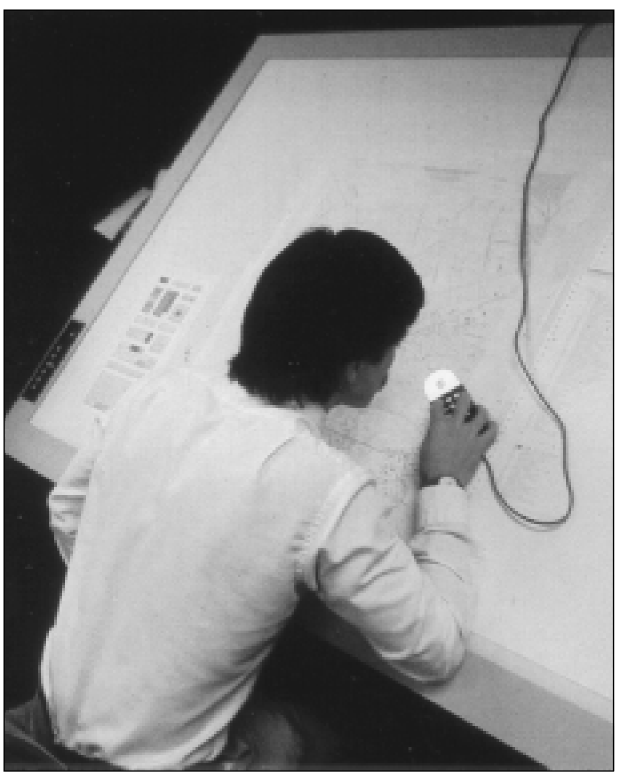

Figure 4. Digitizing converts map information to digital form using a hand-held mouse. (USGS, 1995)

Mercator projections, each one having its own set of parameters that control how the spatial coordinates are displayed. There are 60 zones encircling the earth corresponding to these projections, each zone being six degrees of longitude in width. Since each zone has its own Transverse Mercator projection and set of associated parameters, all data to be used together must be stored in the same UTM zone.

There are two datums in widespread use around the agency: North American Datum of 1927 (NAD27) and North American Datum of 1983 (NAD83). The latter is a more accurate description of the earth's surface and NPS guidelines recommend that data should be placed in this datum whenever possible. However, since many agencies still use NAD27, there is often the practical consideration of converting large amounts of data obtained from other sources to NAD83. Again, the most important concern is that all data to be used together be in the same datum.

Resolution, Accuracy, and Scale

Other issues pertaining to data include resolution, accuracy, and scale. Although these terms are not synonymous, they are often used interchangeably, sometimes leading to confusion. Resolution refers to the degree of precision in a data set; that is, how finely described the data is. In a raster data set, resolution is the same as the cell size. In a vector data set, resolution can be thought of in terms of how closely the shape points in a line or polygon are spaced. (For a straight line, no more than two points are needed to describe it precisely.)

Accuracy describes how close a feature in a data set is to its real location on the ground. This is easier to do with vector data than with raster data. Because raster data is not feature-based, it is often difficult to discern errors in spatial accuracy from errors in attribute accuracy unless the entire grid has been shifted, or rotated from its true location.

Finally, scale is a nearly meaningless term when applied to digital data storage. Digital data is essentially scaleless until it is displayed, and even then its display scale can be easily changed. When performing spatial analysis or creating cartographic output, the most important considerations are the resolution and accuracy of the data. Data presented at too low a resolution will appear crude and blocky when displayed at a large scale. Since cultural landscape management often deals with small areas displayed at large scales, it is often necessary to have very high resolution data.

A good source for information about the suitability of a data set for a particular need is the layer's metadata. Metadata is information about data. It should include such things as the source of the data, estimated accuracy, and time from which the data was collected. Metadata can be stored in many forms, ranging from a simple text file for an entire data layer to complex attribute fields describing each feature in a layer.

Hardware and Software

When the NPS began heavily promoting the use of GIS in the mid-1980s, there were few powerful software packages available for personal computers (PCs). Consequently, most parks turned to workstation computers running the UNIX operating system. Early GIS software included GRASS, a package developed by the United States Army Corps of Engineers, but most of these systems are now running Arc/Info, a proprietary package from the Environmental Systems Research Institute, Inc. (ESRI). The last few years have seen the rise of GIS software for PCs, primarily ArcView, another product from ESRI. Desktop GIS is seen by many in the agency as the best way to get non-GIS specialists actively involved in using spatial data for analysis and mapping. Many opportunities exist for cultural resource managers to receive training for desktop GIS. Contact a regional or cluster GIS coordinator for information.

Where to Go For Assistance

Within the NPS there are many sources for obtaining further technical assistance related to GIS. Many parks have staff who are knowledgeable in the use of GIS and who can respond to inquiries. Many regions and clusters have field technical support centers that provide GIS services. In addition, there are regional and cluster GIS coordinators throughout the NPS who can provide technical guidance and direct individuals to appropriate resources. Their names and phone numbers, along with other agency-related GIS information, are available on the NPS GIS world wide web site (www.nps.gov). For general program information, the national GIS coordinator can be reached at 303-969-2964. The national GIS program office also has a cooperative agreement with North Carolina State University to provide consultation and training services. Finally, the NPS Cultural Resource GIS (CRGIS) Facility of the Heritage Preservation Services Program in Washington provides GIS training and data collection service.

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Global Positioning Systems

Introduction

In little more than a decade, the Global Positioning System (GPS) has revolutionized the surveying and mapping sciences. Until the early 1980s, the surveyor's transit had been the primary tool for accurately locating one's position on the earth's surface. This equipment takes months to learn to use properly, and years are required to master the technique sufficiently to become a licensed surveyor. With relatively little training a novice GPS user can now record his or her location to within a few meters.

GPS was developed by the United States Department of Defense (DOD) for military purposes. Although DOD believed that there would be civilian use of the system, it was never anticipated that nonmilitary applications would quickly surpass defense uses in volume and diversity. The system's foundation is a constellation of satellites known as NAVSTAR. These satellites continually send out signals that are picked up by GPS receivers and used to calculate a receiver's location in three-dimensional space. This information is then translated to any of several geographic coordinate systems, such as latitude and longitude or Universal Transverse Mercator (UTM).

There are several types of GPS receivers that are useful for different applications. (See Figure 1.) Military grade receivers, which can decode a special noncivilian signal called precise positioning system (PPS), are very helpful for navigating (within about 10 meters) to known sites. Normal civilian GPS receivers, which use coarse acquisition (CA) signals, are better suited to mapping applications. After data is collected in the field with these receivers, accuracy can be greatly improved (to approximately two to seven meters) through a process called differential correction (discussed later in this section). Some GPS receivers are capable of collecting data in either

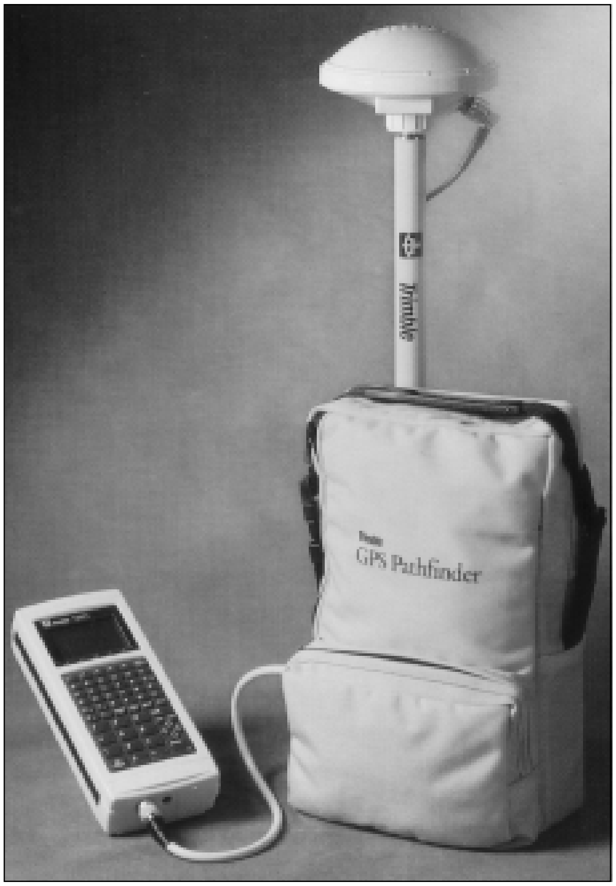

Figure 1. Catalog photograph of a GPS rover unit. (Photograph courtesy of Trimble Navigation, Inc., 1995)

PPS or CA mode. There are also receivers specifically designed for extremely high-accuracy surveying. Most of these units can deliver coordinates accurate to within a centimeter. The most precise GPS receivers have even been used to detect motion in the earth's crust to within a millimeter.

Applying GPS to Cultural Landscape Management

In association with a Geographic Information System (GIS), GPS is an expedient and accurate tool for verifying the location of specific landscape characteristics and associated features to identify UTM coordinates. The coordinates can, in turn, be used to verify georeferenced spatial data in GIS and aerial photographs. A GPS unit with an accuracy to within nine feet horizontally will most often be used to locate cultural landscape characteristics and associated features on a 1 inch = 20 feet base map. A survey grade GPS unit is more likely to be used when locating features on a 1 inch = 20 feet base map.

Technical Considerations

When a GPS receiver picks up signals from four satellites simultaneously, it can calculate a three-dimensional position for the user. When GPS first came into use, the NAVSTAR satellite system was incomplete. As a result, it was always necessary to plan data collection times to coincide with maximum local satellite visibility to ensure that four satellite signals would be detected by the receiver (often referred to as "mission planning"). Now satellite coverage is available nearly continuously throughout the world, and data collection can be performed almost anywhere at any time. However, there can still be problems receiving a sufficient number of satellite signals in deep canyons or under heavy canopy. Under these conditions, mission planning may still be advisable.

Accounting for Signal Error

Because DOD wants to retain a strategic advantage over other countries' military organizations, it introduces a deliberate random error into the civilian satellite signals called selective availability, or SA. This error makes it necessary to take extra measures to obtain coordinate locations more accurate than 100 meters.

The most common method of eliminating SA-introduced error is known as post-processed differential correction. This technique requires that a second GPS receiver, known as a base station, be established at a known location, preferably over a survey control monument or other such site. The base station must be collecting data from the same satellites at the same time as the rover unit. As the base station collects data recording its location, the coordinates recorded wander randomly due to the SA error. When field collection is complete, software is used to apply a set of corrections to the base station's data, based on its known, true location. These same corrections are then applied to the corresponding rover data. In this manner, data that was no more accurate than 100 meters can be made as close as two meters or even better. To ensure that the base station and rover unit "see" the same satellites, it is usually recommended that the rover unit be no farther than 500 kilometers from the base station, and that no signals from satellites lower than a certain level above the horizon (usually 15 degrees) be used in calculating rover positions.

Another method of eliminating SA error is real-time differential correction. The process is similar to post-processed differential correction, except that the base station has a radio beacon that transmits its corrections to the rover unit as data is collected. The rover unit is equipped with a radio receiver to pick up the correction signals, and an internal computer to calculate the corrected coordinates.

Military grade receivers that use PPS to record their locations avoid SA altogether. To prevent use by foreign countries, however, PPS is a coded signal that can only be read by a receiver properly configured to decode it. Through an agreement between the departments of Interior and Defense, the NPS has access to purchase and use receivers capable of decoding PPS signals. Most of the receivers of this type procured to date by NPS are Rockwell PLRGs (nicknamed, "pluggers").

Satellite Visibility Constraints

Sometimes, even when more than four satellites are visible, it is not possible for the GPS receiver to get an accurate reading for its location. This is due to other sources of error in the system, such as atmospheric and ionosphere effects on the satellite signals, and errors in the internal timing mechanisms in the receivers. Most of this error can be minimized when the satellites being used to calculate a position are in a desirable geometrical configuration. However, often the angles between the satellites are too shallow or too near 180 degrees to help eliminate enough of these other errors to produce a good positional reading. This problem is known as position dilution of precision (PDOP), and can be quite vexing in less than ideal terrain or canopy situations. Often a GPS user may be having a difficult time just trying to get enough satellites, only to find that when a fourth signal kicks in, it results in a reading with much too high a PDOP to be acceptable for mapping. Sometimes the GPS user can move to a more favorable location and record an "offset" distance to the desired point, but unfortunately there is often nothing that can be done other than

 

Figure 2. GPS operators and equipment in the field. (Photographs courtesy of Trimble Navigation, Inc., 1995)

to wait for a lower PDOP reading. This is why it is still important to use mission planning software when collecting data under difficult satellite visibility conditions.

Using a Data Dictionary

As data is collected by the user (see Figure 2), the points, lines, and/or polygons being recorded are stored in the receiver's data logger. When collecting data for input into a GIS it is often useful to have a list of the types of features to be collected, and information about them, stored in the data logger. This list is known as a data dictionary. As an example, if data about a cultural landscape were being collected with a GPS receiver, the data dictionary might contain a field for a unique feature identifier number, and another field containing the type of feature, such as building, fence, or rock wall. The user can select the appropriate codes as each feature is collected, saving time and confusion trying to remember which feature was which after the data has been entered into a GIS. (See *Landscape Lines 10: Geographic Information Systems*.)

Where to Go For Assistance

Within the NPS there are many sources for obtaining technical assistance on GPS. Many parks have staff who are knowledgeable about using GPS and who can respond to inquiries. In addition, many regions and clusters have field technical support centers that provide GPS services. There are regional and cluster GIS coordinators throughout the agency who can provide technical guidance and direct individuals to appropriate resources. The coordinators' names and phone numbers, along with other agency-related GIS information, are available on the NPS GIS world wide web site (www.nps.gov). For general program information, the national GPS coordinator can be reached at 505-988-6710. Finally, the NPS Cultural Resource GIS (CRGIS) Facility of the Heritage Preservation Services Program provides GPS training and data collection service.

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Treatment of Plant Features

Introduction

Virtually all cultural landscapes are influenced by and depend on natural resources and processes. In many ways, the dynamic qualities inherent in natural systems differentiate cultural landscapes from other cultural resources. Plant and animal communities associated with human settlement and use are considered "biotic cultural resources." These can reflect social, functional, economic, ornamental, or traditional uses of the land.

Vegetation is considered a biotic cultural resource when it can be linked to an established period of significance and adds to the overall significance of the landscape. Vegetation is a common landscape characteristic associated with the historical development of a cultural landscape or resulting from cultural activities on the land. Vegetation has a cycle of growth, change, and eventual death and often requires constant management and intervention to retain its overall structure and appearance. The features associated with vegetation are recognized as either a system (such as a forest or wetland), an aggregation of plants (such as a hedge or orchard), or an individual plant (such as a tree or shrub), all of which have distinct, unique, or noteworthy characteristics in a landscape.

It is important to understand the degree to which change contributes to or compromises the historic character of a cultural landscape, and the way in which natural cycles influence the ecological processes within a landscape. For example, preservation of a single tree in a designed landscape may be critical to the overall integrity of the design. In contrast, an entire woodlot may have significance, in which case it is necessary to preserve the ecological processes of the system rather than an individual tree. Determining a treatment strategy for the vegetation within a cultural landscape involves consultation with appropriate natural resource professionals.

Figure 1. Planted in the early nineteenth century, this Ginko Tree is an individual plant feature. Vanderbilt Mansion National Historic Site. (NPS, 1995)

This text describes the process of historical research, existing conditions investigation, and analysis and evaluation conducted during the preparation of a Cultural Landscape Report (CLR) as it relates to treating vegetation, in particular individual plants and aggregations of plants. Individual plants are solitary (see Figure 1), whereas an aggregation of plants is a physical grouping of multiple individuals of the same plant type, such as a hedge, allee, bosk, and orchard. The aggregation of plants shares the same aesthestic or functional role in the landscape because of the collective arrangement of plants in space. In most cases, an aggregation of plants can be treated similarly to an individual plant because its composition is uniform. (See Figures 2 and 3.)

This text emphasizes the need to determine, during analysis and evaluation, how the features of vegetation contribute to the significance of a landscape. This is particularly important in selecting a primary treatment for a landscape and in implementing treatment and management of plants. This text also discusses special considerations for treatment activities, including replacement of declining vegetation. Because vegetation is living material, plant replacement is an inevitable activity regardless of the treatment. Throughout this text, the term "plant features" refers to both individual plants and aggregations of plants that contribute to the significance of a cultural landscape and retain integrity.

Biotic Cultural Resource Management

The treatment and management of biotic cultural resources was first discussed in Ian Firth's 1985 study: *Biotic Cultural Resources: Management Considerations for Historic Districts in the National Park System, Southeast Region*. The treatment and management of agricultural landscapes, battlefields, and private estates in the Southeast are described using the extant plants and animals associated with historic uses of the land. The document emphasizes the need to preserve biotic cultural resources as a historic record and a living connection with the past, as well as abiotic features that convey the historic character and significance of a landscape.

In a discussion of the treatment of biotic cultural resources in accordance with the Secretary of the Interior's Standards, the 1985 study illustrates the unique challenges in preserving biotic, rather than abiotic features. Biotic features have an inherently dynamic nature, that gives rise to such challenges as managing the size of livestock herds, the need to sow and harvest agricultural crops, resisting ecological succession in a now unglazed pasture, and interpreting the role of a replanted seedling forest in the maneuvers of a Civil War battle, despite the slow pace of restoration. Referring to the attempt to restore biotic cultural resources to depict the appearance of a historic period, Ian Firth states:

> *A repetition of a historic scene composed of several plant and animal communities requires a conjunction of all biotic cycles in their appropriate phases. Therefore, like Halley's Comet, a historic scene may return perhaps once in a lifetime.*

The treatment and management of biotic cultural resources must anticipate and plan for the natural process of change. It must establish acceptable parameters for change and manage the appearance of biotic resources within those parameters.

Figure 2. These evergreen shrub hedges represent an aggregation of plants. Eugene O'Neill National Historic Site. (NPS, 1944)

Figure 3. This birch allee is an aggregation of plants. Saint-Gaudens National Historic Site. (NPS, 1966)

Plant Features and the CLR

Historical Research

Historical research is performed while preparing a CLR to produce the site history narrative. The narrative describes and illustrates the development and appearance of a landscape through successive historic periods. When vegetation is a characteristic associated with the historic development of a landscape, research includes identifying the historic location, appearance, and identity of plant features during each relevant period. (See Figures 4 and 5.)

Sources for historic research of plants include: historic maintenance logs, agricultural records, personal letters, diaries and journals, receipts of plant purchases, historic photographs (including historic aerial photographs), paintings, sketches, planting plans, and oral histories. (See Figure 6.)

Figure 4. The historic record for Rim Village indicated that large trees were selected from other areas in the park, root pruned, and transplanted to the Rim as part of the designed landscape. Crater Lake National Park. (NPS, 1933)

The identification of plants from historic documentation sources, rather than from living or herbarium specimens, is a special technique that may require a plant taxonomist. Some site investigation techniques, such as archeobotanical analysis (the analysis of pollen, phytoliths, and macroflora) and tree coring can also yield information on the existence of plants in historic periods.

Existing Conditions Investigation

The existing conditions investigation provides an understanding of the present conditions of a cultural landscape. The investigation involves both a site survey and site research to identify and document the location and condition of all extant landscape characteristics and associated features, including vegetation and plant features. (See Figure 7.) Based on the site survey and research,

Figure 5. Research illustrated that large conifers were moved and planted at Rim Village in the 1930s to create a "natural appearing landscape." Crater Lake National Park. (NPS, 1933)

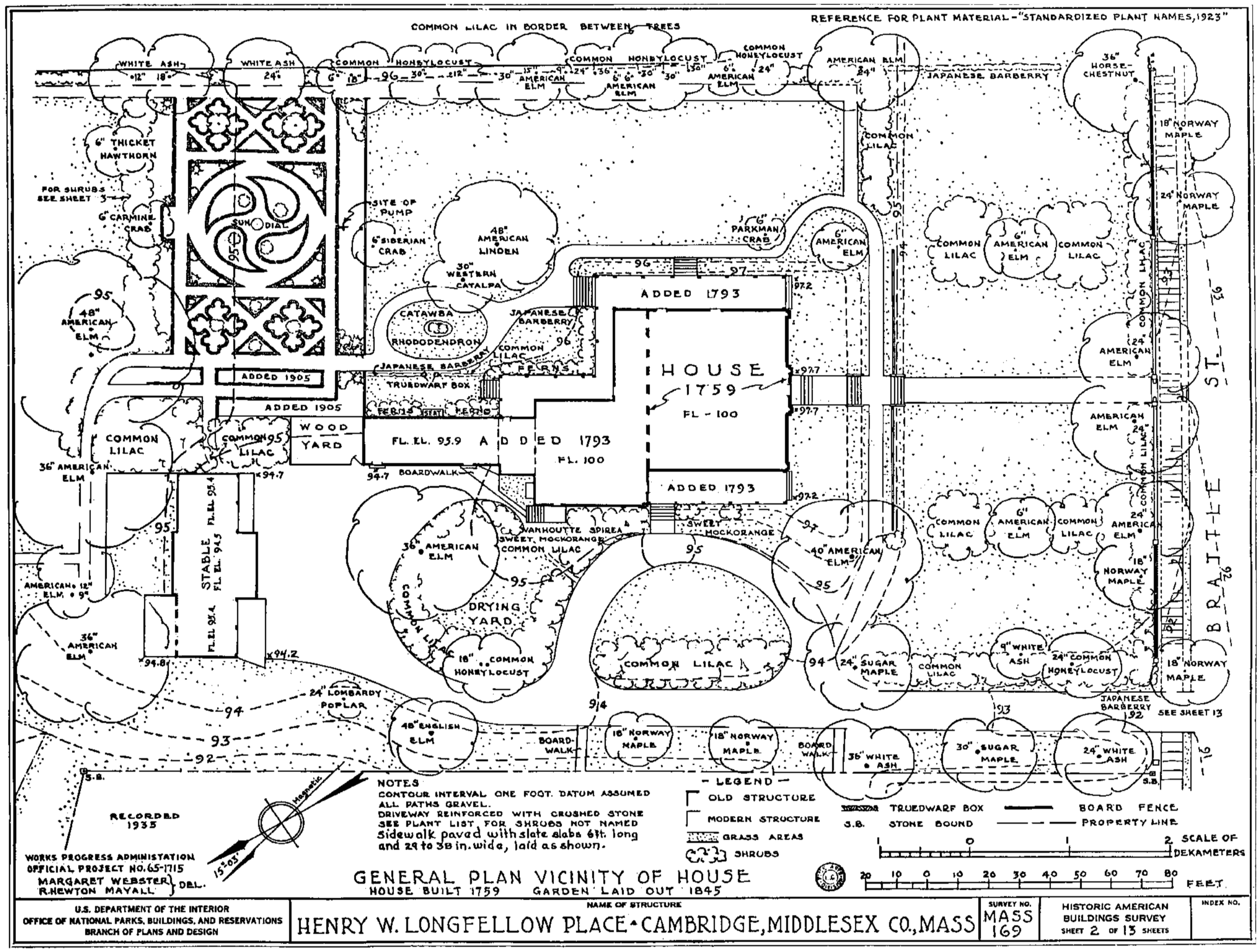


Figure 6. A Historic American Building Survey (HABS) plan of Longfellow Place. The early HABS survey of the landscape identifies plant names and is a valuable source for historic plant information. Longfellow National Historic Site. (NPS, 1935)

plant features may be graphically documented with line drawings (sketches, measured sections, and plans), black and white photographs, color slides, and videography. (See Figure 8.)

Information on the identity and condition of existing plants also may be gathered during a plant inventory. A plant inventory is a specialized type of site survey that focuses exclusively on existing plants. A plant inventory identifies and locates all existing plants, regardless of whether they are known to be associated with a landscape's period of significance.

Information about contemporary introductions of plants, or plant recolonizations, is particularly important in treating and managing plants. If plants cannot be accurately identified in the field (the plant is an unknown variety or cultivar), it may be necessary to make a herbarium specimen with a representative sample from the plant. A botanist or horticulturist can later identify the representative sample. Site investigation techniques used to identify and map existing plant features may include aerial photograph analysis, aerial photogrammetric surveys, topographic surveys (which locate vegetation masses and individual plants),

Figure 7. Field documentation of plants at Lake Crescent Lodge. Olympic National Park. (NPS, 1984)

Global Positioning System with a Geographic Information System, and hydrographic surveys for submerged vegetation.

Analysis and Evaluation

The analysis and evaluation performed while preparing a CLR compares the findings of the site history with the existing conditions investigation to determine the type and extent of landscape change since a site's earliest historic period. The analysis and evaluation identifies the extant landscape characteristics and associated features and defines their contribution to a landscape's significance. If vegetation is a landscape characteristic, plant features are analyzed to determine their integrity and association with the landscape's significance.

In analyzing and evaluating vegetation and plant features, the process must acknowledge the dynamic nature of living organisms; plant features will have changed in appearance since the historic period(s). Therefore, evaluating the integrity of plant features involves determining whether a plant's contemporary appearance is evidence of an association with the significance of a landscape. Plant features may retain integrity if the historic type, distribution, size, and structure are still recognizable.

Plant features are evaluated according to National Register criteria in the same manner as abiotic features of the landscape. Plant features may be associated with a significant event, person, design, or function, or have the potential to yield information about the history or prehistory of a landscape. But generally, plant features are not significant independent of their landscape context; rather, they contribute to the significance of the entire cultural landscape. For example, the fruit trees of Adams National Historic Site in Massachusetts are associated with the lives of John and Abigail Adams (criterion A). The woods and fields of Chickamauga-Chattanooga National Military Park in Georgia are associated with the event of a Civil War battle. The woods influenced the pattern of maneuvers and conduct of the battle in the landscape in 1863 (criterion B). The indigenous eastern woodland of Prospect Park, Brooklyn, New York is associated with the picturesque design of the landscape. The design was carved from the existing woods by Olmsted and Vaux in 1868 (criterion C). The filbert trees of the 75-acre, 90-year-old orchard of Dorris Ranch in Oregon have yielded information about the early cultivation and breeding of filberts in the

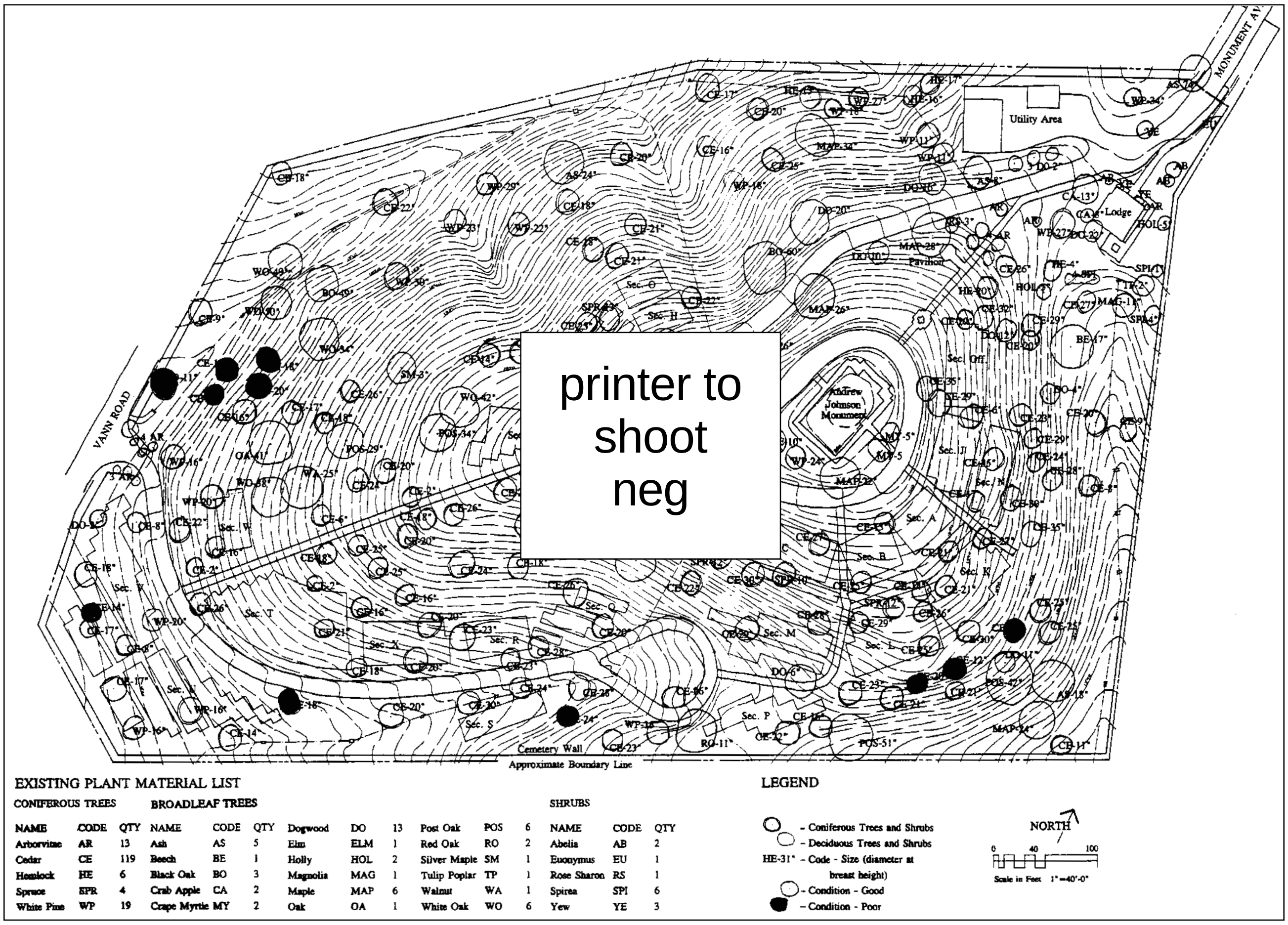


Figure 8. This vegetation assessment plan identifies broadleaf and coniferous trees, and indicates their common name, quantity, diameter at breast height, and physical condition. Andrew Johnson National Cemetery. (NPS, 1992)

United States in their experimental planting arrangements, spacing, culture, and genetic composition (criterion D).

An understanding of the significance of plant features in a landscape is a critical factor in determining how it should be managed. For example, the fruit trees at the Adams National Historic Site were one of the reasons John and Abigail purchased the property south of Boston in 1787, and subsequent generations of the Adams family continued to plant and experiment with the fruit trees. The orchard is an important feature in light of its association with the Adams family. The type and variety of plant material may also contribute to the significance of a cultural landscape. An inventory of the orchards at the Moses Cone Estate on the Blue Ridge Parkway uncovered several unusual varieties of apples that date from the turn of the century. These historic cultivars are part of the historic record at this site, and because of their rarity these cultivars should be genetically preserved within the landscape (through maintenance and propagation for genetic authenticity).

The importance of the plant material may also be derived from its function in the landscape as part of a particular design or land use practice rather than from its association or unique genetic makeup. At Eleanor Roosevelt's rural retreat, Val-Kill (now Eleanor Roosevelt National Historic Site), in Hyde Park, New York, a line of red pines was an effective screen between the drive and the stone cottage during the 1950s. As the pines matured, the lower limbs were lost with a resulting loss of screening. To regain the function of the pine hedge as a landscape feature, the trees were removed and replaced in-kind. A decision was made that the significance of the red pines as a hedge in the landscape was more important than the fact that they were original plantings from the time when Mrs. Roosevelt lived on the property. Similarly, in vernacular landscapes, such as an agricultural district, perpetuation of a particular crop may not be as important as the retention of the overall landscape patterns.

Treatment

The treatment section in a CLR either states the primary treatment (if already known through park planning), proposes a primary treatment (preservation, rehabilitation, restoration, or reconstruction), or proposes treatment alternatives for a cultural landscape. Landscape character areas and management zones may also be discussed in the treatment section of a CLR.

Determining the primary treatment (the goal for the overall appearance of the landscape) for a cultural landscape is influenced by the following:

- integrity and condition of the biotic and abiotic features
- management objectives for the park
- type of cultural landscape and significance
- contemporary use of the landscape

Treatment is guided by policy, guidelines, and standards contained within *NPS Management Policies, Cultural Resource Management Guideline*, and *The Secretary of the Interior Standards for Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. These documents identify four treatments for cultural landscapes: preservation, rehabilitation, restoration, and reconstruction.

Plant features are addressed in relation to the primary treatment for a cultural landscape, along with designated character areas or management zones. For example, the CLR for the Van Buren National Historic Site in New York proposes restoration as the primary treatment, and treatment recommendations include replanting the fruit orchards that existed during Van Buren's occupation. The CLR for the Frederick Law Olmsted Site in Brookline, Massachusetts proposes restoration of the landscape to its appearance circa1930 to illustrate the landscape designed and developed by Frederick Law Olmsted, Sr. and perpetuated by his sons, John Charles and Frederick Law Olmsted, Jr. As a result, the CLR prescribes removing over 200 nonhistoric trees and shrubs and introducing over 800 trees, shrubs, and vines based on the character of the landscape in circa1930. (See Figure 9.)

All treatments for a cultural landscape are represented by a sequence of activities given in order of increasing physical intervention: protect and maintain, repair, replace, design for missing features, and design compatible alterations and

Figure 9. Photographs showing before and after the clearing of recolonizing vegetation. This activity was part of a restoration treatment plan. Frederick Law Olmsted National Historic Site. (NPS, 1994)

additions. The sequence first establishes that significant features, such as plant features, are preserved by regular maintenance and by protecting them from adverse influences. The sequence promotes repairing before replacing deteriorated features, requires substantiated design for replacing missing features, and asserts that alterations and additions be compatible with the historic character of the landscape. The frequency with which various activities occur varies with a given treatment. For example, the majority of activities in preservation involve protection, maintenance, and repair, while restoration involves more replacement and design for missing features.

Special Considerations for Treatment Activities

Treatment activities applied to plant features may be restricted, modified, or influenced by:

- protection and maintenance
- repairs and replacement

Protection and Maintenance

The protection and maintenance of significant plant features, including their form and scale in a landscape, is a high priority in all treatments. Good horticultural practices can enhance the longevity of significant plant material. Although genetics is a major factor in determining plant longevity, external factors can also play a role. For example, erecting barriers, staking, tying, and cabling plants are protective measures that can be performed. Maintenance is performed by irrigating, fertilizing, pruning, dividing, transplanting, mowing, and performing integrated pest management. Such activities create a favorable growing environment and promote the health of plants, but they may also be designed to achieve particular visual effects.

With an aggregation of plants, each individual plant is equally protected and maintained to achieve a uniform effect. The protection and maintenance of plants must integrate a knowledge of the cultivation requirements of individual plant species with an understanding of the primary landscape. For example, the optimal growth and reproductive potential of a plant may be compromised to achieve a visual appearance that accurately conveys the landscape's significance. Protection and maintenance regimes may be modified to achieve a particular effect (for instance, infrequent or high grass mowing to resemble the appearance of meadow-like sod that existed before the advent of lawnmowers).

Contemporary environmental legislation may restrict the protection and maintenance of plants associated with the significance of a cultural landscape. Many old cultivars or varieties of agricultural crops are prohibited by federal or state law to prevent new epidemics of pests and diseases and conserve soil fertility. For example, each year at the Shiloh National Military Park in Tennessee, a representative portion of land is planted in cotton to reflect the appearance of the land at the time of the Civil War battle. To guard against loss of soil fertility, state law requires that the cotton crop be rotated to a different area each year.

Contemporary standards of environmental quality also affect land management practices. These standards may influence the protection and maintenance of certain plant species or affect current practices that eradicate others. New technologies, such as geotextiles and biological pest controls, should be integrated wherever possible into the protection and maintenance of plant features.

Repair and Replacement

The repair of plant features may involve remedial or rejuvenative pruning, cabling, or grafting to remove infection or decay, provide physical support, and promote healing or the regeneration of new tissue. Plant features must be closely monitored to determine the vitality of plants and identify agents that may cause their decline. Replacement typically occurs when repair is no longer possible. Loss of vitality due to age, pest and disease infestation, mechanical damage, natural disasters, or environmental modification may negate attempts at repair and necessitate replacement.

Replacing plant features involves removing a declining plant in a particular location and replanting it with another plant. (See Figures 10 and 11.) The replacement plant may be genetically identical to the former plant, taxonomically the same, or be a substitute cultivar, variety, species, or genus for the former plant. The desired degree of authenticity of the replacement plant is a decision influenced by various factors, but it is primarily based on the association of the plant with the landscape's significance.

When repair and replacement is applied to an aggregation of plants, it may involve just one individual of the group (removing and replanting one dying individual) or the entire group (removing and replanting every plant). The decision to remove and replant one or all individuals of an aggregation of plants must consider two factors:

- whether the feature still conveys its association with the significance of the landscape in its current state
- the vitality, longevity, growth rate, and size of the plant to be replanted

The questions to be answered are what is the condition and anticipated life span of the remaining plants of the feature, and what will be the visual effect of incremental replacement in terms of conveying the historic character of the landscape?

For example, at Saint-Gaudens National Historic Site in Cornish, New Hampshire, the home and studio of the nineteenth century sculptor, Augustus Saint-Gaudens, a significant aggregation of plants is the more than one mile of hedges that divide the landscape into intimate garden rooms. Historically, the hedge was primarily white pine transplanted from the surrounding fields. Park maintenance staff has developed a replacement strategy that integrates new material into the existing hedge. In contrast, if the individual elements of the hedge were deteriorated, missing, or out of scale with the original intent, so that the historic feature as a whole was no longer discernible, the entire hedge would be replaced.

Figure 10. Boxwood around these ponds did not thrive in the climatic conditions and was therefore replaced with Japanese Holly. Naumkeag in Stockbridge, Massachusetts. (Photograph courtesy of the Trustees of Reservations, n.d.)

Figure 11. Japanese Holly being planted as a functional replacement for Boxwood. Naumkeag in Stockbridge, Massachusetts. (Photograph courtesy of the Trustees of Reservations, n.d.)

In-Kind Replacement

The in-kind replacement of plant features in a cultural landscape involves replanting with the same cultivar, variety, or species as the former plant. The degree of authenticity selected for the replacement plant should consider the particular association of the former plant with the significance of the landscape and the primary treatment for the landscape. Individual plants and aggregations of plants directly associated with the significance of a landscape may require the highest level of genetic authenticity in their replacement.

For example, at Adams National Historic Site, the genetic identity of the fruit trees (their particular varieties) is of great importance in associating them with the landscape's significance (the acquisition and development of the property by John and Abigail Adams). The fruit tree replacement at the Adams' property therefore requires the highest level of authenticity. Replacing one dying tree in a woodland of a designed landscape would not require the highest level of genetic authenticity because each tree is indirectly associated with the significance of the landscape. In this case the exact genetic replacement of the dying tree is not as important as the protection, cyclical maintenance, repair, and replacement of the entire woodland. A dying tree may be felled and left as a nurse log, allowing natural regeneration to take place. A replacement tree could be the same species as the former tree or another species of the woodland, according to the management regimes established for the entire woodland. Woodland managers may insist that the replacement tree has the same provenance as the former tree (originating from seed of the same localized region in the United States), but woodland managers would generally discourage attempts to clone the former tree, as genetic diversity contributes to the vitality of such plant communities as woodlands.

The need to clone a plant in decline may be due to the lack of availability of a replacement plant through other sources. Some plants of cultural landscapes are no longer commercially available, either because they are no longer fashionable (extinct as a result of lack of propagation), or they are difficult to find as "unimproved" (nonhybridized) straight species or varieties. Some plants can be found in other cultural landscapes where they have been accurately identified and maintained. But when a source cannot be found for a plant in decline, vegetative propagation guarantees the accurate identity of the replacement plant and the prevention of extinction of the cultivar, variety, or species. If old-fashioned cultivars, straight varieties of exotic plants, or other unusual forms of plants exist, it is useful to check on plant availability before the onset of mortality so that a viable propagule can be made. When genetic authenticity is important, the spectrum for the genetic authenticity of replacements should be considered when planning a replacement.

Plants can be asexually propagated by cuttings, by grafting onto another plant, or sexually propagated by seed, with genetic authenticity decreasing, respectively. Nursery stock has no direct genetic association with the original plant to be replaced; the greatest level of authenticity of nursery stock is another individual of the same variety or species. Note: cultivars must be asexually propagated. All members of a cultivar (or a man-made cultivated variety) are genetically identical.

Substitutions

In-kind replacement of the original species or variety may not be possible because of changes in the site's growing conditions, disease and insect problems, or simply because the original is no longer available. In these cases, substitution of plant material may be necessary. This may be the appropriate action when plants negatively impact the habitat of a rare and endangered species or a diseased plant cannot be replaced

Genetic Authenticity of Plant Replacements

The following list, prepared by the Olmsted Center for Landscape Preservation, illustrates the spectrum of genetic authenticity associated with the following types of plant propagation.

Highest Level of Genetic Authenticity

CLONAL

- Shoot Cuttings
- Root Cuttings

Intermediate Level of Genetic Authenticity

SUBCLONAL GRAFTING

- Cloned Rootstock x Cloned Scion
- Cloned Rootstock or Scion x Seedling Rootstock or Scion
- Seedling Rootstock x Seedling Scion

SEEDLINGS

- Manually Pollinated, Seed Collected from Original Plant
- Naturally Pollinated, Seed Collected from Original Plant
- Naturally Pollinated, Seed Collected from Same Plant on Site

Lowest Level of Genetic Authenticity

NONCLONAL NURSERY STOCK

- Substitution of Cultivar or Variety
- Substitution of Species
- Substitution of Genus

with the same plant. For example, Anthracnose disease precludes the replanting of the dogwoods Cornus florida or Cornus nuttalli with these species, and Dutch Elm disease precludes the replanting of American Elm, Ulmus americana with the same species, though the Liberty Bell or Princeton cultivars are disease-resistant substitutes.

In decisions on substitution, care should be given to match the visual, functional, and horticultural characteristics of the historic plant material. A substitute plant should be compatible with the role of the former plant in its association with the significance of the landscape. The importance of the former plant's genetic identity, aesthetic or functional historic role, physical form, texture, color, size, and longevity should be considered in selecting the substitute plant. These attributes may include the form, shape, and texture of the original, as well as its seasonal varieties, such as the bloom time and color, fruit, and fall foliage. When substitutions are made, it should be recorded to allow future generations to distinguish between historic plants and later alterations and additions to the landscape.

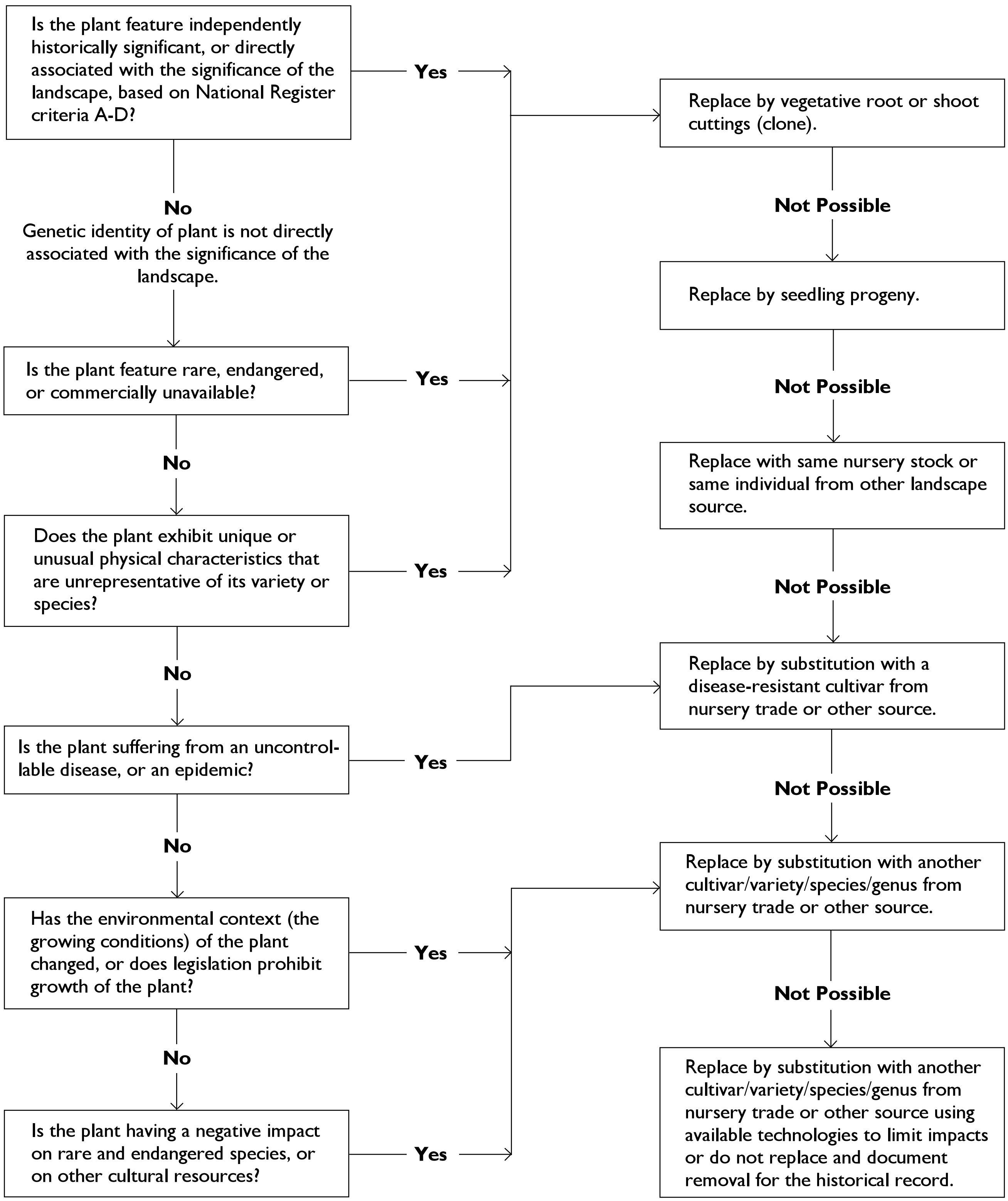
Ideally, plant features should be protected, maintained, repaired, and replaced (in-kind or with substitutions) to accurately preserve the historic character of a cultural landscape. However, under some circumstances, plants that are removed are not replaced. For example, if a plant feature threatens the perpetuation of an endangered species, it may not be preserved or replaced. In addition, when the growth of a plant feature is undermining the structural integrity of another cultural resource, such as the facade of a building or a buried archeological resource, the plant may be removed before its decline and not replaced. However, prior to the removal of such plant features, the available technologies, such as root barriers and support systems in replanting attempts, as well as the plant's association with the significance of the landscape should be considered.

Management Considerations

Beyond the implementation of a treatment plan, all treatment activities eventually focus on protection, maintenance, repair, and replacement. Preserving the landscape characteristics and associated features is the focus of landscape management. The changing appearance of the landscape must be anticipated through planning and managed within well defined parameters that best support the significance of the landscape.

When protection and maintenance are regularly practiced, the requirement for repair is infrequent and the cyclical need for replacement can be anticipated. Maintaining accurate plant records is useful for management. These records may include information on the anticipated longevity of a plant feature, current condition, protection and maintenance regimes, and records of repair and replacement interventions. A record of the anticipated replacement strategy can be included for each plant feature to expedite the replacement process when replacement is necessary. A replacement strategy is particularly important for plant features that will be propagated, because

Decision Process for Replacement of Plant Features



cuttings or grafts must be taken from live, healthy tissue, and special growing facilities may need to be used. Herbarium specimens of plant features, particularly those to be replaced, are excellent archival records.

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LANDSCAPE LINES

13

Accessibility

Introduction

Since the Civil Rights Act of 1964, disability rights legislation and increasing public awareness about the rights of people with disabilities have produced various pieces of legislation, the most extensive of which is the Americans with Disabilities Act, Public Law 101-336. Passed in January 1990, the law identifies equal access as a civil right and prohibits discrimination on the basis of disability in both privately and publicly owned accommodations. Public accommodations include services, programs, activities, goods, and commercial establishments, such as restaurants, hotels, theaters, hospitals, museums, and parks.

The executive branch of the federal government is not bound to the provisions of the Americans with Disabilities Act. Executive agencies and recipients of federal funding are required to comply with the accessibility provisions contained in two pieces of earlier legislation:

- Architectural Barriers Act (1968)
- Section 504 of the Rehabilitation Act (1973)

Accessibility Requirements

Both the Architectural Barriers Act and Section 504 of the Rehabilitation Act contain standards and guidelines that identify the conditions necessitating accessibility requirements and give technical specifications for new construction, alterations, and additions. For both Acts, the minimum standards of accessibility for federal buildings and facilities is defined by the *Uniform Federal Accessibility Standards* (UFAS), published in 1984 by the Architectural and Transportation Barriers Compliance Board.

For nonfederal public accommodations, minimum accessibility requirements are outlined in the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)*. The ADAAG was published in 1991 by the Architectural and Transportation Barriers Compliance Board.

The UFAS and ADAAG have common technical requirements. The general technical requirements for ADAAG (titled "Accessible Elements and Spaces") are the same as the UFAS technical requirements. Both require that the design of new construction be accessible; however, they differ slightly in their scoping requirements for existing facilities. ADAAG has many new technical requirements for various types of public accommodations, including restaurants and cafeterias, medical care facilities, business and mercantile, libraries, transient lodging, and transportation facilities. Both UFAS and ADAAG have special rules for historic preservation, which are discussed in this text.

The technical requirements common to both UFAS and ADAAG are actually derived from accessibility standards first developed in 1961 by the American National Standards Institute (ANSI). The ANSI standards have been modified very little over the past 30 years despite medical and technology advancements and increased awareness about the needs and life expectations of people with disabilities.

The federal government intends to revise the UFAS to be at least equivalent to the ADAAG in its technical and scoping requirements. In a June 30, 1993 memorandum, the Department of Justice requested that until the UFAS are revised, the executive agencies use the higher standards of the ADAAG whenever the guidelines result in more universal access. Currently, both the UFAS and the ADAAG are being reviewed by the Architectural and Transportation Barriers Compliance Board for possible revisions to their respective technical requirements. This review is being conducted in conjunction with the Civil Rights Division of the Department of Justice and the four standard-setting agencies under the Architectural Barriers Act: General Services Administration, the United States Postal Service, the Department of Housing and Urban Development, and the Department of Defense.

Universal Design

Universal design is based on the premise that a facility or product should be usable by anyone. Despite advancements toward universal accessibility, the disability community and universal design advocates have criticized the use of accessibility guidelines. Critics maintain that the use of minimum construction specifications does not promote a greater understanding about the needs of people with disabilities, or contribute to removing attitudinal barriers.

Critics believe that for designed environments, attitudinal barriers are more persistent than architectural ones, and the way to remove the attitudinal barriers is to increase awareness about the many distinctive needs of users. Critics assert that in practice, minimum design standards

Figure 1. View of the original office walkway and location of a proposed accessibility project to create universal access. Frederick Law Olmsted National Historic Site. (NPS, 1995)

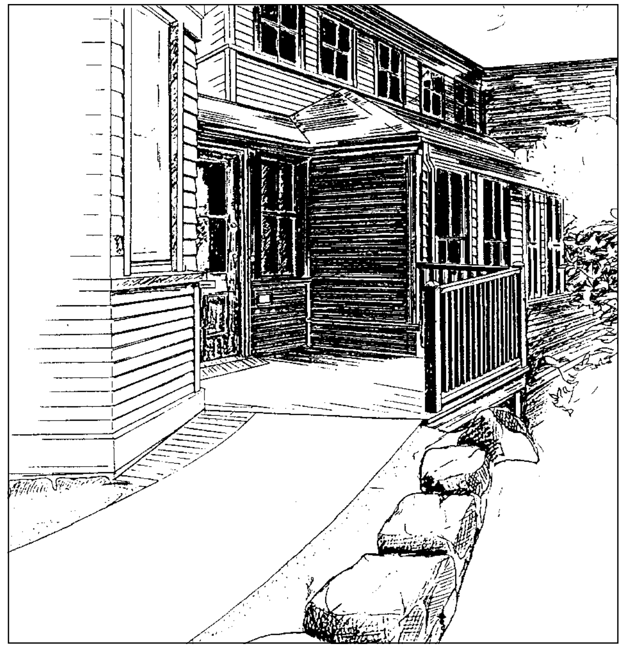

Figure 2. A sketch of the proposed universal access design, which raises the elevation of the historic entrance porch to meet the threshold, and includes a new walkway with an accessible gradient. Frederick Law Olmsted National Historic Site. (NPS, 1995)

become maximum standards, and compliance with minimum standards is viewed as the goal rather than the means to achieving universal or equal access.

Universal design advocates believe strict adherence to accessibility guidelines may result in a design solution that does not create equal access. They distinguish accessibility from universal and equal access, noting that separate provisions for one group of users may ignore the needs of another group with different disabilities. They emphasize education about the concept of "fitness for use by anyone" as the basis for the environmental design process. (See Figures 1, 2, and 3.)

Figure 3. Office walkway following implementation of the accessibility project. The historic stone edge condition of the original walkway was salvaged and relaid to match the gradient of the new walkway. Frederick Law Olmsted National Historic Site. (NPS, 1997)

The Equal Facilitation Clause

A fundamental difference between the UFAS and ADAAG in guiding the creation of universally accessible environments is that the ADAAG has an extra clause within the general provisions, titled “Equivalent Facilitation” (ADAAG 2.2). The clause states:

> *Departures from the particular technical and scoping requirements of this guideline by the use of other designs and technologies are permitted where the alternative designs and technologies used will provide substantially equivalent or greater access to and usability of the facility.*

The ADAAG allows designers to depart from the specifications. For designers to take advantage of this creative opportunity, they should understand the needs of people with disabilities and the reasons underlying the existing guidelines. For example, the reason for requiring handrails along both sides of a ramp or set of steps is that people with different capabilities on either side of their bodies (such as people who have suffered strokes) can use the handrail matching their physical abilities.

Universal design advocates are critical of the prevalence of eight percent gradient ramps with handrails (permitted by UFAS and ADAAG guidelines), because an eight percent gradient is too steep for many people with limited mobility and handrails are unusable by many people with disabilities. They encourage the use of the ADAAG’s Equivalent Facilitation clause because it has more potential to change attitudes and improve the usability of designed environments.

Accessibility in Cultural Landscapes

Historically, the needs of people with disabilities have not been considered in the design and construction of places. As a result, many historic properties have features that are obstacles to equal access. Unfortunately, equal access and historic preservation have often been portrayed as antithetical, technically infeasible, and even impossible. But designing equal access to historic properties, including cultural landscapes, does not have to preclude the preservation of significant resources.

Historic preservation exists to allow experiential access to historic properties that are considered culturally valuable or significant. In this context, the goal of equal access is to create equal access to the experience as well as improve physical accessibility. (See Figure 4.) To create equal access to the opportunity to experience the significance of a cultural landscape, the goal of accessibility needs to be united with the goal of preservation. The loss of integrity resulting from the implementation of an accessibility project represents a compromise to the goals of both equal access and preservation.

Equal access to the experience of a cultural landscape is achieved when the significance is conveyed through the physical integrity of landscape characteristics and associated features and when the experience is equally available to all visitors or users. As defined by the National Register of Historic Places, integrity relates to the presence of physical features that have existed since a period of significance and that contribute to and convey the significance of a historic property. Therefore, the design of accessibility projects in a cultural landscape should retain the extant landscape characteristics and associated features that contribute to and convey the significance of the landscape. New features that are added to provide equal access should be designed in a manner that is compatible with the character of the landscape. The goal is to provide the highest level of access with the lowest level of impact on the integrity of the landscape. (See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix I: Treatment Policy, Guidelines, and Standards.")

Accessibility in a cultural landscape is part of the preservation planning process. Currently, under UFAS scoping requirements, only existing facilities undergoing substantial alteration (all alterations in one year amounting to 50 percent or more of the property value) trigger requirements for accessibility. Under ADAAG scoping requirements, any alterations to an existing element, feature, space, or area, triggers new construction standards for accessibility. Until the UFAS has been revised to the greater scoping requirement of ADAAG, the Department of Justice and the Architectural and Transportation Barriers Compliance Board encourage the executive agencies to use the greater scoping requirement of ADAAG for alterations.

Accessibility Planning

The planning and design of accessibility projects is a multidisciplinary activity involving the expertise of preservation professionals, accessibility specialists, and individuals with disabilities and their organizations. Accessibility coordinators, usually

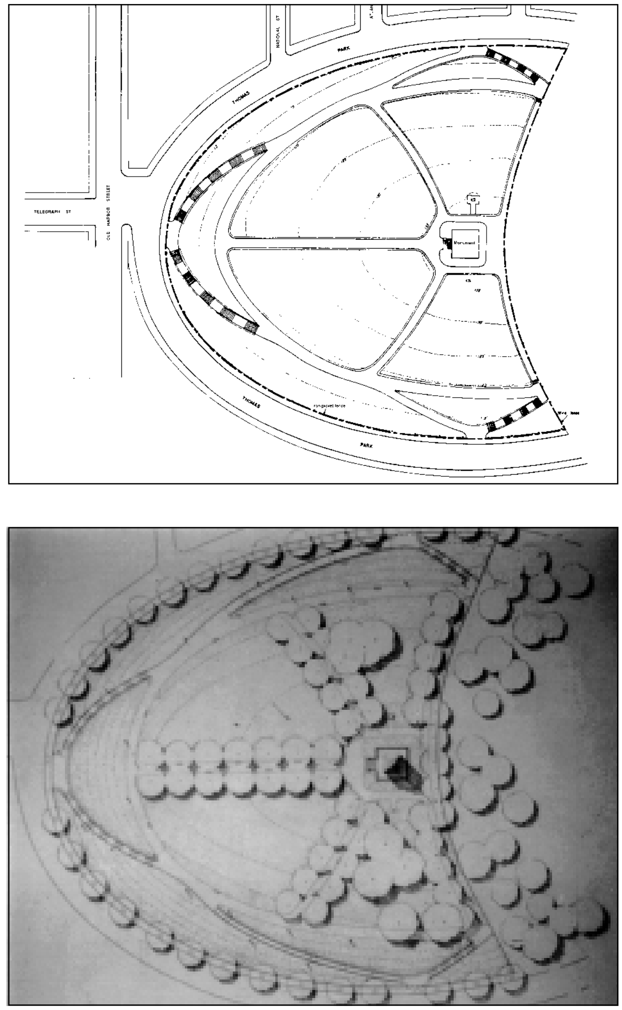

Figure 4. Before (top) and after (bottom) existing conditions plans of Dorchester Heights, the site of an accessibility project in 1995. The accessibility project occurred as part of a rehabilitation treatment plan. It involved "stretching" the pattern of the historic circulation plan (the central walk and the north and south ramps were elongated), to achieve a more shallow, accessible route up to the Dorchester Heights Monument. Boston Historical Park. (NPS, 1994)

located in the National Park Service (NPS) support offices, should be invited to participate in the planning process.

Accessibility planning and design requires a clear understanding of a cultural landscape's significance and how it is conveyed through its extant landscape characteristics and associated features.

Equal access must be defined for each particular cultural landscape based on a variety of factors, including significance, landscape characteristics and associated features, integrity, treatment, and contemporary use of the landscape. These factors influence how a landscape's significance is presented to visitors, and, therefore, affect the extent and location of modifications required to provide access and the physical appearance of access designs.

If a cultural landscape is eligible for listing or is listed in the National Register of Historic Places, and the access project is a federal undertaking, the planning and design stages of an accessibility project involve the review process cited in Section 106 of the National Historic Preservation Act. The NPS initiates consultation with the State Historic Preservation Office to develop a Memorandum of Agreement on the planning and design of access modifications. As a result, the Memorandum of Agreement outlines actions that are agreed upon and it is submitted to the Advisory Council for Historic Preservation for comment. The same review procedure is followed when the less comprehensive scoping requirements of UFAS and ADAAG are used to plan and design access modifications.

Both UFAS and ADAAG have special rules for historic preservation that reduce scoping requirements for particularly challenging circumstances. The rules apply to situations in which creating equal access would destroy the integrity of a historic property because its significance is wholly conveyed by the exact location, original materials, original workmanship, or original design of a feature or features. The special rules add flexibility to the process of creating access changes that retain the integrity of a historic property and therefore allow the significance to be conveyed and experienced. If using the general scoping requirements for accessibility would destroy the integrity of a cultural landscape, the special rules of UFAS and ADAAG are permitted. The circumstances in which to apply the special rules for historic preservation of UFAS (4.1.7 (2)), and ADAAG (4.1.7 (3)) are relatively rare and only apply to a small number of historic properties.

Listed below are the special rules for historic presentation, which are written to apply most directly to historic buildings.

- Allow only one accessible route from one site access point (such as a parking lot) to an accessible entrance.
- The accessible entrance may be different to the one used by the general public (though it cannot be locked and ADAAG requires directional signage to the accessible entrance).
- A ramp steeper than is ordinarily permitted may be used in space limitations (a gradient of 16.6 percent (1:6) for a maximum run of two feet).
- Only one accessible restroom is required and it may be unisex.
- Accessible routes are only required at the elevation of the entrance.
- Interpretive materials should be located where they can be seen by seated persons.

ADAAG also has an exception rule for historic preservation (ADAAG 4.1.7 (1)), which states that if the integrity of a historic property could be destroyed by following the special rules, scoping requirements are reduced even further. The exception permits use of alternative methods to make services and programs available (that is, to create the opportunity to experience the significance of a property). Alternative methods include the use of interpretation (such as audio visual materials), using facilitators to assist individuals with disabilities, and adopting other innovative methods such as those invited by the Equivalent Facilitation clause of ADAAG. UFAS has no exception rule for historic preservation.

Sources of Further Information

The Uniform Federal Accessibility Standards and information can be obtained from:

Architectural and Transportation
Barriers Compliance Board
1111 18th Street, NW, Suite 501
Washington, DC 20036
1-800-USA-ABLE

The Americans with Disabilities Act Accessibility Guidelines and information can be obtained from:

Office of the Americans with
Disabilities Act—Civil Rights Division
U.S. Department of Justice
P.O. Box 66118
Washington, DC 20035-6118
202-514-0301

For NPS accessibility enquiries contact:

Accessibility Program Coordinator
Parks Facility Management Division
National Park Service
P.O. Box 37127, Suite 580
Washington, DC 20013-7127
202-343-3674

Technical and Scoping Accessibility Requirements for Elements and Spaces

Following is a partial list of ADAAG and UFAS "Technical Requirements for Accessible Elements and Spaces," which are most pertinent to access projects in cultural landscapes. For the full list of technical and scoping requirements, refer to the UFAS or ADAAG.

Accessible Route Minimum Specifications

- Width = 36 inches
- Passing zone = 60 inches wide occurring at 200-foot intervals
- Wheelchair 180-degree turning zone = 60 inches x 60 inches
- Gradient = 5 percent (1: 20)
- A gradient greater than 5 percent shall be called a ramp
- Cross pitches (cross slopes) = 2 percent (1: 50) or less
- Abrupt level changes are no greater than 0.5 inch in height

- 0.25-inch level change is permitted without a beveled edge
- 0.5-inch level change must have a beveled edge
- Surfaces must be of stable, firm, slip resistant material

Accessible Parking

- Space = 96 inches wide
- Access aisle is considered to be part of an accessible route
- Spaces and aisles have a 2 percent (1: 50) maximum gradient in any direction
- Passenger loading zone (access aisle) = 60 inches wide x 20 feet long, adjacent and parallel to the vehicle pull-up space

Curb Ramps

- Must be located wherever an accessible route crosses a curb
- 5 percent (1: 20) gradient or less, unless space is limited, then a gradient between 8 percent (1: 12) and 10 percent (1: 10) is permitted for a rise of 6 inches
- Must have flared sides if they are located where pedestrians must walk across the ramp or are not protected by handrails or guardrails
- Maximum gradient of curb ramp flared sides = 10 percent
- Must have returned curbs where pedestrians do not walk across the ramp
- Built-up curb ramps must be located where they do not project out into vehicular traffic lanes
- Must have a detectable warning of raised, truncated domes or contrasting color that extends the full width and depth of the curb ramp
- Must be located where they will not be obstructed by parked vehicles
- Diagonal curb ramps (corner ramps) must have at least a 48-inch width clear space at the bottom of the ramp
- Where a sidewalk landing beyond a curb ramp is less than 48 inches deep, the curb ramp gradient must not exceed 8 percent (1: 12)

Ramps

- Must be at least 36 inches wide
- Gradient greater than 5 percent (1: 20) and a maximum of 8 percent (1: 12)
- Maximum rise on any run = 30 inches in height
- In space limitations, a ramp gradient no greater than 16.6 percent (1: 6) may be used for a horizontal run of 2 feet
- In space limitations, a ramp gradient between 8 percent (1: 12) and 10 percent (1: 10) may be used for a maximum vertical rise of 6 inches
- An 8 percent (1: 12) gradient and a rise greater than 6 inches, or a horizontal run greater than 72 inches, must have handrails on both sides of the ramp

- Surface must be stable, firm, and nonslip
- Ramps and landings with dropoffs on either side must have curbs at least 2 inches high
- Must be well draining to prevent the accumulation of rainwater
- Cross pitch (cross slope) must be no greater than 2 percent (1: 50) gradient

Landings

- Must be located at every 30-inch vertical rise in a ramp
- Dimensions of landing = 36 inches wide x 60 inches deep at the top and bottom of a ramp run
- Dimensions of landing = 60 inches wide x 60 inches deep at a ramp dogleg
- Drop-offs must have curbs with a minimum height of 2 inches
- Height of door thresholds = 0.5-inch high or less, with a beveled 50 percent (1: 2) edge
- Width of clear landing on latch side of door = 24 inches wide

Handrails

- Not required on curb ramps
- Required on either side of 8 percent (1: 12) gradient ramps with a 6-inch rise or greater, or a 72-inch horizontal run, and on either side of stairs
- Must be continuous on the inner side of a dogleg ramp or dogleg stairs
- Must continue at least 12 inches beyond the top and bottom of a ramp and be parallel to the ground plane
- Must continue at least 12 inches beyond the top riser of stairs parallel to the ground plane, and continue to slope for a distance of one tread width from the bottom stair riser and become parallel to the ground plane for an additional distance of 12 inches
- Distance from mounting wall = 1.5 inches wide
- Gripping surface must be uninterrupted
- Diameter or width of gripping surface of handrail or grab bar must be 1.25 - 1.5 inches, or the shape must provide an equivalent gripping surface UFAS 4.26.2.
- Top of gripping surface = 34 - 38 inches in height above the ramp or stair tread surface
- Terminal ends of handrails must be rounded off or returned smoothly to the ground, wall or post

Stairs

- Must have uniform tread widths and riser heights
- Width of treads must be no less than 11 inches high
- Open risers are not permitted
- Nosings must project no more than 1.5 inches
- Nosing undersides must be angled at no greater than 60 degrees from the horizontal
- Handrails must be located on either side of stairs
- Inside handrail at stair dogleg must be continuous
- Handrails must extend 12 inches beyond the top riser, and at least one tread width and an additional 12 inches beyond the bottom riser

- Handrails at the top of stairs must be parallel to the ground plane, and at the bottom of stairs, handrails must continue to slope for a distance of one tread from the bottom riser and for an additional 12 inches be parallel to the ground plane
- Handrail gripping surface must be uninterrupted and be located 34 - 38 inches above the stair treads
- Terminal ends of handrails must be rounded or returned smoothly to the ground, wall, or post
- Stairs must be well draining to prevent the accumulation of rainwater

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U.S. Department of the Interior
National Park Service
Cultural Resources

Park Historic Structures & Cultural Landscapes

LANDSCAPE LINES

14

Cataloging, Printing, and Distribution

INTRODUCTION

The guidelines in this text describe how to prepare a camera-ready copy of a Cultural Landscape Report (CLR) for printing and how to catalog and distribute the report.

There is considerable variety in the layout, style, and graphic conventions used in producing the camera-ready document (the final document ready to be printed). However, the steps leading to publication are standardized across the National Park Service (NPS).

A strongly recommended first step is to have the document edited. Especially when a CLR involves more than one author, an editor can improve the document by making the writing style consistent from section to section. Following editing, the document can be desktop published, which involves designing the page layout, integrating the text and graphics, and formatting the document. Both the editorial and formatting conventions should be based on the most recent edition of the *Chicago Manual of Style*.

Desktop publishing is accomplished using a computer software application. Many contractors (editors and desktop publishers) and printers offer desktop publishing services. They can integrate the text and some, if not all, of the graphics into electronic files. (Some graphics may have to be manually pasted into the camera-ready printout.) When the CLR is camera-ready, the finished typographic format of the document is defined in the project agreement or through subsequent negotiation. If a CLR is to have the same format as an existing document (if it is part of a series of documents, for example), a sample may be provided for the preparer.

Each NPS Region or Support office has a printing coordinator who serves as a liaison between the NPS and the United States Government Printing Office (GPO). The GPO has branches throughout the United States and each Region may have access to more than one GPO within the larger cities of the Region. According to a 1994 memorandum, all NPS printing contracts must currently be tendered through the GPO. In some NPS Regions, the GPO negotiates limited term contracts with local printing contractors for miscellaneous printing services, which may result in lower printing costs. The Form 2511 is used for miscellaneous printing term contracts. Check with a printing coordinator for more information on how to arrange a printing term contract. (See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix L: Government Printing Office Forms.")

The procedure for printing and distributing a document through the GPO requires preparation of several forms, some of which are filled out by the contracting agency (NPS) and some by the printing coordinator. The printing coordinator communicates with and forwards the completed forms to the GPO. The printing coordinator may also send the camera-ready copy and mock-ups to the GPO.

The Camera-Ready Copy

The camera-ready copy is the completed, edited, and formatted document that is ready to be delivered to the printer. The camera-ready copy may or may not contain all of the graphics. Graphics that are not computer-generated (such as photographs) may need to be processed as halftones by the printer and pasted into the camera-ready printout.

In the camera-ready copy, space must be set aside for each graphic. To indicate the location of images, boxes may be drawn with a nonphoto blue pencil or a black hairline. Inside the space designated for graphics, the figure number and caption, any required percent enlargement or reduction, and location should be noted. Instructions to the printer should include the location and size of graphic images in the document.

The camera-ready printout has single-sided pages with a blank separation page inserted wherever the subsequent page has a blank second side. In all cases, no additional changes to the text are anticipated and the document has a title and cataloging information assigned to it, which includes a Library of Congress catalog card number.

Graphic Images

Copies of black and white line art, which have been sized to fit the allocated space in the document, may be directly pasted into the camera-ready printout. Alternatively, black and white line art may be digitally scanned in and positioned within the document. Other types of graphics, such as color line art, grayscale images (with color or shaded areas), and photographs are usually photographed as a halftone by the printer and presented separately from the camera-ready document. Each graphic to be half-toned is notated with the figure number and page on which it will be located. If an enlargement or reduction of the original photograph is required to fit the allocated space, the percent reduction or enlargement should also appear on the note.

It is useful to compile a figure specification sheet, which lists each figure, whether it is to be pasted in or incorporated, and any instructions, such as the percent reduction or enlargement, or extent of cropping. The printer photographs each graphic to be incorporated as a halftone and may manipulate light and darkness to some extent. Contractors with scanning capabilities may directly incorporate scanned, halftone images of the desired size into the camera-ready document, eliminating the need for drawing boxes and leaving spaces in the body of the document.

The GPO requires copyright permission for any copyrighted materials (photographs, maps, charts, and drawings) that are to be reproduced in the CLR. The GPO may also require reprint permission for materials from private sources that are to be reproduced.

Mock-Ups

A document mock-up indicates how folded inserts, illustrations, pocket inserts or other special details should be handled. A mock-up is created by photocopying a camera-ready copy, and then pasting in photocopied images at the correct size and placement. Any cropping of graphic originals can be indicated in the mock-up. The mockup serves as a template to guide the printer. It should be submitted at the time of printing along with the original camera-ready document and all the artwork.

Cataloging Using the Library of Congress Procedure

A CLR can be cataloged with the Library of Congress' Cataloging in Publication (CIP) or the Preassigned Card Number (PCN) programs. The two programs are mutually exclusive. Each has its own requirements and a publication can be cataloged using only one program. Both CIP and PCN are concerned only with books, and for the purposes of cataloging with the Library of Congress, a CLR is considered to be a book.

CIP is the preferred program for CLRs because it provides more cataloging information about the document. To apply for CIP, the CLR text must be complete (if not camera-ready). Allow six weeks for obtaining CIP information prior to the anticipated printing date. When received, the CIP information can be typed in directly or pasted onto the back side of the front cover or title page (the copyright page) before printing.

Once a catalog card number has been assigned by the Library of Congress, the title of a CLR cannot be changed. Participation in either CIP or PCN requires the anticipated publishing date and number of pages. Cataloging is an opportunity to organize and name the publication according to a series to emphasize a relationship to existing documents. For example, a series might include "Cultural Landscape Publication No. 1, 2, or 3" in the title or subtitle, or indicate "Volume 1, 2, or 3," etc.

The advantage of CIP is that more information is included on the copyright page of the book. Although the PCN program provides only a catalog card number, it should be considered in

Cataloging Programs

The Library of Congress Cataloging in Publication Division offers two cataloging programs: the Cataloging in Publication (CIP) program and the Preassigned Card Number (PCN) program. At a minimum, a CLR needs to be cataloged using the PCN program, but CIP provides additional cataloging information that make it the preferred program to use.

While both programs assign a Library of Congress catalog card number to a CLR, CIP provides a description of a CLR's contents. The description is an additional aid to researchers, enhancing access and retrieval of the document. The Library of Congress catalog card number is a bibliographic control number that facilitates retrieval of the CLR from any library.

Cataloging in Publication (CIP) Program

The CIP program provides a CLR with a Library of Congress catalog card number, a description of contents, and other publication data to be printed in the book on the copyright page. CIP requires an application form (referred to as the data sheet) and a copy of the complete galley (preferably camera-ready copy or quality draft).

CIP requires ten working days once the application is received by the Library of Congress. The criteria for eligibility to receive CIP data include the likelihood that the publication will be widely acquired by the nation's libraries. CIP also requires that a complimentary "best copy" (most durable copy) of the document is sent to the Library of Congress after publishing.

To apply for CIP, call the CIP data liaison for the NPS at the Library of Congress 202-707-1630, or write to:

The Library of Congress • Cataloging and Publication Division • Washington, DC 20540-4320

Preassigned Card Number (PCN) Program

The PCN program provides a Library of Congress catalog card number to be printed in the copyright page of the CLR. PCN requires an application form and a copy of the document's title page, and it requires five working days once the application is received by the Library of Congress.

The criteria for selection by the Library of Congress to receive a PCN include the likelihood that the publication will be selected by the Library of Congress for its collections. PCN requires that a complimentary "best copy" is sent to the Library of Congress after publishing.

To apply for a PCN, call the PCN liaison for the NPS at the Library of Congress 202-707-9791, or write to:

The Library of Congress • Cataloging in Publication Division • Washington, DC 20540-4320

a situation where it is not possible to send a completed draft of the document to the Library of Congress to qualify for CIP. (See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix L: Government Printing Office Forms.")

Copyright Information

Although the GPO is responsible for printing and distributing CLRs, the NPS is considered to be the publisher of these documents. Because government funds are used to prepare, print, and distribute a CLR, its contents are public domain. Therefore, a CLR should not be registered for copyright. The following statement should appear on the copyright page, under the heading *Publication Credits*:

> *Information in this publication may be copied and used, with the condition that full credit is given to the authors, their companies, and the National Park Service. Appropriate citations and bibliographic credits should be made for each use.*

GPO Procedure for Printing and Distribution

Form 3868

Thirty days before sending in the printing requisition to the GPO (Forms SF-1 and DI-1), the "Notification of Intent to Publish Form 3868" must be completed. Form 3868 may be completed and forwarded by the printing coordinator. This form is necessary for the GPO to include the published document in its sales and depository library programs. If a CLR is intended for sale, Form 3868 requires a description of the target audience. The GPO may issue the CLR with an International Standard Book Number (ISBN) for sales of the publication. If indicated on Form 3868, the GPO will distribute copies of the publication to federal depository libraries throughout the United States including the Library of Congress, at no expense to the NPS. (See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix L: Government Printing Office Forms.")

Cost Estimate

To obtain an accurate cost estimate from the GPO, printing specifications must be known. Each specification will add to the printing cost, and the more detailed the specifications provided, the more accurate the GPO estimate will be. A printing coordinator or GPO representative can help determine the full range of printing specifications for an estimate. The following are typical specifications required by a printing coordinator to obtain an estimate:

- Number of copies. The number of copies required for minimum distribution is 35. Beyond the minimum number of copies, the number of any additional copies printed is influenced by the following factors:
  - distribution objectives
  - demand for the document
  - cost of additional copies
  - potential use of the information in the document (a CLR that addresses planning issues may have a broad appeal)
- Paper stock and ink. A local printer may be a good reference source for reviewing and choosing standard materials. The printing coordinator may also have sample swatches of paper and an ink color chart.
- Composition. This is only important when the document is completely typeset by the printer. If the CLR will be camera-ready when given to the printer, specify that a camera-ready copy and mock-ups will be furnished.
- Press and bindery. A book-like document is usually printed "head-to-head" (forms can be printed "head-to-foot"). Indicate the overall document size (width x height), number of inserts, if any, and the type of binding. Adhesive bound (also called perfect binding) is commonly used for NPS documents. In this binding method the pages are glued to the spine. Comb binding and saddle stitching are alternatives for smaller documents. Different document formats work better with certain types of binding; for example, lightweight paper, rather than heavy cover stock, should be used as dividers between chapters in adhesive bound publications. Heavy stock tends to crack and fall out of adhesive bindings.
- Proofs and delivery. A date for receipt of proofs for review and delivery date of final product should be indicated. Also indicate whether these dates may be extended. Proofs are reviewed for errors in image placement, enlargement, or reduction. It is too late to review the text for errors at this stage. Proofs can be cropping proofs of illustrations, and blueline or gray dylux proofs of the entire document. Blueline proofs have

greater legibility, though gray dylux proofs are less expensive. A press proof may also be requested. (This is an exact copy (printed and bound) of the finished product. The press proof is the most expensive proof.) Indicate "suitable" for delivery packaging unless there is a specific requirement.

Form DI-1

The DI-1 Requisition Form obligates funds for printing a CLR. The DI-1 requires a requisition number, an appropriation number, and a description of the printing specifications. The DI-1 must be completed by the NPS and forwarded to the printing coordinator. The description of printing specifications must be the same as those provided for the estimate. A printing coordinator will use the information provided on the DI-1 to fill out the Standard Form or SF-1.

Form SF-1

Form SF-1, Printing and Binding Requisition to the Public Printer, is submitted along with the DI-1 to the GPO by the printing coordinator, after an estimate has been received. The same printing specifications as above are outlined on the SF-1, along with the following additional information:

- Any enclosures to be sent with the SF-1 are listed: typically the camera-ready copy, two mock-ups, original artwork, and reprint permission for materials from private and copyrighted sources.
- It should be indicated that all originals, master plates, film negatives, etc., must be returned to the NPS. The negatives may be used to reprint more copies of the document in the future, at lower cost.
- Printers to be included on the bid list may be indicated.

(See *A Guide to Cultural Landscape Reports: Appendices*, "Appendix L: Government Printing Office Forms.")

Minimum Distribution List

Copies of final CLRs should be provided to the following offices and repositories (the list has been excerpted from the *Cultural Resources Management Guidelines*, Release No. 5. A CLR containing an archeological report must have a certification of its level of availability. Copies of a CLR are sent to those on the minimum distribution list by the NPS. GPO automatically has the printer send copies to the Library of Congress and to Depository Libraries if so indicated on the Form 3868.

No. of Copies	Send to:
2	**Associate Director, Cultural Resource Stewardship and Partnerships** **National Park Service** P.O. Box 37127 Washington, DC 20013-7127

2 **Associate Director, Natural Resource, Stewardship and Science**
National Park Service
Natural Resources Library
Washington, DC 20240

1 **Associate Director, Professional Services**
National Park Service
P.O. Box 25287
Denver, CO 80225-0287

2 **National Park Service**
Harpers Ferry Center Library
P.O. Box 50
Harpers Ferry, WV 25425-0050

1 **National Trust for Historic Preservation**
McKilden Library
University of Maryland
College Park, Maryland 20742

1 **Smithsonian Institution Libraries**
Gifts and Exchange
Washington, DC 20560

1 ea **Cultural Landscape Program Managers in all System Support Offices (recommended)**

20-25 **Superintendent of Park**

1 **State Historic Preservation Officer**

1 **Support Office Archeology or Preservation Center**

1 **Support Office Library**

1 ea **Coauthors or consultants**

Further Information

The Chicago Manual of Style (University of Chicago Press, 14th edition, 1993) has helpful information on printing technology and copyright issues for publishers. *The Mac is not a Typewriter* by Robin Williams (Peach Pit Press, 1990) is a useful reference for basic information on preparing a camera-ready document, including desktop publishing.

National Park Service. *Editing Reference Manual.* This manual provides guidance for capitalization, preparing bibliographies and notes, and other information useful for preparing documents for public distribution. Copies of the manual are available from Denver Service Center, Technical Information Center.

LANDSCAPE LINES

15

Historic Trails

Prepared by Margie Coffin Brown, Historical Landscape Architect, National Park Service, Olmsted Center for Landscape Preservation

INTRODUCTION

Trails take us to places of nature and history. They lead us through rugged terrain, exceptional scenery, places of contemplation, and cultural sites. Many contemporary trails once served as utilitarian routes for hunting, migration, communication, and trade. Individuals, organizations, and government agencies have developed recreational and heritage-related trail systems to provide access to scenic areas, as links between communities, or as alternative paths for non-vehicular travel. The resulting trails vary in length, purpose, and physical characteristics. Many are built and maintained with simple tools and extensive hand labor, containing highly-crafted works of stone, iron, and wood. Though seemingly simple, a trail's route, construction methods and materials, and inherent landscape characteristics can embody a significant chapter of American history and make it eligible for listing in the National Register of Historic Places.

Effective treatment and management of these trails requires an understanding of their historic context, design principles, and construction methods. Trail managers are often faced with questions regarding the repair of trails, especially those constructed in the late 1800s or early 1900s. Heavy use, limited funds for maintenance and other treatments, and lack of treatment guidelines have caused trail managers to seek economical materials and methods to accomplish their work, often resulting in the loss of historic features or changes in character. Management practices that fail to consider the historic value of America's trails may diminish their historic character and significance.

This *Landscape Line* describes an approach to treatment and management of historic trails that balances historical considerations with contemporary concerns. Using the methodology of the Cultural Landscape Report (CLR), this *Landscape Line* describes the process of historical research, existing conditions documentation, and analysis and evaluation for historic trails with an emphasis on developing historically informed treatment recommendations.[1] It provides an overview of federal guidelines that relate to historic trails and is supplemented with case studies from a range of historic trail treatment projects. The document focuses on treatment of the trail prism, which incorporates the trail tread, associated features and the associated corridor leading through the landscape.

In this publication, the term "historic trail" refers to a route that is currently managed for interpretive or recreational purposes and is limited to pedestrian and non-vehicular traffic (See Sidebar 1). Heritage trails accessed by automobiles and multi-use recreational trails that allow bicycles, horses, and other means of transportation besides walking have special requirements that are not addressed in this document.

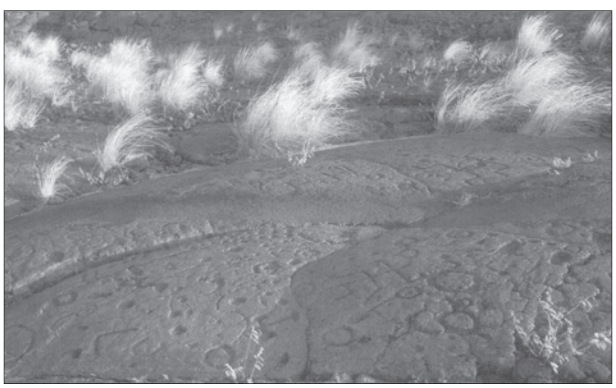


Figure 1. Trail worn into lava from centuries of foot traffic through the Waikola petroglyph field on the recently designated Ala Kahakai (Trail by the Sea) National Historic Trail. The ancient path, extending for approximately 175 miles along the coast of the island of Hawaii, has been altered in sections by natural changes such as lava flows, floods, and high surf, but also widened for horse and cart use, and later for paved roads and resort developments. (CRM, Steve Elkinton, 1997)

A Brief History of America's Trails

To fully understand the origin of a trail, one must trace the broad patterns, historical events, and individuals that shaped its development through time. The following brief history pertains to many trails in the United States that are now considered "historic trails."

Native peoples, often following animal tracks, established the earliest network of overland and water trails for hunting, seasonal migration, trade, and ceremonial purposes. Footpaths often followed the most direct, flat route between waterways or through mountain passes. Routes were sometimes marked with debarked trees, rock cairns, petroglyphs, burial mounds, and objects left as spiritual offerings. A few of these trails are extant (Figure 1).

With the arrival of Europeans, some primitive trails became migration routes and were widened for carts and subsequently became roads. For example, when charting the Oregon Trail in 1812, trappers located the South Pass over the Continental Divide by following an existing Crow Indian trail. With easy grades and proximity to the upper reaches of the Platte River, the route was later followed by thousands of pioneers.

Recreational walking and mountain climbing trails, referred to as "paths," became popular in the early nineteenth century.[2] American artists and writers, particularly those connected with the Hudson River School in New York, portrayed vast unspoiled landscapes as icons of a new flourishing country and often explored remote areas on foot. Public appreciation of paintings by artists such as Thomas Cole and Frederic Church prompted nature tourism as an escape from the growing industrial cities and engendered a sense of public ownership of these magnificent landscapes. Popular during the mid 1800s, the "American Grand Tour" encompassed a circuit of grand hotels, each with recreational paths, located along the Hudson River, the Catskills, Lake George, the Erie Canal, Niagara Falls, the White Mountains, and the Connecticut River Valley (Figure 2).[3]

This growing appreciation of landscape scenery led to a style of path development based on the "picturesque"

SIDEBAR 1: DEFINITIONS

Trail: A travel way established by construction or use for foot traffic, bicycles, wheelchairs and/or pack animals. Trails designed for motorized off-road vehicles are not emphasized in this document.

Historic trail: A trail built or in use during a significant event or historic period; associated with themes in our country's heritage (e.g., prehistory, history of commerce, communications, community planning and development, conservation, recreation, landscape architecture, engineering, military, religion, or transportation); and eligible or listed in the National Register of Historic Places.

National Historic Trail: Federally designated long-distance trails, preserved for public use and commemoration by an act of Congress. Most National Historic Trails (NHT) cross state boundaries and trace nationally significant routes such as Ala Kahakai NHT. The National Park Service administers many NHTs, while the Bureau of Land Management and Forest Service manage others. Designated trails need not be on federal land or be contiguous and can be sites and segments linked by adjacent auto tour routes.[4] Some of these trails are associated with historic events and differ in character from the trails described in this document. The Selma to Montgomery National Historic Trail, which follows a road corridor traversed by Civil Rights advocates, is an example of this type.

National Scenic Trail: National Scenic Trails (NSTs) are long-distance trails designated for the nationally significant scenic, natural, and cultural qualities of the region through which they pass. Examples include the Appalachian National Scenic Trail and the Pacific Crest National Scenic Trail.

Figure 2. A short distance from New York City, the Catskills were laced with footpaths and hotels by the 1820s. Nearby lakes, waterfalls, and mountains were viewed from a network of paths, ornamented with rustic ladders and places to rest. (Engraving from The Scenery of Catskill Mountains as Described by Irving Cooper, 1876)

and "sublime." Andrew Jackson Downing (1815-1852) suggested that garden walks lead through the landscape in an ever-changing manner, winding with easy, flowing curves to highlight picturesque landscape scenery or turning abruptly at an obstacle of dramatic interest, such as a sublime rock formation. He believed that constructed features, such as bridges, steps, seats, and shelters along a path could provide comfort, as well as enhance one's appreciation of the landscape.[5] In the late nineteenth century, Frederick Law Olmsted, Sr. (1822-1903) laid out picturesque parks with carefully separated but intertwined pedestrian paths, bridle paths, and carriage roads with bridges and underpasses to accommodate traffic flow. Routes that encouraged contemplation were gracefully curved along the natural terrain, whereas routes that encouraged social interaction were cut as broad, straight promenades.[6] As large tracts of land were set aside for public enjoyment, the principles of Downing, Olmsted, and other influential landscape architects of the period, were often applied in the development of new road and trail circulation systems to wind through scenic landscapes, sometimes obliterating earlier more direct routes (Figure 3).

By the late 1800s, land protection and recreational hiking were firmly rooted in American politics and society. In the Northeast, hotel companies built footpaths as part of their facilities, while in the West similar hotel trails were designed for stock and pack trains into remote country. In California's Yosemite Valley, a network of tourist trails begun in the 1850s expanded as the area was protected as a state park in 1864 and later as a national park in 1890 (Figure 4).

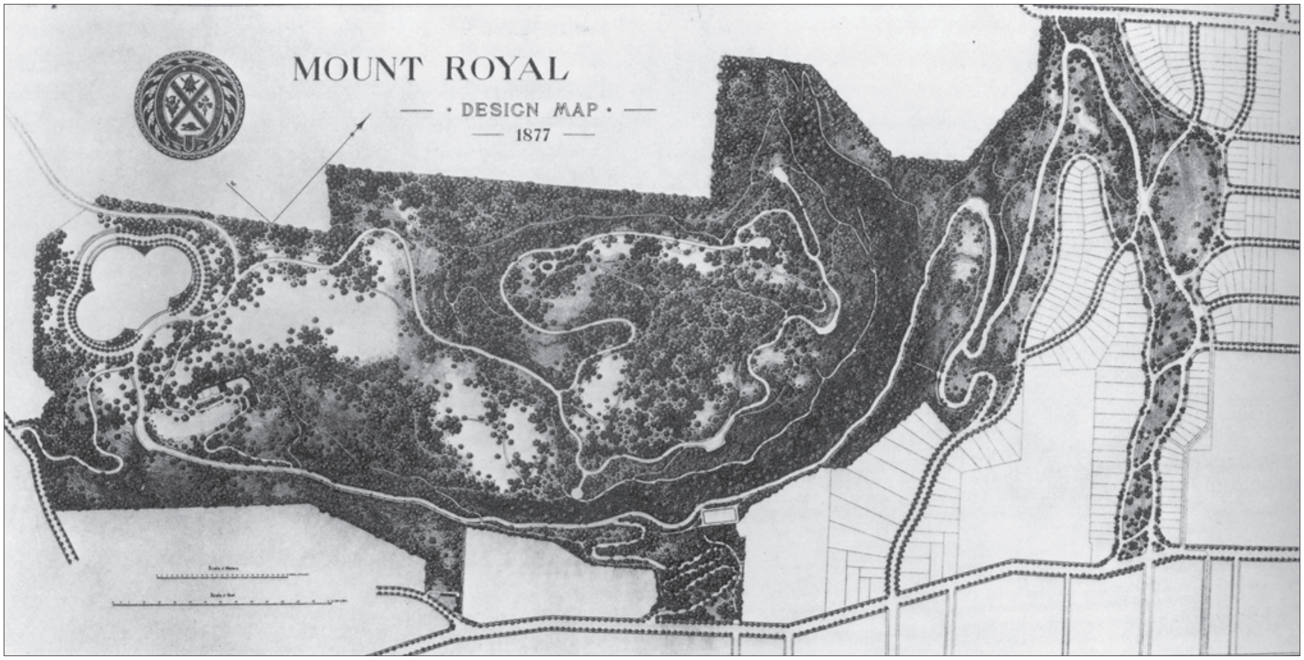


Figure 3. Plan by Frederick Law Olmsted, Sr. for Mount Royal, in Montreal, Canada, showing circulation system of carriage roads and foot paths, 1877. (Frederick Olmsted National Historic Site archives)

As railroads traversed the country, speculators and concessionaires built extensive "trail" systems as part of tourist hotel operations. Trails, such as the Grand Canyon's Bright Angel Trail in Arizona, built in 1890 by a private entrepreneur as a toll trail, received greater use after the arrival of the railroad in 1901.[8] In Montana, the Glacier Park Hotel Company, a subsidiary of the Great Northern Railway, constructed an equestrian trail network in the 1910s to link tourist chalets and tent camps. The 163-mile trail system, consisting of three loops, earned Glacier the title of America's "Trail Park."

Economic ventures often spurred western trail development, while local village improvement societies and regional hiking clubs constructed many eastern trails. Village improvement societies, widespread throughout the Northeast after the Civil War, used membership dues and funds donated in remembrance of community members to hire local laborers for civic enhancement projects. Promoting picturesque landscape principles, attractive sidewalks, footpaths and drives became a hallmark of the village improvement movement.[9] Walks were extended beyond villages to surrounding scenic points, symbolically linking civilization and nature (Figure 5).

Figure 4. The Nevada Falls Trail in Yosemite near Nevada Falls constructed in 1869 and 1870. Trails that ascended the valley walls were built for saddle tourism but never became roads. (NPS Historic Photo collection, Harpers Ferry Center, HFC-000532)

In more remote areas, hiking clubs formed in the 1870s and 1880s were responsible for a proliferation of new trails, guidebooks, and maps, such as those produced by the Appalachian Mountain Club. Formed in 1875, the club engaged in explorations and organized volunteers to construct trails and shelters for recre-

Figure 5. The Emery Path was built in the 1910s by the Bar Harbor Village Improvement Association on Mount Desert Island, Maine (now part of Acadia National Park), which included extensive stonework. (Acadia National Park archives, 1922)

ational use, primarily in the White Mountain Region of New Hampshire.[10] Each improvement society and hiking club fostered philanthropy, volunteerism, and a land protection ethic. Their interests broadened in the early twentieth century as many organizations became effective advocacy groups for local, state, and federal land protection and recreational trail networks. In Vermont, the Green Mountain Club formed in 1910 to "make the Vermont mountains play a larger role in the life of the people." The group established the Long Trail, a 270-mile footpath across the state (Figure 6).

While hiking clubs grew in popularity, village improvement societies waned in the early 1900s when their efforts were eclipsed by publicly funded land management agencies, professional planners, American involvement in the World Wars, and the Great Depression of the 1930s. Similarly, the railroad concessionaires and great hotels were supplanted by automobile touring and family camping.

Federal agencies such as the US Forest Service (USFS), established in 1905, and National Park Service (NPS), established in 1916, became increasingly involved in trail construction and maintenance. The USFS developed an extensive network of trails for timber harvesting and fire control, while the NPS added many trails to accommodate motorists by creating connections with

Figure 6. Early hikers along the Long Trail in Vermont pictured in a 1927 promotional brochure published by the Central Vermont Railway. (Appalachian Trail Conference, Potomac Chapter archives)

Figure 7. A rustic footbridge over Indian Creek in Yosemite Valley was designed by the NPS Landscape Division and built in 1928 with unpeeled logs, following the picturesque design principles put forth by A.J. Downing. (National Archives, Record Group 79)

Figure 8. Myron Avery (right), involved with the construction of the Appalachian Trail between 1927 and 1952, was one of several influential leaders who carried forth a grand regional vision of a foot path through "wilderness" from Maine to Georgia. Largely conceived, marked and built by volunteers, the trail required extensive coordination between regions and partnerships between public and private landowners. (Appalachian Trail Conference, Potomac Chapter archives)

parking areas, campgrounds, visitor centers, and other dispersed facilities located within designated park areas.

In the 1920s and 1930s, the NPS played an active role in the development of trail design standards and trail construction. An emphasis on master planning or development plans for parks ensured that there was an integrated network of foot trails, bridle trails, road systems, visitor facilities, and park buildings. Constructed features were to be "laid gently on the land," so as to harmonize with the setting and native materials of the park. Wood, stone, and clay were fashioned with rustic building techniques for bridges, culverts, and retaining walls, with the avoidance of straight lines and right angles in all aspects of design.[11] NPS landscape architects, supervised through the NPS Landscape Division, perpetuated the nineteenth-century naturalistic design principles on a grand scale (Figure 7).

The NPS constructed two main types of trails. The first type consisted of narrow, rough trails, cut along the line of least resistance, which were to be used by park staff to monitor game animals and areas vulnerable to wildfires—similar to trails constructed on USFS lands. The second type consisted of tourist trails to lead park visitors through attractive scenery. For these trails, the NPS aimed to construct trails four feet in width that did not exceed a fifteen percent grade.[12] By 1932, the NPS had built over 700 miles of tourist trails within 15 parks, including 216 miles in Glacier National Park and 150 miles in Sequoia National Park in California.[13] Another type of trail, constructed in proximity to visitor facilities at the earliest national parks, were wildflower garden trails, which showcased the native flora, such as Castle Crest Wildflower Garden at Crater Lake National Park.

During the same period, private organizations coalesced to build new trails and lobby for the protection of trail corridors. The New England Trail Conference formed in 1916 to coordinate trail-making agencies and clubs; this led to the founding of similar organizations in other regions. Five years later, Benton MacKaye articulated his vision for the Appalachian Trail between Maine and Georgia, eventually leading to the formation of the Appalachian Trail Conference (ATC) in 1925. Mackaye asserted that, just as "The railway 'opens up' a country as a site for civilization; the trailway should 'open up' a country as an escape from civilization." The ATC successfully organized land protection advocates and trail volunteers in the fourteen states along the 2,174-

Figure 9. The lookout platform at Massai Point, Chiricahua National Monument, completed by the CCC in 1935, is an example of highly crafted stone steps, stone walls, and ironwork constructed to harmonize with the natural scenery. (NPS Historic Photo Collection, Harpers Ferry Center)

Figure 10. Two views of Inspiration Point in Yellowstone National Park, showing rustic wooden overlook in 1925 and steel and concrete overlook built in 1956 as part of the Mission 66 program. The Mission 66 program, established to bring the National Parks into the modern age, funded the construction of modern roads, trails, utilities, camp and picnic grounds, and many kinds of structures needed for public use or administration to meet the requirements of an expected 80 million visitors by 1966. (NPS Historic Photo Collection, Harpers Ferry Center)

mile route, and enabled the connection of many trail networks along the Appalachian Mountain range. The trail is heralded as one of the first major acts of regional planning that promoted the concept of a linear protective zone or greenway (Figure 8).

In the West, a similar vision for a long distance hiking and equestrian trail was articulated by Clinton Clark in 1932 for a route along the ridgelines of the Sierra Nevada and Cascade regions from Canada to Mexico. Forming the Pacific Crest Trail Conference, the group eventually created the 2,658-mile trail, now designated the Pacific Crest National Scenic Trail. Ironically, the automobile contributed to the development of long-distance trails between mountain ranges by facilitating access to dispersed trailheads.

Trail development flourished during the 1930s as a means of combining conservation and economic relief. As a result of federal recovery programs such as the Civilian Conservation Corps (CCC) and Works Progress Administration (WPA), many trails were constructed on state and federal lands. Relief crews carried out projects all over the country in accordance with specifications for trails and related structures, which were issued in 1934, 1937, and 1938.[14] With tight controls on design and construction techniques, most trails were highly crafted and durable (Figure 9). The large crews of young men developed a set of skills to be passed on to the next generation of trail builders and maintainers. With the onset of World War II, however, the crews disbanded and without subsequent maintenance, many trails fell into disrepair during the 1940s. Other trails were left incomplete or were poorly routed and soon abandoned.

The greatly expanded network of trails suffered from lack of maintenance during the 1940s and early 1950s. For NPS trails, relief came through the Mission 66 program, initiated in 1956 to upgrade park facilities, staff, and resource management before the fiftieth anniversary of the agency. With a different set of objectives, crews built short trails in association with park facilities and educational initiatives, such as self-guided nature trails and paved multi-use trails. Rather than rely solely on locally available rustic materials, Mission 66 standards employed modern materials such as pipe drains, concrete bridge forms, cut stone, and

Figure 11. In Idaho's rugged mountains, the Nez Perce National Historic Trail marks part of a 10,000 year-old route used by Columbia Basin Indians seeking buffalo in the Great Plains. In 1805, it became the path followed by Lewis and Clark. In 1877, the non-treaty Nez Perce Indians, attempting to escape the U.S. Army, fled east along this route. Segments of trails, totaling 1,170 miles, are now protected as the Nez Perce (Nee-Me-Poo) National Historic Trail and administered by USFS and NPS. (Nez Perce National Historic Trail)

asphalt surfaces. (Figure 10). A resurgence of NPS master plans documented the expansion, relocation, and in some cases reduction of park trails. Outside of parks, many communities and resort areas installed off-road multi-use trails to provide safe routes separated from increasing vehicular traffic.

Several federal laws established to protect cultural resources in the 1960s have affected trail management. The National Historic Preservation Act (NHPA) of 1966, with subsequent amendments, established the National Register of Historic Places, to protect districts, sites, buildings, structures, and objects of national, state, and local significance in American history. The National Trail System Act of 1968 established legislative authority for the federal establishment and protection of significant long-distance trails such as the 2,174-mile Appalachian Trail, which was designated a National Scenic Trail at that time. In 1978 the act was amended to include national historic trails to commemorate significant routes of exploration, migration, military action, civil rights, or commerce (See Sidebar 1 and Figure 11). On federal lands, a 1996 Executive Order to protect Indian Sacred Sites led to the closure and rerouting of trail sections in significant religious and ceremonial sites.[15]

Another group of laws enacted in the late 1960s and 1970s established protective measures for natural resources and influenced the management of many trail systems. The Wilderness Act of 1964 established millions of acres of federally protected wilderness lands "for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness." This act protected many of the country's primitive trails from alterations by mechanized equipment yet at the same time resulted in their abandonment due to lack of use. Additional acts affecting all trails include the National Environmental Policy Act (NEPA) of 1969, the Endangered Species Act of 1973 regarding the protection of critical habitat for endangered, threatened, or candidate species, and the Clean Water Act of 1977 with associated guidelines for protection of floodplains and wetlands.[16] All require careful documentation, a systematic analysis of impacts, and a public review and regulatory process. Protection of natural resources resulted in the seasonal closure of trails for nesting and migration, the reroute of trails around wetland areas, increased use of boardwalks, and restricted use in wilderness areas. Similarly, protection of cultural resources such as sacred sites and archeological areas has resulted in reroutes of trails around sensitive areas or the development of parallel trails. Trail planning now requires full public involvement and consideration of feasible alternatives.

A growing interest in recreation in the 1970s paired with limited maintenance programs resulted in extensive erosion, disrepair and deterioration of structures along many trails as they were "loved to death." Managers struggled to develop trail maintenance programs and crews, and a new generation of volunteer programs emerged, including the Youth Conservation Corps formed in 1970, and state-run conservation corps. To fix trail problems, managers increasingly relied on non-native or imported materials using overland vehicles and helicopters to transport stone, gravel, cement, asphalt, steel, and planks, often replacing the rustic log and stone work from the CCC era. Similarly, high use and liability concerns resulted in the closure of many trails, reroutes of damaged or dangerous sections, and increased use of railings, often set in concrete walls and footings.

In the 1970s, a growing interest in recreation, urban open space, linear parks, and environmental protection led to a network of multi-use trails developed on abandoned railroad tracks, former canals, and other unused transportation routes. Many of these trails preserved industrial remnants including water towers, switching signals, stations, bridges and tunnels. Some of these corridors are listed in the National Register as significant symbols of American industry, engineering and labor. Their relatively recent conversions to trails may, in the future, be considered part of an important trend in American history (Figure 12).

Figure 12. View of Lock 37 on the Ohio & Erie Canal in the late nineteenth century, showing a dwelling and general store, paired with view nearly one century later, showing the Towpath Multi-use Trail within the Cuyahoga Valley National Park. The park was established in 1974 to protect historic resources and create a recreational corridor along the canal. (Cuyahoga Valley National Park)

In the 1980s and 1990s an increasing number of heritage routes and scenic trails were recognized either as significant national historic trails, national scenic trails, or listed in the National Register of Historic Places as historic districts, historic sites, or as part of a thematically-linked multiple property nominations (See Sidebar 6 for trails recently listed). In some cases, notable features along trails such as bridges, are listed as historic structures. With an increased awareness and understanding of preservation practices, many additional trails and trail features will likely be listed. Recognition of trails as historic resources raises issues related to their management such as reroutes, addition of new features, resource protection, and treatment guidelines as will be discussed further in this document.

Historic Trails and the CLR

With the tremendous use of historic trails and concomitant maintenance concerns, a clearly defined approach for treatment and management is essential. A Cultural Landscape Report (CLR) provides a comprehensive approach to guide treatment and management decisions based on historical research, existing condition documentation, and analysis and evaluation. Other studies and planning methodologies may also guide management of a historic trail. A Comprehensive Management Plan (CMP) is mandated for all trails designated as National Scenic or National Historic Trails while a General Management Plan (GMP) is required for all National Park System units. Also, other cultural resource specific studies as described in Sidebar 2 may inform trail management decisions.

The historical research component of the CLR clarifies the general context and intent that influenced the trail's development, and supplies information about the original layout, design, workmanship, materials, setting, and construction process. The existing condition documentation provides a comprehensive account of the trail's current physical appearance, paying particular attention to aspects that have been identified as character-defining features from the period of primary significance. Comparing current conditions to historical precedents reveals the extent to which the trail's

SIDEBAR 2:
PLANS, REPORTS AND INVENTORIES WITH HISTORIC PARK TRAIL INFORMATION

Below is a list of plans, reports and inventories that may contain information about historic trails. Ideally, a historic trail would have been addressed in a General Management Plan, but in absence of this overarching document, or in conjunction with a master planning effort, a Cultural Landscape Report (CLR) is a valuable tool.

Documents Specific to National Scenic or Historic Trails:

Comprehensive Management Plan [CMP]. A plan required for all designated National Scenic and Historic Trails that typically provides a historical overview, identifies significant resources associated with the historic trail, and outlines objectives, practices, and responsibilities for the managing agencies associated with the trail. The plan defines a marking system with design guidelines to ensure consistency, identifies responsibilities for all cooperators, and provides a prioritized list of the tasks necessary for implementation. An example is the "Comprehensive Management and Use Plan, Trail of Tears National Historic Trail."[17]

Documents Specific to the National Park Service:

General Management Plan [GMP]. The overall plan for a National Park System unit that ensures that the park has a clearly defined direction for long-term resource preservation and visitor use. GMPs typically contain mission goals and management prescriptions that address the preservation of park resources, types and areas of development, visitor carrying capacities, and potential boundary modifications. It is critical that historic trails be identified within a park GMP.

Historic Resource Study [HRS]. A HRS for a trail system evaluates associated cultural resources within historic contexts. Through documentary research, typically led by a historian, and field investigations, this report describes the integrity, authenticity, associative values, and significance of the trail and related resources. This report includes National Register nominations for all qualifying resources and is used as a basic report for completing more detailed studies such as a CLR or interpretation plan. An example is the "Historic Resource Study, Pony Express National Historic Trail."[18]

Historic Structures Report [HSR]. A report that serves as the primary guide to treatment and use of a historic or prehistoric structure. The purpose, content and use of the report parallels that of a CLR. The treatment and use of an adjacent structure can directly affect the trail.

Cultural Landscape Inventory [CLI]. An evaluated inventory of all cultural landscapes in the National Park System having historical significance. The CLI provides baseline cultural landscape data for a park, including trails and trail-related resources. The information collected about a landscape includes location, description, historical development and significance, landscape characteristics, and management decisions.

List of Classified Structures [LCS]. An evaluated inventory of all historic or prehistoric structures in the National Park System having historical, architectural, or engineering significance. The LCS provides baseline structure data for a park, including the location of historic and prehistoric structures, description, historical development and significance, and management decisions.

Archeological Overview and Assessment. A report that describes and assesses known and potential archeological resources in a park area. The overview reviews and summarizes existing archeological data while the assessment evaluates the data. Further investigation requires an archeological identification and evaluation study to identify the location and characteristics of some or all sites in a geographical area. Data is then added to the Archeological Sites Management Information System (ASMIS).

Ethnographic Overview and Assessment. A report that reviews and summarizes existing information on park resources valued by associated traditional communities.

National Register of Historic Places. The National Register Information System (partially available on-line at www.nr.nps.gov) includes information on historic trails that have been listed in the National Register. The full text of nominations and copies of supporting documentation can be obtained by contacting the National Register of Historic Places.

purpose, users, or physical characteristics have changed. The analysis and evaluation component helps to identify treatment and management issues. The CLR may be based on or expand on existing studies such as Historic Resource Studies or National Register nominations, but in some cases the CLR can serve as an initial analysis and evaluation of the trail's significance and integrity.

The CLR is intended to address a range of concerns, from basic historical research and definitional criteria to broader managerial issues. The questions that the CLR should provide guidance in answering include: *What is the historic trail or trail system? Is it part of a larger circulation system or a single linear trail? Why is it significant? How should it be protected and enjoyed?*

Historical Research

Historical research for a CLR provides an in-depth understanding of the trail's evolution and lays the foundation for subsequent analysis and treatment. Historic trail research should begin by placing the development of the trail within the broader trends and events in American history. The political, social, economic, and environmental context can offer insights into the purpose of the historic alignment or method of construction. Research should then clarify the intent of the trail with respect to the origin, destination, and other trail or landscape characteristics (See Sidebar 3).[19] For trails that are highly crafted, it is important to provide information on the development of specific trail characteristics and features such as layout, grade, tread width and composition, step construction techniques, other stabilization measures, drainage systems, bridges, and associated features. Tracing the appearance of trail characteristics and features through successive historic periods may reveal the influence of changing social patterns, land uses, construction practices, management philosophies, and funding situations. A trail may have been relocated in response to natural processes such as a flood or fire, changes in land ownership, the shift from trains to automobiles as the primary means of accessing trail heads, or evolving tastes in scenery or recreational activity. Legislation to limit the type of use or restrict access to traditional tribal properties might also alter trail

Sidebar 3: Researchers Checklist

Historic Context

- Themes or associated events that influenced trail development or use
- Builders and users of route, owners, managers, and jurisdiction
- Adherence to local, regional, or national design standards, laws, and policies

Development History

- Evidence of prehistoric use or associated sites, especially springs and grave sites
- Evidence of segments capitalizing on natural routes, i.e., dry floodplains, natural sandhill benches, or mountain saddles
- Designers and builders of the trail, design intent, width, grade, origin, route or alignment, destination, views, natural features, cultural sites
- Materials used and sources, local or imported
- Tools and equipment used for construction and maintenance, professional skills of builders
- Types and extent of built features such as drainage systems, steps, retaining walls, ladders, railings, tread preparation, and bridges

Management History

- Maintenance and stewardship responsibilities for the trail, advocacy groups, volunteers and users
- Location and frequency of repairs for trail sections or rationale for trail closures and reroutes
- Descriptions of trails by users: recommendations and concerns
- Successes and failures of maintenance solutions, particularly in high use areas
- Changes in origin, destination, tread materials, width, or use
- Maps or other documents that locate features difficult to find in the field, such as closed trails, drainage systems above the trail, closed culverts, iron work, or retaining walls that may be obscured or in poor condition

location and appearance; a formerly unimproved trail may require stone steps, puncheon bridges, or scree wall curbing to withstand increasingly heavy use; changing safety standards and accessibility regulations may call for hand rails, grade changes, and surface alterations. The timing, nature, and reasons for such changes should be thoroughly documented and clearly articulated.

Sources for historical information on trails include old maps, trail guides, hiking club annual reports, travel journals, maintenance logs, paintings, sketches, photographs, aerial photographs, postcards, newspaper articles, oral histories, and interviews with maintenance staff and trail users. In some cases, trail archeology may be studied to either understand how the trail was built or determine if the trail is associated with a historic or prehistoric use. For trails on public lands, extensive records for the Civilian Conservation Corps (CCC) and other New Deal federal work programs are held by the National Archives in College Park, Maryland, and their satellite repositories across the country (Figures 13 & 14). Specific types of trails, such as pioneer trails, may have associated repositories, like the National Frontier Trail Center in Independence, Missouri.

To ensure that data gathered is well organized and retrievable, it is helpful to create a database and assign a code to each trail or trail section. A database can generate a chronology of trail construction, sort trail segments by land ownership or region, and compile types of built features. Information can also be linked to maps produced through Geographic Information Systems (GIS) as described in the next section.

Figure 13. Historic photograph of rustic foot bridge constructed in 1934 by the CCC on the Eagle Rock Creek Trail in the Great Smoky Mountains in North Carolina. (National Archives; NARA MD, 79--42, NC, Box 21)

Figure 14. Historic photograph of horse trail, retaining walls, and guard rail built by the CCC in 1935 for a trail south of Sunset Rock in Chickamauga & Chattanooga National Military Park, Georgia. (National Archives; NARA MD, 79-42, GA, Box 14)

Existing Conditions Documentation

Documenting the trail's existing condition is an essential component of the CLR process. The existing condition documentation includes a geographical survey and field verification to locate and assess the current condition of general landscape characteristics and specific features associated with each trail. A US Geological Survey map at 1:24,000 scale may serve as the base for a survey. GIS and Global Positioning System (GPS) computer technology can be used to develop an electronic map with links to a GIS database with standardized terminology and attributes.[20] The database can contain historic, contextual, and trail-specific information. The graphic layers and data can then be manipulated to produce plans that illustrate past periods of development, rerouted sections, existing conditions, and proposed management actions (Figure 15).

Contemporary photographs are useful for documenting the current condition of trail features, particularly when paired with historic photographs taken from similar vantage points, as shown in Figure 12. A video of a trail is also useful. With visual documentation it is important to maintain a concise record of the trail name, number, and location within the trail. For highly crafted trail features, sketches, measured sections, and plans are useful for subsequent phases of analysis and treatment.

All features of a trail should be inventoried, if possible, at a cursory or comprehensive level (Sidebar 4). For a cursory inventory, a map and a scale bar are used to determine the length of trail segments. The types of features and conditions encountered on the trail are recorded but not their specific location. The width of the trail should also be measured at key points. For a comprehensive inventory, a measuring wheel or GPS unit should be used to document the trail route, length,

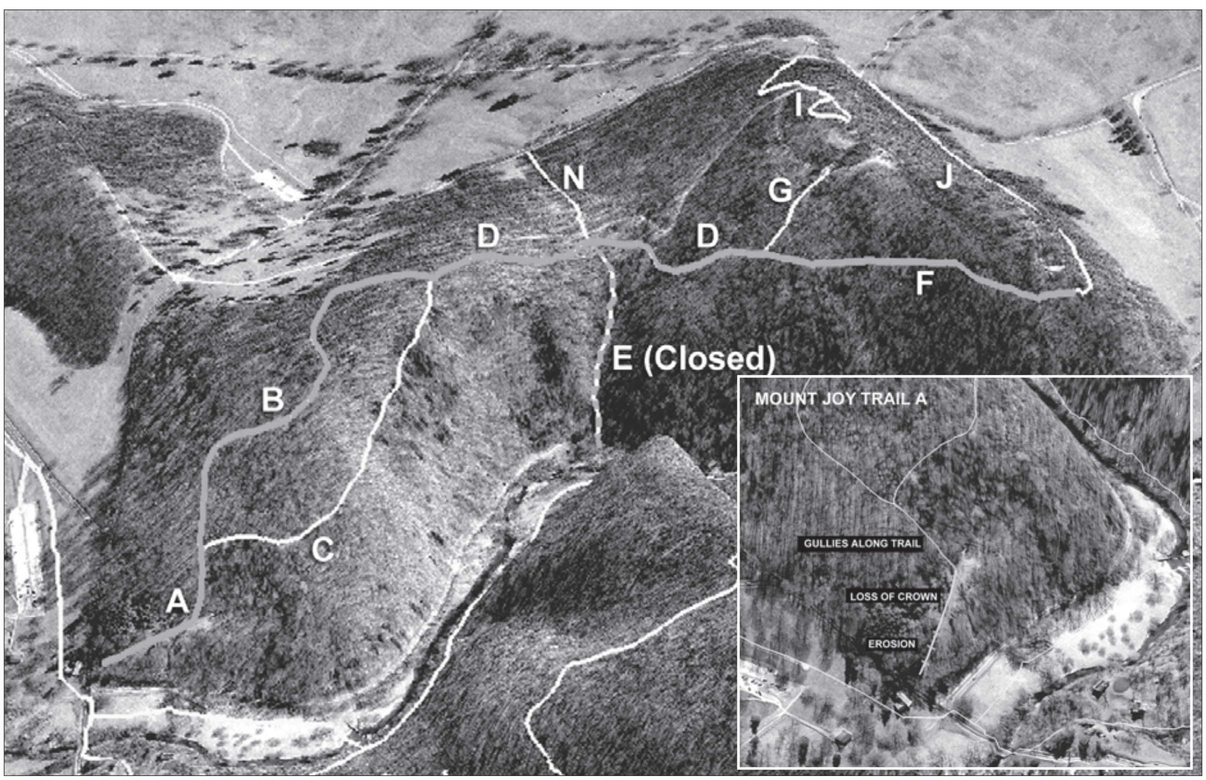


Figure 15. Geographic Information System map layers including an aerial photograph projected with three-dimensional topography, showing the configuration of open and closed historic trails on Mount Joy at Valley Forge National Historical Park, with close-up showing the condition assessment for Trail Section A. (NPS, Olmsted Center for Landscape Preservation, Mark Davison, 2003)

and features. Written notes should be supplemented with photographs keyed to the linear distance from the trailhead. The materials, dimensions, and construction style should be recorded.

The inventory can be combined with a log of corrective work needed, which can also be keyed to linear distance from the trailhead. A comprehensive inventory is useful to both augment archival research and inform subsequent steps in the CLR process. This record of existing conditions will serve as the benchmark for ongoing management of the trail.[21] The Appalachian Trail Conference has developed an assessment process to identify key features and analyze trail maintenance and land management needs for trail sections within the long distance trail.[22]

Sidebar 4: Sample List of Trail-related Features

Design and Layout: origin, destination, relationship to significant natural features, width, grade/profile, curvature, switchbacks, junctions, views and vistas, cut/fill slopes, planted vegetation

Guides: fences, stiles, scree wall curbing (stone or log), railings, signs, blazes, cairns, plaques

Drainage Structures: culverts, side drains, water bars, water dips, ditches

Retaining Structures: coping stones, log or stone walls, checks, log or stone cribs, rip rap, iron pins

Crossings: stepping stones, bog bridges (split-log, topped-log; timber), stream bridges (note material, design & construction techniques: log, timber, or laminate; stringer, truss, suspension, etc.; style, materials, and dimensions of footings & pilings, railings, etc.)

Steps, Rungs, and Ladders: stone steps (rock-and-earth, set/tuck-behind, rock-on-rock or slab-laid, cut steps), log steps, foot and hand rungs, steel rung ladders, log ladders

Tread: edgings (log or stone), surface materials (soil, gravel, ledge, stone, concrete, bituminous asphalt, corduroy logs), turnpiking

Trail-related Structures: benches, shelters, tent sites, camp grounds, lookout towers, comfort stations and privies, trail heads, assembly areas, parking lots, constructed water features

Associated Cultural Features: archeological sites (including associated vegetation), traditional use sites, historic sites

Associated Natural Features: water (streams, water falls, lakes, ponds, springs), native vegetation (woodland, prairie, desert), wildlife, geologic formations

Analysis and Evaluation

The analysis and evaluation component of the CLR compares existing conditions with historic conditions in order to assess the integrity of historic trails and associated features. To determine the historic character of a trail, one must understand its historic and existing conditions, as well as its associated contexts. A trail may be historically significant for its association with historic events or notable persons, its distinctive construction, or its association with prehistory or history. The National Register of Historic Places has articulated the general criteria for assessing the significance and integrity of historic districts, sites, buildings, structures, and objects. These criteria can be adapted to the evaluation of historic trails for CLR purposes as demonstrated in the accompanying sidebars (Sidebars 5 and 6).[23] This comparison is facilitated by the identification of landscape characteristics and features that contribute or do not contribute to the historic character of the trail. Landscape characteristics and features, including processes and physical forms, are the tangible evidence of the activities of people who shaped the landscape or trail.[24] The evaluation includes a brief description of historic and existing conditions, as well as a determination of whether a particular characteristic or feature of the trail contributes to its significance as a whole. Trail characteristics or features defined as "contributing" are those that were present during the period of significance and survive or are replacements in-kind of historic features. The analysis and evaluation section identifies features that should be preserved and those that should be removed or mitigated.

Many trails are listed in the National Register of Historic Places. Trails can be listed as historic sites, as parts of historic districts, or as part of a multiple property nomination. A major trail feature such as a bridge, cairn, earthwork, or tunnel may also be listed as a historic structure. A trail-related feature such as a

Figure 16. The West Rim - Angels Landing Trail in Zion National Park, which ascends 1,700 feet to the summit, is listed in the National Register under criterion C for its exceptional rustic style design and construction and contains extensive switchbacks, stonework, railings, and chiseled steps. (Zion National Park)

monument or marker may also be listed as a historic object. Typically trails are listed as part of a historic district or a thematically-linked multiple property nomination. Using the National Register criteria for evaluation, trails may be significant in many ways as previously highlighted in the brief history. For example, trails may be recognized for their association with events that have contributed to our country's history (Criterion A), such as the Oregon Trail; recognized for their association with significant individuals (Criterion B), such as explorers Meriwether Lewis and William Clark; possess high artistic or architectural values (Criterion C), such as the trails in Zion National Park built by the NPS between 1917 and the 1930s; or may yield information significant in the country's prehistory or history (Criterion D), such as the earliest trails in Yosemite National Park.[25]

The National Register defines seven aspects of integrity that can be used to evaluate the degree to which a trail retains its historic character (Sidebar 5). A trail that was partially rerouted, leaving a section closed or no longer maintained may still retain its historic integrity. However, if the origin, destination, or trail corridor has been substantially altered or if historically significant sections have been closed, changed or obliterated, integrity may be compromised and only a portion of the trail may be significant. For example, along designated National Historic Trails there are many sites and even trail segments that are listed in the National Register of Historic Places, such as the Barlow Road on the Oregon Trail. In other cases, an individual trail may not be noteworthy, but a network of trails may be significant as part of a larger circulation system such as the trail system at Acadia National Park. Studying the resource holistically is recommended, such as an integrated circulation system of roads, bridle paths, trails and associated developed areas within a park. Sidebar 6 provides several examples of National Historic Trails and National Park trails, the criteria for which they were listed, and the physical aspects that contribute to their integrity.

Treatment Approach

After documenting a trail's historical development, determining its significance, and evaluating its integrity, a long-term treatment and management approach should be chosen. The development of a CLR treatment section is typically a collaborative process, involving managers, field staff, representatives from associated communities and organizations, and multidisciplinary expertise such as a historian, archeologist, ethnographer, wildlife biologist, and historical landscape architect. Goals for treatment are defined and a range of alternatives may be developed. Based on the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*, four types of treatment are defined below with trail-specific examples of each.

Preservation allows for measures necessary to sustain the existing form, integrity, and materials of a trail. This treatment includes stabilization work, ongoing maintenance, and repair of historic materials and features, such

SIDEBAR 5: EVALUATION OF INTEGRITY FOR TRAILS

Aspect of Integrity	Trail Characteristics and Features	Retains Integrity	Does Not Retain Integrity
Location	• Describe how the route is influenced by natural systems and features, including the surrounding landforms, geology, and hydrology • Describe changes in microclimates and plant communities. • Describe the three dimensional spatial organization of a trail, including the ground, vertical and overhead planes, which is often referred to as the trail corridor. • Identify a boundary width for the trail corridor, which may be widened to protect adjacent resources and critical viewsheds.	Continued use of the historic route or the presence of the historic route that is abandoned but not obliterated	Substantial reroutes and obliteration of the historic route
Design	• Describe the evolution of the trail route and its lack or presence of constructed features, including associated roads, canals or other circulation systems. • Determine whether the trail route was selected to orient the traveler to framed vistas of a peak, tower, or landscape features that are designed or natural. • Determine if there are clusters of buildings, structures and associated spaces that relate to the trail and historic links to places obscured by subsequent development • Determine whether the trail itself is a contributing resource to a larger designed circulation network. • Describe the overall landform, as well as the trail's slope, solar aspect, elevation, and response to topography. • Describe the trail character and whether it is straight, winding, connected to water bodies, or evenly graded between scenic knolls with extensive switchbacks. • Consider whether the historic route is a contributing characteristic and should be preserved through an ecologically sensitive area.	Evidence of the design style or design standards from the period of significance	Redesign, realignment, or obliteration of design from the period of significance
Setting	• Describe how the surrounding land use may have changed through time and influenced trail development or use. • Describe historical and contemporary land uses and determine what types are appropriate. • Identify overlooks, summit destinations, and routes along ledges that may have been selected for broad, open views; or determine if migration or hunting trails may have been strategically located for protection and concealment. • Describe the overall character of a trail, exposed or concealed, and specific views and vistas that may be contributing.	The presence of the setting or views from the period of significance	Loss of the trail corridor setting, important sites, destinations and views due to subsequent development
Materials	• Describe the materials used for structures that are associated with the route, such as culverts, trailheads, retaining walls, bridges and tunnels.		

SIDEBAR 5: EVALUATION OF INTEGRITY FOR TRAILS

Aspect of Integrity	Trail Characteristics and Features	Retains Integrity	Does Not Retain Integrity
Materials (continued)	• Describe materials used for buildings, such as hotels, cabins, shelters, monuments, towers, or developed areas that are key nodes or destinations within a trail system. • Identify constructed elements that are contributing features and recent elements that are not. • Document the materials used for constructed water features, such as dams, canals, springs, constructed waterfalls, or reservoirs, which may influence the route and purpose of the trail. • Describe stone, wood, and iron small-scale features such as retaining walls, railings, and steps, that contribute to trail character. • Document the types and dimensions of construction materials that are contributing characteristics. • Identify native plant communities or cultivated landscapes that may be associated with the trail's alignment or historical use. • Determine whether wooded or open areas, individual trees, groves, or wildflower meadows are contributing features.	The repair of tread, crossings, drainage features or plant communities in the same style as the period of significance	Loss or replacement of materials from the period of significance
Workmanship	See materials above. • Describe the construction methods used for structures that are associated with the route, such as culverts, trailheads, retaining walls, railings, steps, bridges and tunnels. • Describe the construction methods for buildings, such as hotels, cabins, shelters, monuments, towers, or developed areas that are key nodes or destinations within a trail system. • Document constructed water features, such as dams, canals, springs, constructed waterfalls, or reservoirs, which may influence the route and purpose of the trail.	The presence of trail structures and features, such as bridges, walls, steps, planting design and associated buildings that date to the period of significance	Loss of workmanship from the period of significance
Feeling	See setting, design, materials, workmanship. • Describe the overall feeling of the trail corridor with respect to its setting, topography, views, designed elements, presence or lack of built structures, and associated trail features.	The presence of a trail corridor or setting, views, design elements, and materials from the period of significance	Dramatic change in use, setting, views, design elements, or destinations
Association	• Identify cultural events and practices that may have influenced trail development and route, such as seasonal or ceremonial use. • Determine whether traditional uses are so significant as to influence restrictions on the use of a trail for a particular day or season, or result in the development of parallel routes for non-traditional users. • Determine whether prehistoric and early historic trails contain archeological sites that require protection.	Physical evidence of associated sites, uses, or cultural traditions	Loss of associated sites, uses, or cultural traditions

Sidebar 6: Examples of Trails Listed in the National Register

Bold titles indicate the name on the National Register or National Historic Landmark forms.

The **Glacier National Park Multiple Property Listing** includes three distinct trail loops, North Circle, South Circle, and Inside Circle (made up of 13 individual trails), with a period of significance of 1890 to 1945 and key dates of 1911 and 1919. The trails were initially built by the Glacier Park Hotel Company to link scenic areas with tent camps and eight chalets. Beginning in 1929 the NPS reconstructed the trail system. The 163-mile district is listed under criteria A and C as an exceptional recreational system and for the physical development of rustic architecture and landscape design by the NPS. The trail boundary is ten feet to each side of the centerline, with broader areas to incorporate associated buildings and structures.

The **Bryce Canyon National Park Multiple Property Submission** identifies the Civilian Conservation Corps (CCC) as building the Under-the-Rim Trail, 32 miles long, and Riggs Spring Fire Trail, 8 miles long, between 1934 and 1944. The trails are listed under criteria A and C. The nomination relies on the context provided by the multiple property documentation form entitled "Historic Park Landscapes in National and State Parks (1993)."[26] The trail boundary is ten feet to each side of the centerline.

The **Mount Rainier National Park National Historic Landmark District** identifies the 93-mile Wonderland Trail as a contributing resource that encircles Mount Rainier. The nominated historic district includes most of the front-country developed areas within the park, as well as historic backcountry structures associated with the trail. The NHL district was designated under the themes of "Expressing Cultural Values" and "Transforming the Environment" for the period of 1904 to 1957 because of its many examples of rustic architecture, park village plans, and other aspects of 1920s and 30s national park planning and design. The trail passes through a federally designated Wilderness Area and maintenance must be accomplished within the guidelines for this area. For most sections of the trail, the boundary is five feet to each side of the centerline, with broader areas to incorporate associated buildings and structures.

In **Multiple Resources for Zion National Park** seven trails are listed in the National Register. The Angels Landing – West Rim Trail, East Rim Trail, Canyon Overlook Trail, Emerald Pools Trail, Grotto Trail, Hidden Canyon Trail, and Gateway to the Narrows Trail are all listed for their NPS and CCC construction and improvements between 1925 and 1949, some of which were built under the direct supervision of Chief Engineer Frank Kittredge. All have exceptional stonework including rubble stone walls, chiseled steps, handrails, switchbacks, and are intertwined with natural features. The trails are listed under criterion C as exceptional examples of NPS Rustic style design and construction. The East Rim Trail, is also listed under Criterion A for Native American origins and use by pioneers with an extended period of significance that includes 1875 to 1949. A boundary width is not defined.

The **Lolo Trail National Historic Landmark** is a 92-mile-long trail that extends from Lolo, Montana to Weippe Prairie, Idaho. The route is listed as a transportation corridor under Criterion A for its association with exploration and settlement and for Native American ethnic heritage, and Criterion B for its association with Meriwether Lewis, William Clark, Toby (Shoshoni guide), and Sacajewea (Shoshoni interpreter). The prehistoric route connects the Columbia River basin and the Missouri River basin through the Bitterroot Mountains. The route was used by the Nez Perce in their annual journeys to the buffalo plains in the east and was followed by Lewis & Clark and their Shoshoni guides in 1805, representing one of the most arduous stretches of their expedition. The route also contains significant ethnographic, archeological, and historic resources associated with Nez Perce and the Nez Perce War of 1877. The trail extends over private, local, state, and federal lands, with most owned by the U.S. Forest Service. The 92-mile corridor covers 86,000 acres and is at least a half mile wide and defined by a boundary line of 400 miles. Some sections are up to a mile wide where the trail diverges, wanders through difficult terrain, or is difficult to locate. The route has a high level of integrity with 32 contributing sites and 382 identified segments.[27] To preserve the sensitive cultural and natural resources associated with the trail, the U.S. Forest Service established a permit system for access to the area.

The **Hood River County Historic District** in Oregon includes a 30-mile section of the Barlow Road, a segment of the Oregon Trail listed in the National Register under Criterion A as an exploration, settlement and transportation route. The route was marked by Samuel Barlow in 1845 and operated as a toll road from 1846 to 1919, providing pioneers with an alternative route to the Willamette Valley. The route crosses over local and state owned land, but is predominantly on U.S. Forest Service lands within Mount Hood National Forest. Many sections of the original route and wagon ruts are still evident. The trail boundary is 600 feet to each side of the road trace, with some wider sections.

In **Historic Resources of Acadia National Park Multiple Property Listing**, the historic trail system of 250 individual trails covering 225 miles has been determined eligible for the National Register, with a period of significance from the 1860s to 1942. A network of unconstructed recreation trails grew in popularity beginning in the 1860s. In 1890, local village improvement associations began marking, mapping, and maintaining these trail and built many additional highly crafted trails. In the 1930s the Civilian Conservation Corps further expanded the system. The trails are eligible under criteria A and C for the unprecedented role of the local village improvement associations in land protection, community development, and exceptional trail construction and high quality stonework, and for the role of the CCC. Many of the trails are no longer marked or actively used but can still be found in the park. These have been documented using GPS and GIS technology. The trail boundary is fifteen feet to each side of the centerline, with broader areas to incorporate associated buildings and monuments.

In Yosemite National Park, as part of the **Yosemite Valley Historic District**, four trails built between 1858 and 1920 are listed. The trails include the Mist Trail to Vernal and Nevada Falls, the Four Mile Trail up to Glacier Point, the Yosemite Falls Trail, and the Valley Loop Trail. The district is listed for Criteria A, B, C, and D for its seminal role in the preservation of natural scenery, association with preeminent artists and conservationists, high quality stonework, significant trail design, and archeological sites. The trail boundary is ten feet to each side of the centerline.

as the repair of a wall that has collapsed or steps that have slipped. Because preservation prescribes maintenance of trail features as they currently exist, it is often the best treatment approach for a recently designated historic trail, where a detailed inventory of historic features has yet to be completed. For a trail that has suffered from severe erosion and subsequent loss of surface material, it may not be possible or desirable to preserve the existing condition. Preservation may require restrictions on the number of trail users by determining a carrying capacity for the route that prevents further erosion. Preservation may not be feasible if trail features were originally constructed with local natural resources that can no longer be used for repair work, such as large fir or redwood trees, or pond-side gravel.

Rehabilitation acknowledges the need to meet continuing or changing uses through alterations or new additions, while retaining the historic character. This treatment allows for compatible yet distinguishable materials, which may be brought in from non-local sources. For example, tread material can be imported to stabilize the pathway in sensitive natural and cultural resource areas. For trails with high use, rehabilitation allows for updating trail markings and sign systems, applying new surface materials and drainage features, rerouting sections of trail without obliterating historic features, or other measures necessary to sustain a durable and safe tread. All modifications require careful specifications to ensure that historic materials, features, and spatial relationships are protected.

Restoration is the process of accurately depicting the form, features, and character of a trail at a particular time in history, while removing evidence of other periods. This treatment requires a thorough understanding of the construction methods and materials for the period of significance. For trails with high design, ceremonial, or archeological significance, where limitations on use are feasible to protect restored features, this approach may be appropriate. For soft-surface trails that are heavily used, restoration may be difficult because of the need to modify the tread material, retaining walls, and/or drainage features.

Reconstruction allows for new construction that replicates the form, features, and detailing of a non-surviving trail for the purpose of depicting its appearance at a specific period of time and in its historic location. Though this is an uncommon treatment, reconstruction of a trail or trail segment would be appropriate if it had been destroyed or if the pre-trail landscape was determined so significant that its re-creation was critical to the interpretive mission of the park and only if the documentation exists to reconstruct an accurate duplication of historic features. For National Park Services resources, this treatment requires the approval of the Director of the National Park Service.

For large trail networks, with multiple layers of significance and management needs, treatment alternatives may differ within management zones. Defining these management zones requires multidisciplinary input, as underscored by the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA) compliance procedures. Management zones can be used to organize the CLR treatment section and recommendations.

Compliance

Selection of a treatment and management approach is done in accordance with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA) to ensure interdisciplinary involvement and systematic consideration of the human environment. For parks, following compliance procedures involves completing an environmental screening/project review form and determining the potential effects on cultural resources that are either listed in or eligible for the National Register of Historic Places. Management alternatives may need to be developed in accordance with NEPA to consider the impacts of major federal actions on the affected environment. Compliance ensures meaningful participation by the public and other stakeholders, development and evaluation of alternative courses of action, rigorous application of scientific and technical information in the decision making process, consultation with expertise through multidisciplinary teams, and attention to mitigation measures, pollution prevention measures, and sustainable management principles.[28] For historic trails, actions that require NEPA compliance include opening, major relocation, or closing a major trail;

extensive vista clearing; management of trails in fragile environments or rare habitats; and construction of associated features such as parking areas and facilities.

Compliance may be necessary for activities such as extensive regrading for accessibility, rerouting, restoration, or rehabilitation of a historically significant trail or a trail that passes through a significant cultural site.[29] For a long term or extensive trail rehabilitation project, a programmatic agreement with a list of programmatic categorical exclusions may be developed for repetitive procedures or a series of rehabilitation projects within a historic trail network.

Format of a CLR Treatment Section

Once a treatment approach is selected, a CLR treatment section should convey three levels of information:

1) An overall treatment philosophy and guiding principles (Sidebar 7);

2) Guidelines for types of features common to many trails or trail segments; and

3) Specific guidelines for individual trails or trail segments.

For primitive trails with few constructed features, a recap of the evolution of the trail and its historical functions, an overview of its general appearance and character-defining features, and a summary of contemporary issues, such as carrying capacity and types of appropriate use, provides the necessary background for treatment recommendations.

For trails with many constructed features, more extensive descriptions of the historic materials, construction methods, and contemporary management concerns are needed to develop treatment recommendations. Since many trail features are rustic and assembled with local wood and stone, guidelines can offer a range of parameters, e.g., bridge railings to consist of logs between 4 and 6 inches in diameter or stone steps must be between 16 and 24 inches wide.

Sidebar 7: Example of Treatment Recommendations

The following treatment recommendations were developed for the rehabilitation and maintenance of the historic hiking trail system in Acadia National Park.[30]

- Preserve as much of the historic trail system as possible. Replace in-kind or rehabilitate historic features such as steps, bridges, walls, ladders, rungs, drainage, tread, markings, memorial plaques, and other historic trail features
- Maintain historic trail routes, with their winding or straight character, and names where possible
- Reroute trails only when necessary to preserve historic resources or stabilize the tread, try to retain the character and design intent of the trail
- Retain original trail width where possible and allow for rehabilitation work to guide and contain foot traffic on designated trails
- Protect associated scenic, natural, and cultural features that are part of the attractions and destinations of the trail system, including rock formations, vegetation, water bodies, views, buildings, structures, developed areas, plaques, and monuments
- Preserve the original choice of materials and methods used to construct the trails
- Prevent further dissection of natural areas by roads, reduce traffic, and disperse hikers to preserve the wilderness setting of the trail system
- Preserve and rehabilitate village connector trails to preserve the feeling of hiking from a village into wilderness
- Encourage public transportation to trailheads to reduce automobile use and enhance the island experience
- Use modern construction materials and methods that reduce material and labor costs and enhance durability where they are not visible or do not detract from the historic character
- Use historic or contemporary methods to produce the same style of historic workmanship
- Preserve association with the four surrounding villages and their local trail systems
- Preserve cultural traditions and protect archeological sites
- Preserve association with park recreation areas and facilities.

For both primitive and highly constructed trails, historic and contemporary photographs, diagrams, and text should convey the guidelines or parameters for trail work. Historic photographs can be used to show the construction of historic features, or be paired with contemporary photographs to illustrate compatible yet distinguishable differences in construction. Historic photographs also can be paired with diagrams to demonstrate underlying maintenance and construction techniques (Figure 17). Diagrams can be developed to show concealed features that aid in preserving historic character by improving durability. In all cases, graphic illustrations supported with concise text, aid in conveying the character, scale, and composition of the historic trail and its unique features. These guidelines are typically developed in collaboration with field staff to ensure their feasibility.

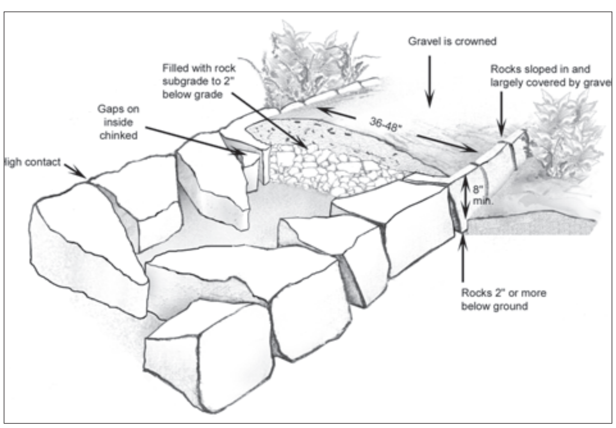


Figure 17. Historic photograph of Great Pond Trail constructed by the CCC in 1937 and contemporary detail showing walled causeway construction for a pond-side trail. (National Archives; NARA MA and Acadia National Park, Barter and Baldyga)

Trail Treatment Considerations

This section discusses concerns common to many trail systems, with examples from across the country. In order to determine the best treatment and management strategy for a trail, it is essential to understand the features that contribute to the trail's historic character and significance.

Primitive and Vernacular Trails

Many historic trails are significant for their primitive origins and association with Native American use such as the Lolo Trail from Montana to Idaho. Others are significant for their association with more recent broad social or historical patterns, such as American pioneer and settlement trails and long-distance recreation trails such as the Appalachian National Scenic Trail. For historic trails associated with broad social patterns, because of the scarcity of constructed features, the associated archeological sites, traces, or erosion caused by wagon ruts define their historic character. For recreational trails, distinctive design and construction features or key location decisions define their historic character. In both cases, the routes may be direct, have multiple branches, or lead through rugged terrain. Adding constructed features, making improvements for increased use or accessibility, or applying highly crafted trail design standards may be inappropriate. These decisions need to weigh the need for change versus the effects on the historic integrity and appearance. For trails to retain their primitive character, it may be necessary to determine a carrying capacity and limit use through a permit process or to restrict trail use during seasons when the trail is most vulnerable to erosion.

In some cases rerouted sections or a parallel route may be necessary to support contemporary use of a primitive trail. For example, steep and eroded sections of the Appalachian National Scenic Trail have been rerouted to follow side hill alignments with a more gradual slope and improved drainage. Trail sections and campsite locations near sensitive archeological sites or fragile environments have been relocated to prevent impacts to natural and cultural resources. Steep sections of trail on exposed ledges with erosion have also been relocated to follow safer routes.

Safety

Safety-related trail treatment measures include signs, railings, barriers, tread, and bridges. Historic barriers, such as dry-laid stone walls or iron, wood, or cable railings at precipitous overlooks, have often proved inadequate. The potential for loss of life or serious injury must be considered carefully on trails that attract high numbers of users with varying abilities. Handrails along ledges, over bridges, and at overlooks must be capable of withstanding exposed conditions and heavy use, such as extensive leaning, sitting, hanging, and vandalism. To meet the Secretary's of the Interior's standards, any added safety features should be compatible yet distinguishable from historic features. In many cases this may result in the substitution of steel for rustic wooden features or the addition of steel rails and pins to rustic stone retaining walls (see Figure 10).

In remote areas, warning signs that are difficult to remove or vandalize may be added to alert travelers that a particular route contains hazards such as exposed ledges, drops, loose footing, or potential flood conditions. Use of signs may be limited in designated wilderness areas where use of the area is acknowledged to be at the visitor's own risk. Warning signs may be more appropriately placed closer to the trail head, where information may be paired with accessibility information.

Accessibility, Topography, and Signs

The United States Access Board is currently developing Accessibility Guidelines for trails as described in the *Report of the Regulatory Negotiation Committee on Accessibility Guidelines for Outdoor Developed Areas*.[31] These guidelines describe the ideal provisions for tread, width, openings, protruding objects, obstacles, passing space, running slope, cross slope, rest intervals, edge protection, and signs. The report describes exceptions that define allowable departures from these provisions. For historic trails, exceptions are allowed where compliance would cause substantial harm to cultural, historic, religious, or significant natural features or characteristics. Exceptions are also allowed where the provisions are not feasible due to terrain or prevailing construction practices. Despite these allowable

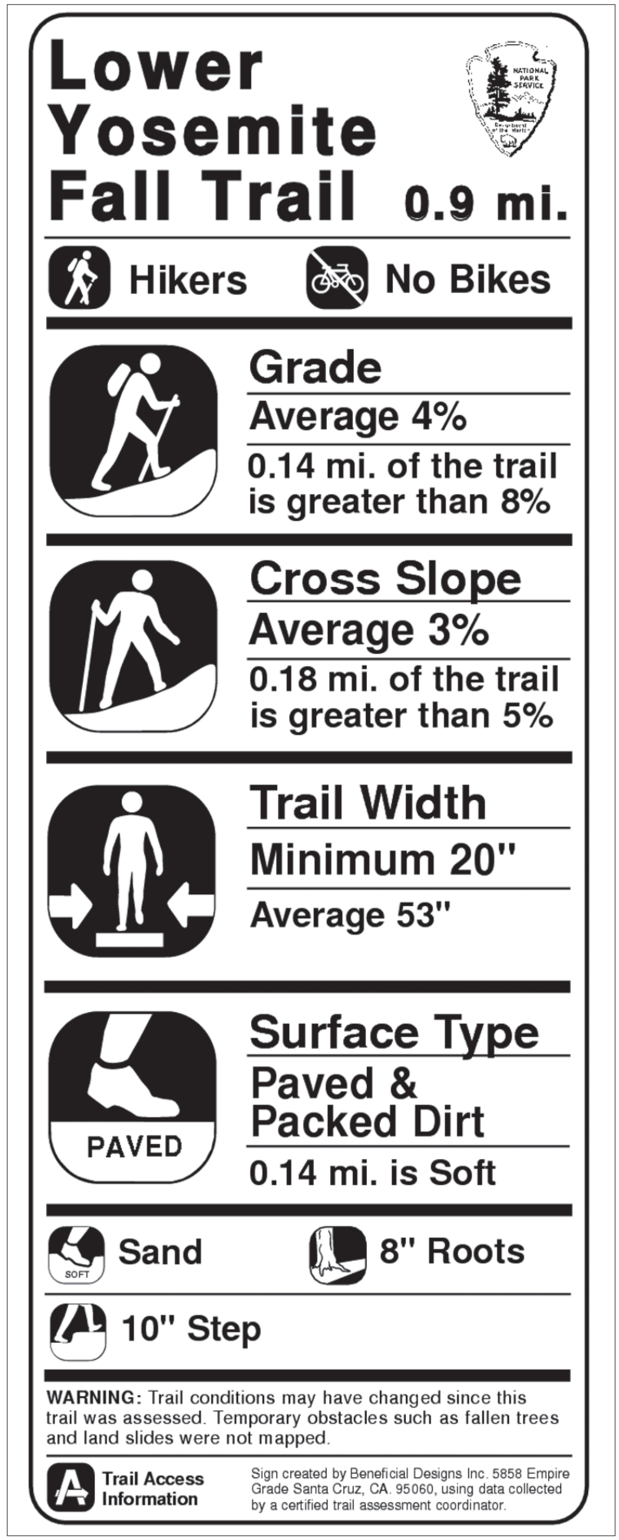


Figure 18. Proposed sign format provides more information on trail conditions for users with disabilities. (Beneficial Designs, Inc.)

Figure 19. National Historic Trail logo for the Oregon Trail.

Figure 20. Historic cairn at Acadia National Park. The length of the top stone indicates the direction of the trail. (NPS, Olmsted Center for Landscape Preservation, 1995)

exceptions, many historic trails are accessible to people with disabilities. In some cases, measures taken to improve accessibility may also enhance historic character and sustainability. For example, the CCC built many trails with an uninterrupted tread surface 42 inches wide, including closed culverts and bridges that were surfaced with compacted gravel. After years of neglect or low maintenance, the original closed culverts may have been replaced with open culverts and split-log bridges. If a higher level of maintenance can be re-established, restoration of historic features and improved accessibility may be achievable. In many places, the accessible trails with gentler grades may be the most sustainable as they are less susceptible to surface erosion. In addition, trails built with a substantial subgrade may drain better and retain a hard compacted surface that benefits all users and reduces long-term maintenance requirements. Materials may be added to increase the smoothness and durability of the tread.[32]

A key component to accessibility is providing information to the public on trail characteristics. People tend to select trails based on their personal interests and abilities. Trail signs and maps can be improved to provide specific information about the trail conditions and difficulty levels. One example is the Universal Trail Assessment Process (UTAP) developed by Beneficial Designs, Inc. to create informative signs, guidebooks, and web sites. A recommended UTAP sign lists the trail length, destination, average and maximum grade, along with information about the cross slope, duration of steep grades, average and minimum trail width, surface hardness, and the presence of obstacles, hazards, and facilities (Figure 18). Such signs can also include drawing of the trail profile to show changes in grade and length.

Many historic trails have changed names or marking systems several times. This creates a dilemma as to which name and marking system to use. If subsequent trails are added, there are questions about whether to use the same marking system. For National Historic Trails, a uniform marking system helps users associate trail fragments and associated historic sites and features (Figure 19). At Acadia National Park, trails dating to different historic periods are all marked with similar blue blazes in order to minimize confusion in remote areas.

Trails built in Acadia in the 1800s and early 1900s continue to be marked with historic cairns, which are rebuilt when toppled (Figure 20). This style of cairn is not used on contemporary additions to the trail system.

An overabundance of trail blazes and signs can detract from the scenic purpose of a trail. Many trail maintenance guides contain explicit guidelines on the use of blazes, signs and markers to discourage overuse and ensure their proper location.[33]

Many historic trails have multiple names that have been used during different historic periods. Management documents should promote the consistent use of names for trails with clearly identified endpoints to minimize confusion.[34]

In some situations, historic trails may be deliberately left unmarked, or a historic marking may be removed in response to evolving cultural or environmental concerns. For example, trails to sacred sites may be left unmarked and a non-historic route constructed to direct trail users around these historic trails and sacred sites. Similar actions can help preserve natural areas that have been deemed too fragile to accommodate contemporary use. Interpretive waysides may be used to explain the significance of the area.

Historic trail signs are considered souvenirs to vandals. For trail users, a missing sign can result in confusion, or worse, becoming lost. Since there is little protection for historic signs in the field, they may need to be kept in a museum. Replacement signs should resemble historic signs but will be most likely manufactured using contemporary tools. Strategies for minimizing vandalism include: bolting rather than nailing signs to posts and using specialized bolts that are impossible to remove without specific tools, such as Tufnut,™ Vandlgard Nut™ and Teenut.™[35] Other strategies include inscribing information on posts that are sunk into the ground, installing posts with underground anchor bolts or crossbars, and piling large stones at the base of each post.

Another dangerous practice is the construction of false cairns that lead people off the marked route. Options for preventing this situation include using a unique construction style that is difficult to replicate, using iron pins to anchor route cairns, educating hikers on how to distinguish a historic cairn from a contemporary fabrication, or increasing ranger patrols.

Natural Features, Systems, and Resource Management Issues

Many trails were built in association with a natural feature, such as a river, lake, rock formation, or mountain, or as a connection between two such features. These features, often referred to as "control points" in trail construction manuals, are key elements in the trail planning process. The trail serves as a safe and comfortable connector between these points. Identifying and protecting these control points is critical to preserving the intent and integrity of a historic trail.

Like natural features, natural systems such as waterways, geological formations, soil types, or plant communities, may have influenced the route of a historic trail. Identifying the relationship of the trail to these natural systems may result in the development of treatment guidelines for land management practices, such as the preservation of field patterns, along with opportunities for educational information on waysides or brochures.

Most historic trails predate natural resource protection policies for threatened and endangered species, invasive plants, clean water, wetlands, and resource extraction. Preserving the trail route or the materials used to construct a historic trail may conflict with these policies. Botanists, biologists, or wildlife specialists may survey areas to locate natural resources of concern.

In some areas, such as wetland and alpine zones, historic trails often become rutted, eroded, and braided.[36] Either the natural resources or the trail itself may benefit from closure during particular seasons. These trails may require rerouting or a higher level of construction than was historically present. In wet areas it may be necessary to stabilize the historic trail and protect the surrounding resources by using raised log or board-walks, or construct stone causeways with adequate cross-drainage systems. Alternatively, a reroute may be necessary. These improvements may be added using historic construction methods and materials found elsewhere on the trail or imported

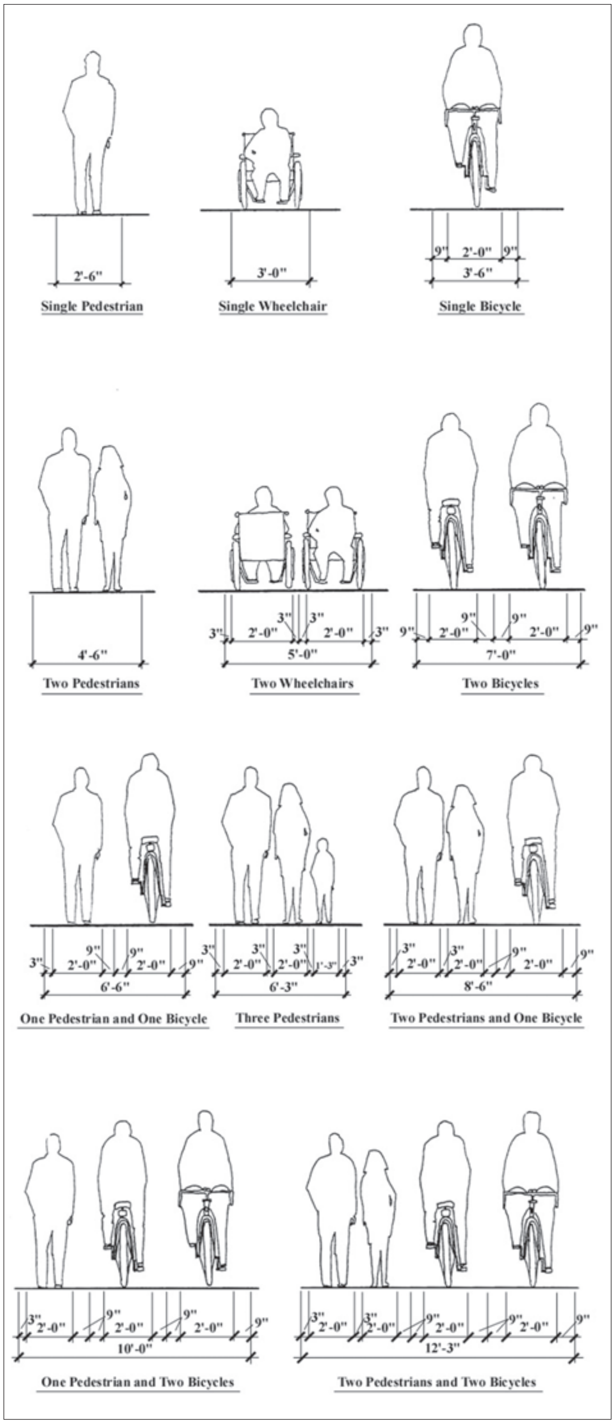


Figure 21. Width studies for different sections of a new interpretive trail to parallel the historic Battle Road within the Minute Man National Historical Park. (Carol R. Johnson Associates, Boston, MA)

from other locations. While the resultant built features themselves are not historical, the route and experience are preserved.

In alpine areas, scree or coping stones to define the trail edges, cairns placed at regular intervals, raised log or boardwalks, or causeways with adequate drainage may be added to direct hikers through fragile habitats. These built features should be unobtrusive but provide clear guidance along a comfortable and dry treadway. In addition, educational signs may be posted or increased ranger patrols may be desirable. Trails may be closed for nesting or migration season. Ideally, reroutes should not eliminate a control point along the trail that relates to the purpose of the trail, such as a significant view.

Trail Corridor Protection

Documentation of the history and significance of a trail may be part of a larger effort to protect a scenic corridor. Definition of the physical dimensions of the trail corridor, views, and its historic use and feeling may lead to zoning and development guidelines or land protection and acquisition priorities. For example, the Appalachian National Scenic Trail includes a buffer zone of up to one mile in order to protect the wilderness setting of the trail corridor.

Multiple Users, Traditional Use Patterns, and Archeological Resources

To meet multiple interests, segments of a historic trail may be rehabilitated for various users, including people with wheelchairs, horses, bicycles, or dogs. Alterations necessary to allow for multiple users should be evaluated for their impact on the historic route, grade, associated features, and feeling. Through an evaluation process that presents a series of alternatives, it may be determined that certain uses damage the integrity of the historic trail and are not appropriate. For example, a towpath trail may be wide enough to accommodate multiple users, whereas a narrow hiking trail with historic stone steps may not. A comprehensive analysis of all circulation systems within an area will aid in developing opportunities for different types of use (Figure 21).

Trails that are considered sacred to certain peoples require careful treatment to protect spiritual sites or archeological resources. These routes may have been used for domestic purposes, work, trade, or led to ceremonial places that were used by multiple generations or for one significant event. The treatment approach should be developed in partnership with affiliated groups and specialists. The use of such trails for visitor enjoyment and education should be weighed against impacts to affiliated groups and threats to cultural resources.

Alternative routes may be necessary to direct people away from sensitive resources. For example at Tsankawi, a unit of Bandelier National Monument in New Mexico, park staff worked in consultation with the affiliated Pueblo tribe to reduce disturbances to religious and spiritual sites by eliminating several public trails. Eroded trails that remained open were hardened by adding rustic steps, which were cut from non-local, but similar tufa volcanic stone (Figure 22).

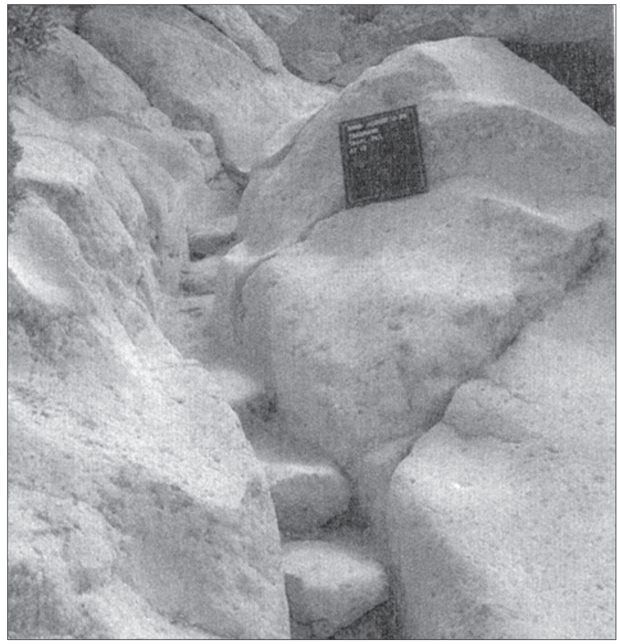


Figure 22. Steps of a similar stone type were added to a heavily eroded section of a Pueblo trail at the Tsankawi Unit of Bandelier National Monument. (Bandelier National Monument)

Trail-related Structures

Buildings, structures, and monuments can contribute to the character and significance of a trail system and require treatment guidelines to safeguard their integrity. A related building such as a hotel, cabin, shelter, or tower may be an integral part of the trail system. In some cases, the structure will have been determined historically significant, but its relationship to the trail system may not yet be defined and documented. Treatment recommendations may include the preservation of construction methods and materials for both the trail and related structure. Similarly, bridge and tunnel structures require careful attention in terms of safety, construction methods and materials. While historic trail bridges should be replaced in-kind if possible, a compatible yet distinguishable bridge may be necessary to accommodate greater loads, provide more safety features, or afford a higher level of accessibility. For example, to replace a historic wooden bridge of natural rough-cut logs, it may be necessary to use wider dimensioned logs and secure them with bolts rather than nails (Figures 23 & 24). Concealed steel stringers may be added for structural strength while key elements of the bridge design are preserved. Materials may be transported to the site

Figure 23. Historic photograph of corduroy bridge constructed by the CCC in Shenandoah National Park in Virginia. (National Archives; NARA MD, 79-42, VA, Box 32)

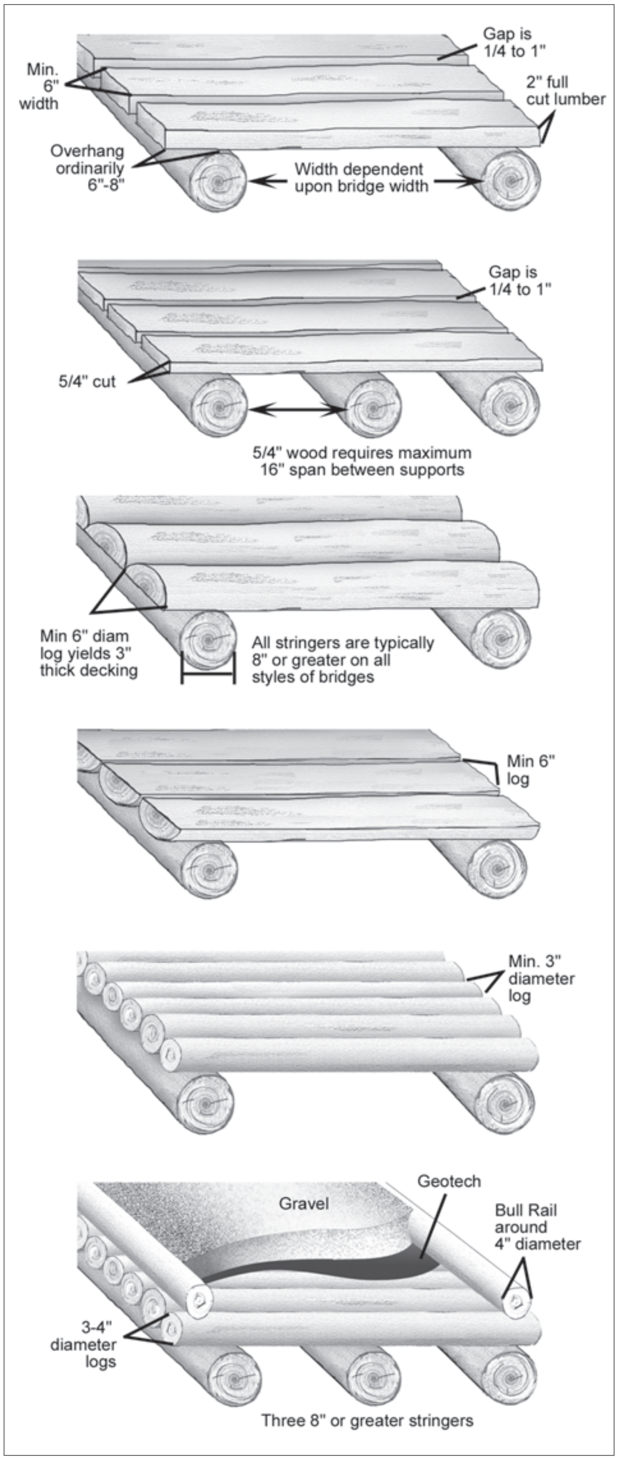


Figure 24. Examples of alternative bridge decking characteristics that reflect CCC era bridges. (Acadia National Park, Barter and Baldyga)

instead of following the historic practice of cutting down nearby live trees.[37] For trails with more than one period of significance, a historian or trail manager may be able to discern bridge characteristics from different periods and determine the appropriate treatment style (Figure 25).

Some trails include significant monuments, stone markers, tablets, and benches that are associated either with the trail's construction, dedication, or some other form of recognition. These features should be documented and inspected by a specialist, since markers and monuments are vulnerable to damage by vandals and natural processes. Significant trail-related features that can not be protected should be catalogued, removed to collection storage and an appropriate replacement should be installed along the trail.

Interface with Other Circulation Systems, Reroutes, and Parallel Routes

Many trails are either former transportation corridors or are linked to existing ones. Variations in width, surface materials, marking systems, and associated features may differentiate historical routes from other types of transportation corridors. If a rail line or canal towpath is converted to a trail, the signals, structures, tunnels, trestles, locks, or bridges should be retained. Features such as waysides, kiosks, benches, and associated visitor facilities may be added at intersections and other relevant points. These additions should be compatible in character yet clearly distinguishable from historic elements.

Maintaining the historic route of a trail can be a challenging goal that will not always be perfectly attained. Many historic trails were not designed to withstand the volume of use that they must now accommodate. Native American trails, early roads, and early recreational trails often traveled the most direct route without regard for drainage, sustainable grades or cross slopes. Even some trails that were carefully built, such as those constructed by the CCC, may not have adequately addressed water flow, rock slides, and unstable slopes, or anticipated that a beaver dam would flood the trail. If the trail cannot be stabilized, or if there are additional constraints such as sensitive archeological and ethnographic resources, a reroute may be necessary.

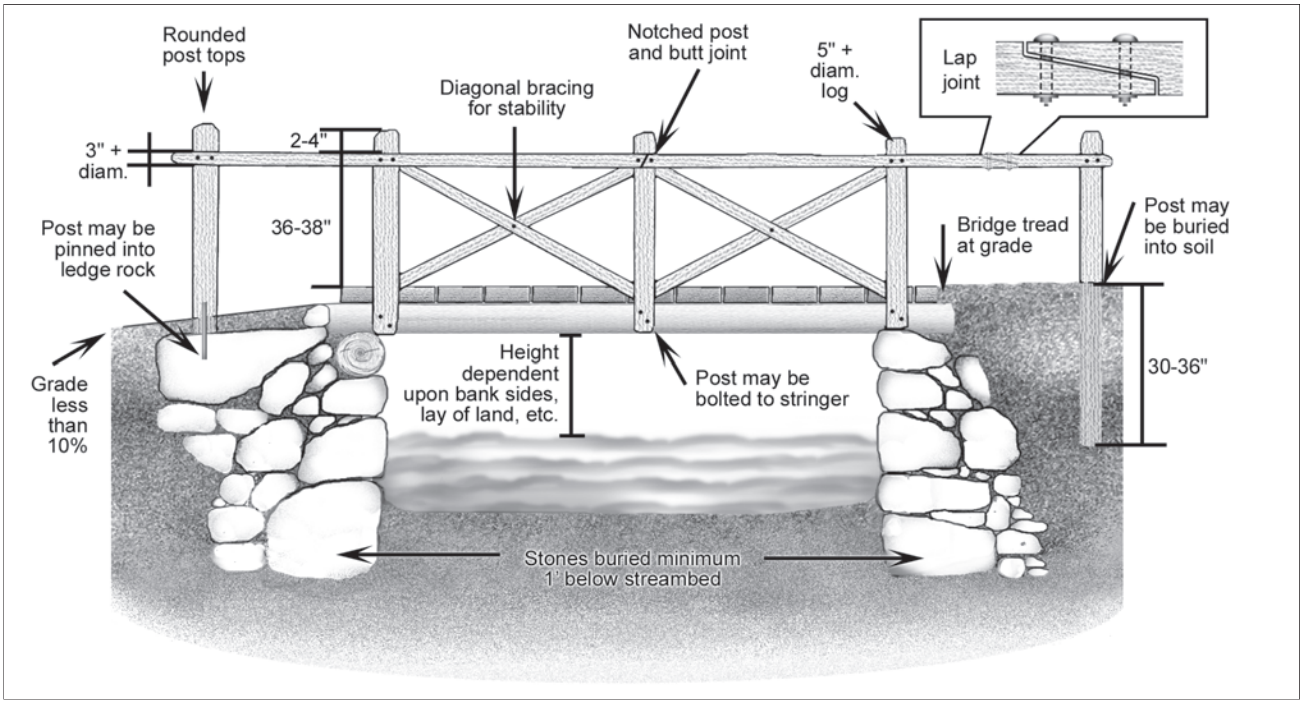


Figure 25. Example of bridge specifications for CCC era bridges. (Acadia National Park, Barter and Baldyga)

Before rerouting, control points or key attractions along the trail should be identified. Rerouted sections should provide new access to the same points. When the historic alignment is no longer tenable, another alternative is to design a parallel trail that enables users to experience the same landscape setting and feeling without adversely impacting the general location. At Minute Man National Historical Park in Massachusetts, an interpretive trail was added that parallels and intersects with the historic Battle Road to improve visitor circulation, safety, and enjoyment in the linear park. The width and surface treatment of the road and trail differ slightly, but both are compatible with the interpreted eighteenth-century landscape (Figure 26).

Figure 26. Section of the interpretive trail system in Minute Man National Historical Park that connects to and is similar in character to the historic Battle Road. (NPS, Olmsted Center for Landscape Preservation, Debbie Smith)

Opening or Closing Historic Trails

Historic routes may be abandoned, forgotten, and rediscovered. An abandoned trail or trace can serve as an outdoor archive of historic features that are often well-preserved from lack of use. Examination of built features on abandoned trails can provide information about historic construction methods that have been altered on heavily used trails either by natural processes or detrimental treatment. Photographs and measurements of features such as culverts, steps, and retaining walls on abandoned trails can inform treatment for other trails. If an abandoned trail is to be reopened, it is useful to research its origin, purpose, and reasons for abandonment. It is also important to complete a comprehensive inventory as soon as possible to document its appearance prior to reuse.

Documentation may include photographs, video, maps, measurements, and descriptions. A survey of associated natural and cultural resources is very important, particularly if the route leads to significant cultural sites or bisects a large contiguous natural area. Reopening a trail creates future maintenance requirements which should also be considered.

A historic trail may also need to be closed or rerouted. For example, many historic trails follow logical routes through mountain saddles and cross streams where there are broad, gentle banks. Such areas become desirable camping and picnicking sites, but may also contain sensitive archeological or natural resource sites. When closing a trail section, it is better to cover and obscure access with leaf duff and branches rather than obliterate historic features, which should be documented and left in place for future reference. For example, at Valley Forge National Historical Park in Pennsylvania, a historic cart road that leads to a busy road was closed and covered with branches and leaves, but all subsurface features were left intact.

Views, Vistas and Vegetation Management

Managing views can be difficult in areas where land was previously cultivated for agriculture or cleared for timber. These areas historically had expansive views. In the East, changes in land use and increased land protection have caused many areas to revert to forest. Trails once described as scenic are now often woodland corridors to tree-covered summits. Many of the outlooks that late nineteenth-century concessionaires, early NPS designers, and the CCC built to provide sweeping views have become overgrown. Identification of control points is helpful and may lead to selective clearing for the most significant views. Depending on the extent of clearing, these actions may require NEPA compliance.

Natural processes also affect historic trail character when trails that showcased certain types of vegetation have their surroundings changed through forest succession. This phenomenon can be particularly problematic when a name like the "Birch Grove Trail" refers to a species that is no longer prevalent. The CLR treatment section should address preservation of plant species, designed planting configurations, selective thinning and replacement-in-kind of certain species.

Trails through wooded areas typically require routine trimming to maintain an open trail corridor. Extensive removal of understory vegetation to improve views and remove dead and downed wood for "forest cleaning," as was done by the CCC in the 1930s, may no longer be appropriate from an ecological perspective. A balanced approach to resource management objectives may limit the clearing of understory vegetation in some areas while recommending the thinning of canopy trees to promote understory growth in other locations.

Revegetation is often needed to rehabilitate disturbed sites after trail work. Once the characteristics of the historic vegetation is identified, appropriate plants may be propagated from local material (a process that may require up to two years) or purchased from a nursery. In sensitive habitats, imported tread material should be sterile and devoid of non-native seeds.

Drainage Structures

Improving drainage with historically compatible design techniques can improve durability and minimize maintenance for many decades. For most trails, drainage is a major issue requiring careful study of the surrounding topography, soil types, total water flow, seasonal flow, and direction of trail slope. Ideally, trails are designed to work with the natural drainage pattern and water runoff is controlled without eroding the trail surface.

All drainage measures, even simple side ditches that collect water and direct it along or away from the trail require annual maintenance to remove leaves, duff, and

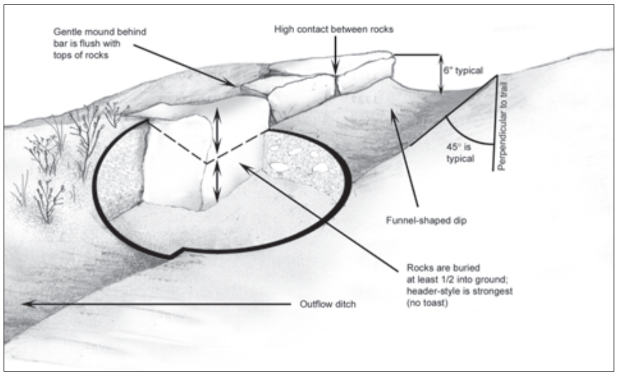


Figure 27. A water bar reinforced with stone. A water dip is similar without the use of stone to direct water off of the trail. (Acadia National Park, Barter and Baldyga)

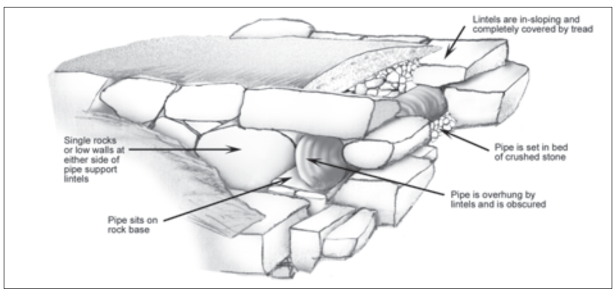


Figure 28. A pipe culvert is concealed with stone headwalls and covered with crushed stone and gravel to provide an uninterrupted tread. (Acadia National Park, Barter and Baldyga)

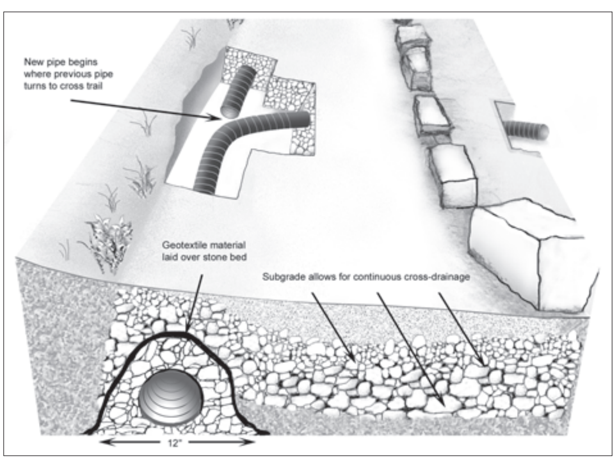


Figure 29. Perforated pipes are added below the treadway to improve drainage but not alter historic character of the treadway. (Acadia National Park, Barter and Baldyga)

debris. Where water crosses the trail, drainage features should suit the level of flow. For sections where light surface water crosses the trail, out-sloped tread, water bars, or water dips may be added (Figure 27). Water dips are desirable because they are less obtrusive and only minimally interrupt the trail surface, though they may loose their effectiveness with heavy trail use or with the heavy flow of storm water. Dips that flatten or are routinely washed out may need to be replaced with another form of drainage.

For trails with greater use or more serious drainage problems, side drains, culverts, and possibly bridges, should be constructed with the historically appropriate style and materials. For example, early cart trails and CCC trails were constructed with closed culverts for an uninterrupted tread. Some of these culverts are like small bridges and are remarkable examples of dry-laid field stone masonry. Other culverts are less evident, often overlooked and hence not maintained. A damaged section of trail may be the result of a clogged, closed culvert.

Where such precedents exist, preservation and accessibility may benefit from the restoration, rehabilitation, or addition of closed culverts. Rehabilitation is often the most viable strategy. In some cases, historic culverts may have been constructed entirely of stone, whereas contemporary replacements may consist of buried metal pipes with stone headwalls (Figure 28). Careful documentation of the location of drainage features should take into account the location of the trail with respect to topography, e.g. sidehill, direct or a switchback trail. The exact location of drainage features can be documented using a measuring wheel and/or GPS with field notes in order to expedite maintenance routines.

New materials and additional drainage may be necessary to preserve sections of historic trails. Underground drainage, such as concealed pipe culverts may be necessary. Similarly, subsurface drains using perforated pipe, gravel and geotextile fabric may aid in directing water under the trail without altering its appearance, though such a solution would not be appropriate in a sensitive archeological area or wilderness area (Figure 29).

Figure 30. Ascent of Half Dome at Yosemite National Park by steel pipe and cables installed by the CCC in 1939. (National Archives; NARA MD 79G-17C-4. May 1939)

Retaining Structures, Walls, and Steps

Most trails contain features that reflect their ceremonial, functional, industrial, or recreational history. These may include stone piles, railroad signals, iron rungs, or pins. Some of the most remarkable trails are constructed of simple materials, such as logs, iron pins, rungs and rails (Figure 30).

Recognizing and documenting these features can often guide future decisions on the appropriate use of materials, such as the use of stone instead of wood, or the use of iron for reinforcement of log or stone retaining walls. For example, at Mount Rainier National Park, the CCC used drift pins in bridge construction. A local blacksmith

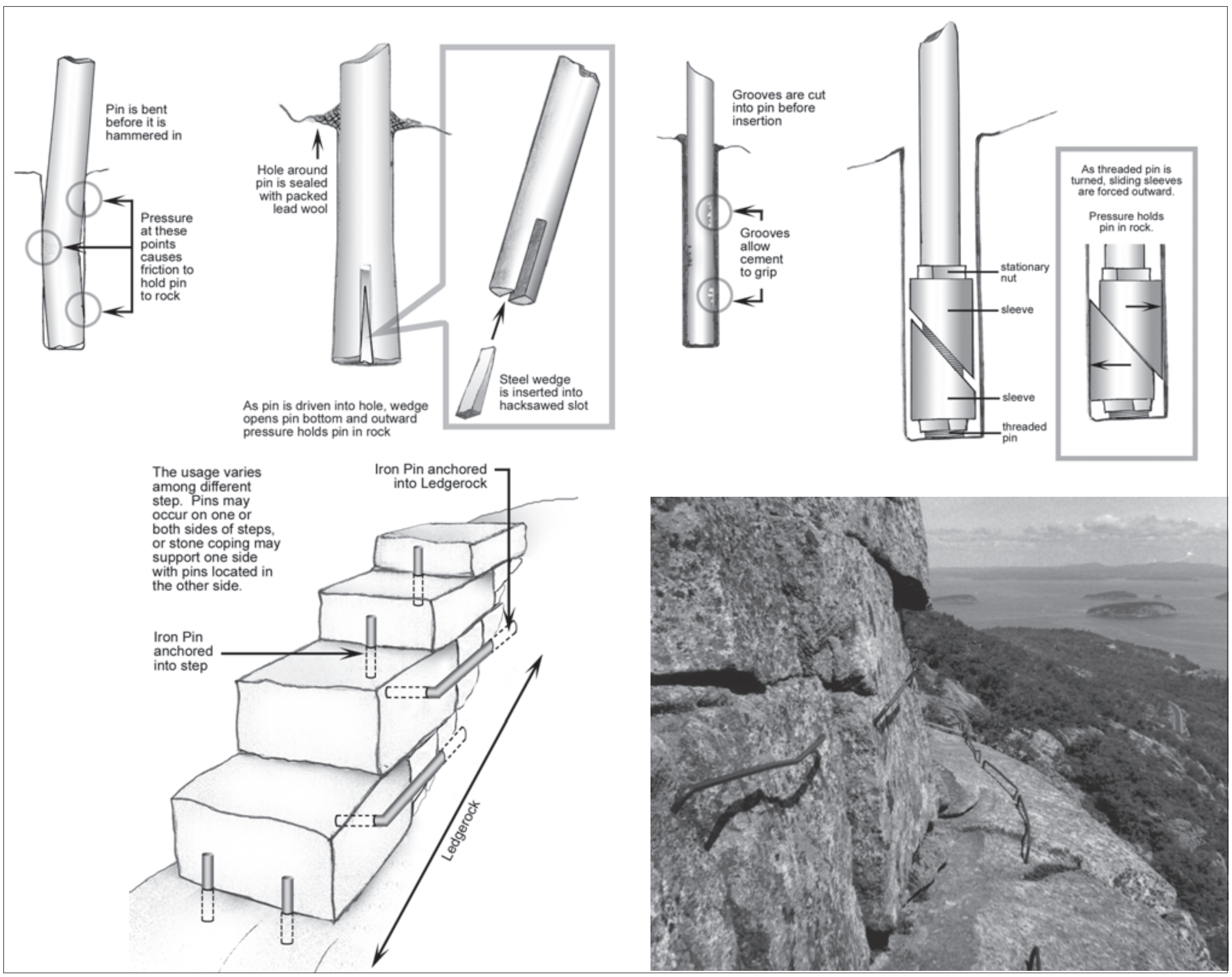


Figure 31. Photograph of the Precipice Trail in Acadia National Park and diagrams for installation of iron rungs. (Acadia National Park, Barter and Baldyga)

Figure 32. Nearly complete rebuilt wall at Big Bend National Park. To preserve the rough appearance, stones were placed with varied orientations. To improve stability, backfill was carefully laid. The wall was topped with large coping stones and the load was transferred down through the semi-laid backfill. (NPS, Steve Griswold)

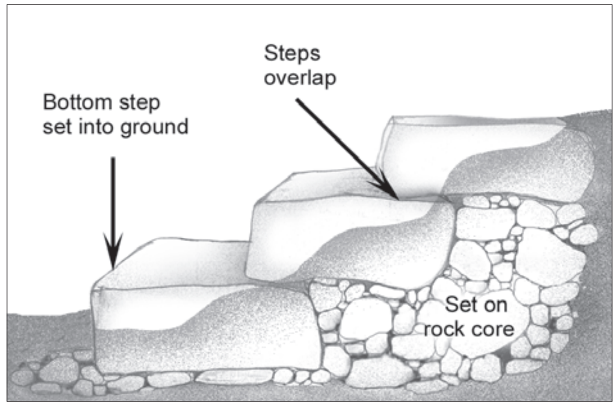


Figure 33. Diagram of slab-laid steps, a common construction used by the CCC in the 1930s. (Acadia National Park, Barter and Baldyga)

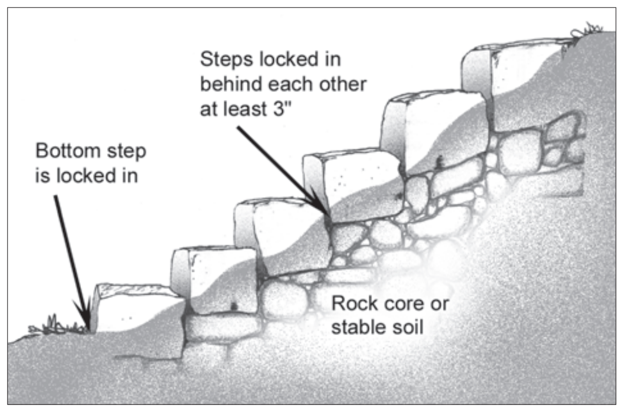


Figure 34. Diagram of set-behind steps, a contemporary method used to prevent stones from slipping downhill with heavy use. (Acadia National Park, Barter and Baldyga)

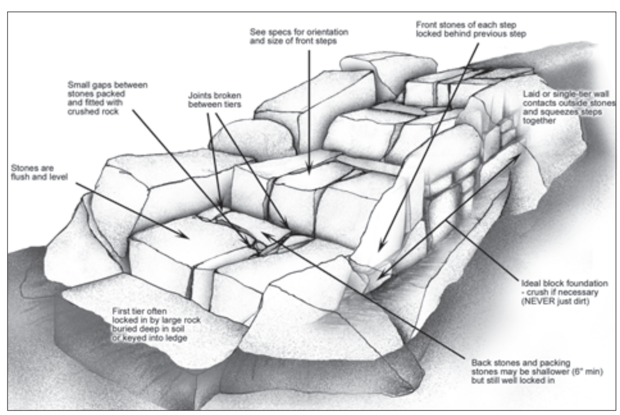
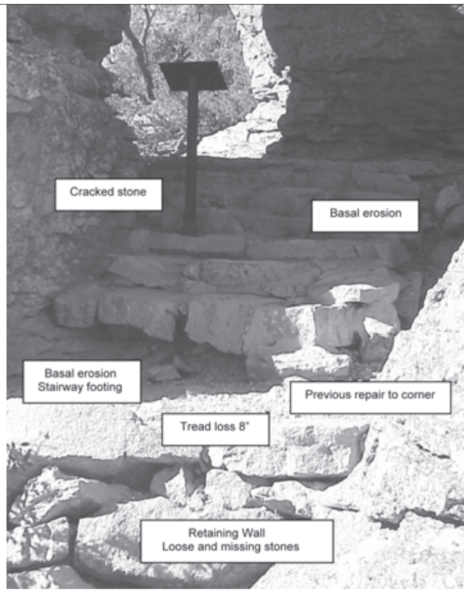


Figure 35. Diagram of rip-rap steps with random size stones used to blend into the surrounding landscape. (Acadia National Park, Barter and Baldyga)

is now making similar drift pins to use for replacement bridges. At Acadia National Park, trails ascend ledges by iron rungs installed in the 1910s. While some original rungs remain, many have been replaced using similar materials and installation methods (Figure 31).

Most trails have some component of dry laid, rubble, fitted, piled, or reinforced retaining wall, which aids in travel across slopes and ravines and is often part of a drainage system. Specifications for wall treatment should include the type of wall, associated drainage systems, foundation material, characteristics of the wall face, batter or relationship of rise to run in the face of the wall, backfill, and fill and tread surface materials. For example, at Big Bend National Park in Texas, plans were developed to rehabilitate a long rubble wall by preserving the rustic exterior stonework, constructing a more durable drainage system, foundation, and backfilling to improve the overall strength of the structure (Figure 32).

Trails designed primarily for foot traffic may contain extensive arrangements of rock or wooden steps, which often date to a historic period of intensive construction. Although each step and staircase was built in response to topography and typically used local materials, work can often be categorized by period of construction and characteristics. Treatment guidelines should address layout, materials, step size, rise, run, and



Chiricahua National Monument Feature Form

Feature Form Trail: Massai Point Nature Trail

Date: October 15, 1999

Feature #: MNT 27

Location: South portion of trail overlooking upper end of Rhyolite Canyon – approximately 300 feet from trail head.

Context: Hilltop

Aspect: South

Feature Type: Stairway

Size: Small

Feature Description: Stairway constructed of flat tabular to blocky slabs of rhyolite set in cement mortar on a rubble foundation abutted to the base of rhyolite pinnacle. Each riser is composed of two to five individual stones of variable size and covers a vertical drop of approximately four feet. Voids are filled with small angular fragments of rhyolite or cement. Stairs lead from trail down to a platform, created by a stone retaining wall (MNT 28), that provides a scenic overlook into the dense woodland and rhyolite pinnacles of upper Rhyolite Canyon. In addition, a metal interpretive sign was installed on one of the stair steps.Feature Condition: Stairway risers all show signs of deterioration – cracked and missing stone, collapsed stones, basal erosion of footings and loss of foundation material – leading to uneven and potentially unstable step surfaces. While the abutted portion of the stairway appears stable, the basal footings of the outer side are actively eroding. The area adjacent to exposed footings is unstable and subject to channeled drainage from trail surface. Platform exhibits substantial loss of tread material, thereby contributing to loosening of retaining wall (MNT 28). The installation of a metal interpretive sign may have contributed to deterioration of step. Previous repairs are evident in numerous cement patches and placement of stones to provide support for deteriorating stairway foundations.

Figure 36. Treatment work including step repair identified on historic CCC trail in Chiricahua National Monument.

degree of uniformity. Stone steps may be slab-laid, with each step set on top of the one below, or set-behind, with each step set behind and above the step below it (Figures 33 & 34). Stones may be cut, uncut or a combination. The term "rip rap steps" refers to randomly laid, abutting stones, which provide a seemingly natural staircase (Figure 35). Shims, or small stones placed under steps to fill gaps or reduce wobble, may have been used. The absence of shims generally indicates a higher level of craftsmanship. Rock steps may also be accompanied by coping stones, sidewalls, iron pins, shims, railings, and associated drainage features.

At Chiricahua National Monument, where there is extensive CCC era step work, each step or stair type was classified and a series of stabilization and repair needs was identified. Guidelines included the repair of associated walls and footings, mortar replacement, repair of loose capstones and steps, and the reinforcement of steps using concealed iron retaining bars (Figure 36).

Wooden steps, which are generally less durable, were usually constructed with locally cut logs. Squared timbers were also used in more accessible locations. Log steps were staked in place or secured with rocks, anchor logs, pins, or trenching techniques. In some cases, wood steps were used in combination with log cribs or even more elaborate log ladders requiring a high degree of craftsmanship. Current regulations may prohibit replacement with native materials. When repairs or replacements are necessary, the use of compatible materials acquired from other locations should be considered. Dimensions, design techniques, and workmanship should follow historical precedents.

Tread

Most trails can be classified as either unconstructed, such as the wagon trails used by pioneers, or constructed, such as those built by the CCC. Treatment of an unconstructed wagon route, primitive trace, or "opportunistic trail" formed by repeated use, is particularly difficult since management activities or increased use can easily alter historic appearances. In some cases, however, low or moderate use is essential for keeping the trail open and defined. The carrying capacity of a trail needs to be determined and the construction of a parallel or alternate route may be necessary. For example, along the Lolo Trail between Montana and Idaho, continued use is helping to preserve the trail. Increased use may prompt a permitting process to help protect the trail from deterioration.

For both unconstructed and constructed trails, increased use may lead to extensive degradation, particularly the loss of surface material. Without adequate maintenance, a smooth, graded trail can become a treacherous collection of gullies, rockslides, exposed roots, protruding stones, and puddles. Once conditions become this severe, relocation may be necessary or a major rehabilitation project must be initiated, requiring extensive labor to stabilize loose materials, control drainage, and replace surface materials. In such cases, treatment guidelines need to comprehensively address the improvement of drainage systems, the stabilization of tread, and the development of effective maintenance routines.

Trails that need substantial rebuilding or resurfacing may require large quantities of stone and gravel. Historically, these materials were extracted locally. If that is still a possibility, archeologists, botanists, biologists or wildlife specialists may need to determine if any local cultural sites or habitats would be damaged by borrow pits. A limit may be set on the amount of materials to be extracted from an area. When larger quantities are needed, the materials should be transported from outside protected areas, using the safest, most efficient, and most resource-sensitive methods available, which may include wheelbarrows, trucks, all-terrain vehicles, tractors, helicopters, or pack stock, some of which may not be feasible in wilderness areas. For trail construction within a designated Wilderness area at Rafferty Meadow in Yosemite National Park, mules were used to bring additional tread material to the alpine meadow (Figure 37). Such actions may require NEPA compliance.

To support a higher level of use, tread composition may be strengthened by adding subsurface rubble, checks, and/or surface material additives such as clay or a soil stabilizer. Subsurface rubble was commonly used in CCC trails, which typically contained a six to twenty-four-inch layer of stone rubble below the surface to improve drainage. Subsurface rubble can greatly

Figure 37. This stone-lined causeway with crowned tread material was constructed in 1985 through Rafferty Meadow in Yosemite NP to repair eroded alpine area. Because the trail is located in a designated Wilderness area, materials were imported by mule. (NPS, Steve Griswold)

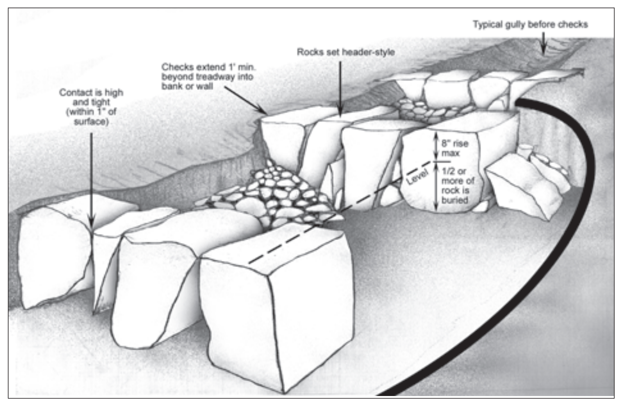


Figure 38. Diagram showing installation of stone checks before they are covered with surface gravel. (Acadia National Park, Barter and Baldyga)

improve drainage, but should be used in combination with other drainage features such as culverts, side ditches, and water dips. Some trail rehabilitation projects have included a layer of geotextile fabric between the rubble and surface material. This is not recommended, however, especially in backcountry or wilderness areas, as the fabric inevitably becomes exposed over time.

Checks may be used to stabilize trail sections that have gullied or have the potential to gully. Checks are effective when trail slope is less than twenty percent and it is not possible to shed water from the trail surface, such as when a trail travels down a natural gully. When installed and maintained correctly, checks are not visible, acting as "hidden steps" underneath the evenly graded tread surface, holding back or "checking" the uphill infill material—a more subtle and durable solution than log cribbing. Checks are particularly useful on trails that travel directly up slopes, such as early migration and recreation trails that were not carefully laid out (Figures 38 & 39). Checks may not be effective in areas of poor, loose soils and/or where there is high precipitation. The source of water above a section of checks should be directed off the trail, if possible, using a waterbar, dip or other drainage structure.[38]

For large resurfacing projects, a soil mix may be imported, allowing for the mechanical mixing of desired materials. The addition of clay can aid in forming a compacted tread with a crown, much like a road. Commercially available soil stabilizers may also be added, such as EMC²™ or Road Oyl™ (a pine resin binder) both by Soil Stabilization Products or Stabilizer,™ by Stabilizer, Inc., which is an organic binder made from *Plantago,* a desert plant. Other methods include mixing in dry Portland cement or similar binding agents. The *Plantago* Soil Stabilizer was used effectively as a binder and stabilizer on the Minute Man National Historical Park interpretive trail (see Figure 26).

A series of test sections is recommended in order to develop a surface mix that can withstand local environmental conditions and trail use, as well as provide a compatible color and texture with native materials, since ultimately some of the material will wash from the trail surface. The material should also be checked for non-native plant material, especially invasive species.

Figure 39. A section of checks installed to repair a gullied trail shown during and after completion on the Ocean Path at Acadia National Park. (NPS, Olmsted Center for Landscape Preservation)

CONCLUSION

Historic trails offer unique opportunities to retrace America's cultural heritage and experience a sense of place, history, and natural splendor. Understanding these resources and making thoughtful treatment and management decisions enables contemporary users and future generations to share these experiences.

Preserving a historic trail requires careful planning, a dedicated group of respectful trail users, and ongoing maintenance. This planning requires a substantial amount of time and the involvement of a multidisciplinary team, including affiliated groups and specialists. The project team should strive to develop clear goals and guidelines that are based on a thorough understanding and analysis of the physical history and existing conditions of the trail (Sidebar 8).

Trail users are often the best sources for information. Many can offer multigenerational knowledge and photographic documentation of historic conditions. Trail users frequently also serve as stewards, advocates, and volunteers for the trails. In fact, for the Appalachian National Scenic Trail, the Long Trail, and many other trails, volunteer-based organizations serve as full-fledged management partners that are involved in every aspect of trail management.

For many historic trails, use has increased dramatically but maintenance programs have not changed. Dedicated crews depend heavily on oral tradition to pass along techniques and rely on extensive hand labor and simple tools, including hand saws, loppers, mattocks, and pulaskis (Figure 40). Those responsible for the long term care of a historic trail need to employ an appropriate mix of historic and contemporary construction methods and materials to ensure the integrity of historic trails is preserved. Faced with the challenges of limited funding and the effects of increased use, maintenance is an increasingly complex task. The best way to meet this challenge is to develop an approach to trails stewardship that brings together a wide range of specialists and other stakeholders to collaborate in the development of comprehensive, historically informed, environmentally sensitive, and administratively sustainable treatment and management program.

SIDEBAR 8: CHECKLIST FOR IMPLEMENTING A SUCCESSFUL PROJECT

- Document cultural and natural resources using all tools available. Use the Cultural Landscape Report process, other plans, reports, and inventories, and associated compliance procedures for both historic (i.e., NHPA) and natural resources (i.e., NEPA) to develop and work through alternatives.
- Develop a treatment approach that incorporates the project goals and objectives, while addressing issues identified, including safety, structural stability, accessibility, and connections to other circulation systems and facilities.
- Define historic details to replicate and/or develop new details that will complement the historic trail. Select materials that are compatible with the historic trail system. Develop a consistent identity to link trail fragments and associated features through signs, guidance, and information systems.
- Evaluate and mitigate impacts to sensitive natural resources or other cultural resources by evaluating reroutes, seasonal closures, parallel routes, or restrictive use.
- Establish relationships with cooperating non-profit organizations to assist in identifying issues and alternatives, and locating volunteers to work on a project.
- Develop a work plan with all interested parties. Use experienced crew leaders to teach and serve as mentors to other crew members.
- Plan for sustained funding of maintenance work.

Figure 40. California Conservation Corps trails crew with pulaskis and mattocks at a scenic overlook along the trail, 2000. (Peter Lewis)

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Government Trail Programs

US Bureau of Land Management
National Landscape Conservation System
1849 C Street, NW, MIB 3123
Washington, DC 20240

US National Park Service
National Trails System Program
1849 C Street, NW (2235)
Washington, DC 20240
www.ncrc.nps.gov/rtca

US Forest Service
Recreation, Heritage, and Wilderness Resources Division
P.O. Box 96090
Washington, DC 20090-6090

US Fish & Wildlife Service
National Trails Program
4401 North Fairfax Drive, Room 634
Arlington, VA 22203

Non-Profit Trail Organizations

American Hiking Society
1422 Fenwick Lane
Silver Spring, MD 20910

American Trails
P.O. Box 491797
Redding, CA 96049-1797
www.AmericanTrails.org

Appalachian Trail Conference
799 Washington Street
Harpers Ferry, WV 25425
www.atconf.org

Leave No Trace Center for Outdoor Ethics
P.O. Box 997
Boulder, CO 80306
www.lnt.org

Rails-to-Trails Conservancy
1100 17th Street, NW, 10th Floor
Washington, DC 20036
www.railtrails.org

Tread Lightly!, Inc.
298 24th Street, Suite 325
Ogden, UT 84401
www.treadlightly.org

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ENDNOTES

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6 Junctions and scenic points were marked with an object, such as a tower, bridge, monument, or rustic feature. Charles E. Beveridge and Paul Rocheleau, *Frederick Law Olmsted: Designing the American Landscape* (New York: Rizzoli International Publications, Inc., 1995) 49, 51, 88, 89.

7 Beveridge, Charles and Paul Rocheleau. *Frederick Law Olmsted: Designing the American Landscape* (New York, NY: Rizzoli International Publications, Inc., 1995) 88.

8 An entrepreneur constructed the Bright Angel Trail in 1890 as a toll trail from the south rim to the inner canyon and profited for many years, until the federal government acquired the land.

9 The country's first village improvement society, the Laurel Hill Association, was formed in 1853 in Stockbridge, Massachusetts, to raise funds from residents to beautify the community, and improve the public setting through landscaping. In 1895 a path was built on Stockbridge's Laurel Hill in memory of the Association's long-time president and natural areas were donated to the organization. Egleston writes in *Villages and Village Life,* "There are few things which could do more for the social life and true enjoyment of a village than the making of good footpaths." Richard Cloues, "Where Art is Combined with Nature: Village Improvement in Nineteenth Century New England." (Unpublished thesis, 1987) 27, 59, 65, 761-776, 859-872.

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24 For further definitions, see to *Landscape Line 3: Landscape Characteristics.*

25 For criteria definitions, see National Register Bulletin 15.

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33 Birchard and Proudman, 145-147.

34 Changing the name of a trail to reflect an earlier historic name requires coordination with the US Geological Survey and all other map vendors.

35 Birchard and Proudman, 155-173.

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LANDSCAPE LINES

16

Historic Roads

Prepared by Timothy Davis, Lead Historian, National Park Service, Park Historic Structures and Cultural Landscapes Program

Introduction

Roads have long played a prominent role in shaping the national park experience. In addition to providing access to natural and cultural resources, park roads are often compelling cultural landscapes in their own rights. Their sensitive layout, impressive views, rustic guardrails and picturesque bridges make them highly attractive, especially when contrasted to most ordinary roads and highways. In many cases, the distinctive characteristics of historic park roads serve as defining elements of the National Park System, creating a sense of continuity from park to park and providing cherished memories of leisurely excursions through America's most beloved landscapes. The appeal of park roads is not limited to the classic "natural" parks and parkways. Roads play important roles in national military parks, as well, and contribute to the cultural landscapes of many historical parks. Even in newer parks, where the influence of traditional landscape aesthetics may not be as readily apparent, roadways exemplify changing patterns of park design and resource management.

The consistently compelling character of America's historic national park roads and parkways is by no means accidental; nor is its survival guaranteed. Historic park roads such as Glacier's Going-to-the-Sun Road, Yellowstone's Grand Loop, and Sequoia's Generals Highway reflect the collective efforts of generations of engineers, landscape architects, and park administrators. Similar skills and collaborations helped create the solemn avenues and winding tour roads of National Military Parks and the exquisitely designed carriage road systems absorbed into the National Park System in places like Acadia National Park, Marsh-Billings-Rockefeller National Historical Park, and Washington, D.C.'s Rock Creek Park. While there is growing appreciation for their significance, many historic park roads are endangered by factors ranging from natural disasters and age-related deterioration to growing traffic burdens, evolving technological demands, and increasingly complex legal and financial concerns. Not only are historic roads among the most significant categories of cultural landscapes to be found within the National Park System, but developing policies for their evaluation and management is one of the most pressing stewardship challenges facing park administrators today.

Landscape Line 16: Historic Park Roads provides guidance to assist in the identification, inventory, evaluation, and treatment of historic park road resources. Its primary purpose is to serve as a guide for the preparation of Cultural Landscape Reports (CLRs). The underlying aim is to promote an approach to park road stewardship that combines rigorous research and thorough understanding of legal and technical issues, with sensitivity toward preservation concerns, aesthetic considerations, environmental issues, and other management challenges. Readers will find a brief account of park road history, an overview of park road terminology, a guide to research, documentation and evaluation methods, a summary of pertinent policies and guidelines, and a brief survey of potential treatment considerations. This document is meant to be used in concert with *A Guide to Cultural Landscape Reports: Contents, Procedures, and Techniques* and other publications in the *Landscape Lines* series. A bibliography is provided to direct researchers to supplemental material.

This *Landscape Line* focuses on the major tour roads that comprise the primary public arteries of the National Park System. While some of these tour ways incorporated pre-existing roads or road segments, most were newly developed by the National Park Service for explicitly recreational purposes and tend to have similar distinguishing characteristics. There are many other road types within the National Park Service's jurisdiction. These range from utilitarian maintenance roads and administrative networks to historic routes and traces that predate park development and contribute in various ways to many parks' character and significance. The former rarely require extensive analysis from a cultural resource standpoint, while the latter frequently involve complex and highly site-specific considerations that are beyond the scope of this publication. Many parks are also traversed by public highways administered by local, state, or federal authorities through cooperative agreements with the National Park Service, which have unique management requirements of their own. While this *Landscape Line* focuses on National Park Service-designed and maintained tour roads, many of the research strategies and treatments described herein may provide guidance for the management of related resources in other jurisdictions.

A Brief History Of National Park Roads

The first park roads were primitive wagon routes constructed by private entrepreneurs and the U.S. Army Corps of Engineers in the late nineteenth and early twentieth centuries. Tight budgets and the challenges of operating in remote and often hazardous terrain produced a pragmatic focus on providing basic access to key park features. Construction crews worked with hand tools and horse-drawn machinery to replace crude pack trails with rudimentary wagon roads. Road-builders generally followed the dictates of the existing terrain, occasionally using black powder to remove stubborn obstacles. Narrow stage roads clung to steep mountainsides, gaining or losing elevation with

Figure 1. Big Oak Flat Road, Yosemite National Park, 1903. (National Park Service Historic Photograph Collection [NPSHPC])

Figure 2. Tourists on Fall River Road, Rocky Mountain National Park, ca. 1924. (Rocky Mountain National Park).

switchbacks and dangerous hairpin turns. Horse-drawn stages raised clouds of dusts as they pounded along simple dirt and gravel surfaces.

Despite these constraints, the engineers and toll road operators established the foundations of today's park road systems, grading roadways, erecting bridges, constructing masonry retaining walls and safety barriers, and endeavoring to showcase park scenery without compromising it in the process. Notable road-building feats of the period include Yellowstone's Grand Loop (1883-1905), Mount Rainier's Nisqually Road (begun as a pack trail in the 1880s and improved and expanded by the Army Corps of Engineers 1903-1910), Rim Drive at Crater Lake (1913-1919), and the access roads to Yosemite Valley, which were initially constructed by private turnpike companies in the late-nineteenth and early twentieth centuries.

Many of these original roads have been altered substantially, both in location and in terms of width, grade, and associated features. The same is true of early engineering structures. Mount Rainier's timber trestles and Yellowstone's Golden Gate Viaduct (1884/1900) and "Chittenden Bridge" (1903) impressed early park visitors, but they have been replaced by more substantial structures designed to accommodate the demands of modern automobile traffic. Yosemite retains a few examples of early park bridge building, from simple concrete spans to the classic covered bridge at Wawona. U.S. Army Corp of Engineer-era bridges in Yellowstone include the elegant open-spandrel Canyon Bridge (1915) and a few smaller spans that have been bypassed or relocated.

The popularization of the automobile in the early years of the twentieth century created a new era in park road development. Automobiles were initially banned from national parks, but these prohibitions were soon relaxed as park managers joined automobile clubs and hospitality interests in promoting auto tourism as an ideal means of expanding support for the nascent national park system. Mount Rainier legalized automobiles in 1907. Crater Lake, Glacier, Yosemite and Sequoia followed between 1911 and 1913. Yellowstone was the last to accept cars, admitting motorists in 1915.

The motorization of park transportation had many advantages. Automobiles were faster and more comfortable than stagecoaches, greatly reducing the time and expense of park travel. This made the national park experience accessible to a larger and more democratic public, especially when visitors took advantage of newly developed free auto camps. Park visitation rose rapidly in the late-1910s and increased at an even greater rate throughout the 1920s. Replacing stagecoaches with motorized buses and private automobiles meant that visitors could cover more ground in a day, so the number of hotels and way stations was reduced in large parks like Yellowstone.

Park managers quickly recognized that adapting park circulation systems to accommodate the influx of motorists would be a difficult, expensive, and time-consuming process. They also realized that the way they addressed this challenge would have enormous impacts on the future of the National Park System. While it was essential to improve the safety and convenience of out-dated stage roads, it was understood that road development should be kept to the absolute minimum needed to provide access to key park features.

Congress was slow to commit significant funding, but NPS Director Stephen Mather secured a $7.5 million road-building appropriation in 1924, which led to a series of additional budget increases. New Deal programs such as the Public Works Administration and the Civilian Conservation Corps channeled millions into park road development during the 1930s. In addition to upgrading existing roadways, new roads had to be developed in the many parks that were being added to the system. Because of the tremendous amount of high quality work accomplished during the 1920s-1930s, this period has been widely regarded as the "Golden Age" of national park road building. The character of the current national park road system was largely established during this era.

The preferred policy was to upgrade existing roads rather than construct new routes through undeveloped terrain. Narrow one-way roads were widened, dangerous sharp turns were eliminated, and grades were made more gentle and consistent. Pavements had to be improved, as dirt and gravel surfaces deteriorated rapidly under the stress of automobile traffic. Safety barriers also became more important, since vehicles were moving at significantly higher speeds. A variety of new facilities were developed to accommodate the needs of motorists. These included gas stations, garages, parking lots, scenic turnouts, expanded lodging and dining facilities, and enhanced entrance stations and sign systems. Great care was taken to ensure that these upgrades were constructed as sensitively as possible and that new roads and related developments harmonized with their natural and cultural surroundings.

This task was overseen by NPS landscape architects working in close collaboration with engineers from the U.S. Bureau of Public Roads (BPR). The interbureau agreement between the NPS and the BPR played a fundamental role in guaranteeing the aesthetic quality and technical excellence of park roads. Under this arrangement, which began in the early 1920s and was formalized in 1926, the NPS outlined the general location and aesthetic goals of each project. BPR engineers then conducted surveys and developed detailed plans for NPS approval. The BPR supervised day-to-day construction while NPS personnel monitored projects for conformance with guidelines developed to ensure that park roads exhibited high standards of design and execution. This arrangement, which still governs the relationship between the NPS and the BPR's successor agency, the Federal Highway Administration (FHWA), was hailed by both parties as an exemplary model of interagency collaboration.

Figure 3. Going to the Sun Road, Glacier National Park, 1932. (Glacier National Park)

The BPR's engineering expertise enabled the NPS to undertake a more ambitious construction program than it could have accomplished on its own. The NPS, in turn, encouraged the BPR to pay greater attention to the aesthetic aspects of road construction. While the NPS established the general parameters of the projects and prepared most of the architectural treatments for bridges, guard walls, and related structures, BPR engineers ensured that proposals were technically feasible and made many attractive and innovative design recommendations of their own. The spectacular cliff-side location of Glacier's Going-to-the-Sun Road was developed by BPR engineers after NPS designers proposed a technically simpler but more visually disruptive route. It was this bold yet sensitive solution that cemented the NPS-BPR collaboration and set the tone for subsequent park road-building efforts.

The NPS-BPR partnership produced a distinctive cultural landscape that has become a defining characteristic not just of national park roads, but of the National Park System in general. NPS landscape architects and BPR engineers drew on nineteenth-century carriage road design techniques, while updating these practices to accommodate the demands of automobile traffic and the technical challenges of national park environments.

Figure 4. Generals Highway, Sequoia National Park, ca. 1936. (vintage postcard: Davis)

Park roads were configured to showcase park landscapes in the most attractive and engaging manner. Where roadside vegetation obstructed appealing views, trees were cut to create carefully framed vistas. Variety of scenery was sought to maintain the motorist's interest. In forested areas, the distance between the edge of the road and the treeline was manipulated to achieve a variety of effects, from a narrow wooded aisle to a broad green corridor, or an alternating series of smaller and larger "rooms" carved out of the surrounding woodlands. Trees, shrubs, and unique rock formations were allowed to remain much closer to the pavement than on conventional roadways, bringing motorists into intimate contact with their surroundings.

Hazardous curves were eliminated to accommodate automobile traffic, but prolonged straight-aways were avoided as much as possible. Sinuous curves were considered more attractive and curvilinear alignments allowed road builders to follow the contours of the land more closely, reducing the need for expensive, environmentally destructive, and visually unappealing excavations. Road widths were narrower than contemporary highways, rarely exceeding twenty-two feet, with limited use of shoulders. Curbs were only constructed on the most highly developed roadways and heavily used visitor service areas.

The NPS realized that it could not afford to provide all park roads with modern reinforced concrete or bituminous "asphalt" paving during this initial improvement campaign, but tried to stabilize as much of its road network as possible with various oil-treated gravel or macadam surfaces. Local rock was often used for the crushed-stone component of park road pavements. Not only did this save on material and hauling expenses, but it helped the roads blend in with their surroundings.

Where excavations were unavoidable, park road builders tried to minimize disruptions and rehabilitate areas disturbed during the construction process. Instead of leaving steep, raw cuts along newly graded roadways, roadside embankments were sloped back gradually and rounded to resemble natural contours. Sodding and planting programs helped stabilize disturbed roadsides and naturalize their appearance.

Visitor safety concerns led the Park Service to develop an array of attractive guard wall designs. Constructed of locally quarried hand-laid stone masonry in most cases, the walls had a pleasingly rugged appearance and mirrored the hues and texture of neighboring outcrops. Both flat-topped and crenellated walls were popular. Rugged log guardrails were used in many locations and a few hybrid designs of stone and timber were employed. The subtle variations among different styles may not be apparent to casual observers, but the sensation of driving along winding mountain roadways flanked by rugged stone or timber barriers became an integral component of the park experience. Traditional split rail fences became a similarly characteristic feature of parkways leading through southern agricultural landscapes. Agricultural fencing and more ornate ironwork barriers were also present in military parks, mostly predating NPS-development.

Figure 5. Roadside revegetation, Glacier National Park, 1933. (Glacier National Park)

Figure 6. Classic crenellated stone guardwall, West Side Highway, Mount Rainier National Park. (Historic American Engineering Record [HAER] 1993)

Figure 7. Clover Creek Bridge, Generals Highway, Sequoia National Park. (HAER 1993)

While the BPR ensured that park bridges employed the latest technological advances, the architectural designs and surface treatments reflected the NPS's naturalistic design philosophy. Many bridges were constructed of reinforced concrete and then faced with rustic stone veneers. Steel girders were often disguised behind heavy timbers. As with guard wall construction, NPS guidelines called for locally quarried stone and random masonry patterns. Culvert headwalls and retaining walls were also given rustic stone treatments where they were visible to the public.

Entrance stations were integral components of the roadway landscape and similarly embodied the rustic aesthetic. Architectural treatments varied considerably within the general rustic framework, however, as designers employed local materials and evoked regional building traditions. Southwestern parks often employed adobe or concrete designed to emulate adobe, while Appalachian parks and parkways mimicked mountaineer building practices. Variations on the Colonial Revival were also popular, especially in eastern historical parks.

Similar policies shaped the design of other visitor facilities, from comfort stations and concessions to water fountains and wayside exhibits. The iconic brown wooden signs familiar to generations of park visitors became standard features of the park landscape at this time.

The visual appeal, intimate scale, and rustic associations of roads constructed during this period profoundly shaped the way visitors experienced national parks. By encouraging motorists to slow down and enjoy their surroundings, moreover, park roads provided an important management function, exemplifying what contemporary transportation planners refer to as "traffic calming." A leaflet provided to park motorists underscored this philosophy, advising "Park roads are for leisurely driving only. If you are in a hurry, you might do well to take another route, and come back when you have more time."

A large number of important projects were completed during this period, producing some of the most spectacular scenic drives in the world and firmly establishing the distinctive character of America's

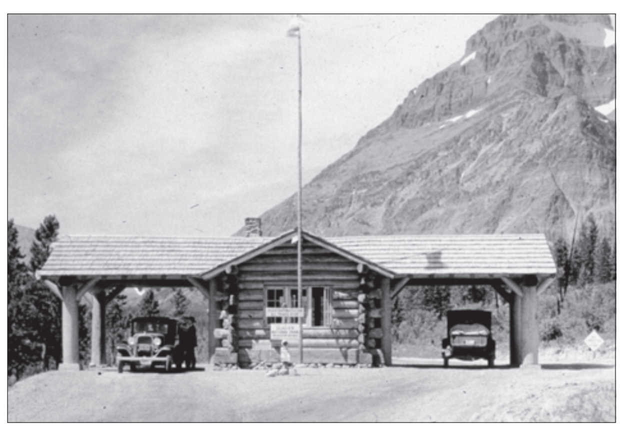


Figure 8. Rustic Entrance Station, Glacier National Park, ca. 1935. (Glacier National Park)

Figure 9. Rustic entrance sign, Crater Lake National Park, ca. 1935. (NPSHPC)

national park roads and parkways. Glacier's Going-to-the Sun Road was widely hailed for its spectacular views and technical difficulty when it opened in 1933. So were Rocky Mountain National Park's Trail Ridge Road (1932) and Sequoia's Generals Highway (1935). The major entrance roads to Yosemite were significantly rebuilt, with major relocations undertaken to accommodate automobile traffic. The union of engineering and aesthetics was epitomized in Yosemite's Wawona Tunnel (1933), which framed a stupendous view of the valley that motorist's could pull over to enjoy in more leisurely fashion from an observation platform constructed on fill excavated from the tunnel bore. Yellowstone did not receive any major new roads or dramatic relocations, but grades and curves were eased, bridges were upgraded, and oil treatments were applied to stabilize road surfaces. Mount Rainier's Nisqually Road was widened, paved, and straightened and several new routes were designed to provide access to previously remote sections of the park. Numerous other parks received vital improvements to their road systems during this period.

In addition to adding and improving roadways in the traditional western wonderlands, the NPS undertook a major effort to develop additional parks in the eastern United States. Recognizing that the vast majority of visitors would be traveling by automobile, the NPS outfitted these parks with motor roads from the start. Engineers and landscape architects combined the lessons learned in western park construction with new approaches to recreational motorway development pioneered by eastern parkway designers in places such as Westchester County, New York. The result was an impressive collection of scenic roadways located within a day's drive of America's major metropolises.

Shenandoah National Park's Skyline Drive (1934-39) exemplified the determination to bring the national park experience within reach of eastern motorists, along with the tendency for tour roads to become signature park features. Great Smoky Mountains National Park's most prominent scenic drive was the Newfound Gap Road. Numerous stone-faced bridges were required to span the park's streams but the most striking road-related structure remains the "Loopover" at Newfound Gap (1934), a stone-faced corkscrew bridge that replaced a series of dangerous and unsightly switchbacks. Acadia National Park augmented an existing system of picturesque carriage drives with an equally scenic series of motor roads designed by the NPS and BPR.

Parkways played an important role in the NPS's effort to reach a broader audience during the 1930s. After developing Colonial Parkway as a relatively short link between the historic sites of Jamestown, Yorktown, and Williamsburg, the NPS greatly expanded the concept with the Blue Ridge and Natchez Trace Parkways (authorized in 1936 and 1938, respectively), which eventually extended well over 400 miles apiece. These parkways showcased cultural landscapes and human history along with natural scenery. Split-rail fences, historic log cabins, and service facilities designed to mimic vernacular buildings celebrated regional culture and exposed urban motorists to America's agrarian heritage. The location, acquisition, design, and development of these two extraordinary linear parks was such an ambitious task that Blue Ridge Parkway was not completed until 1987 and the Natchez Trace is only now nearing completion.

Figure 10. Blue Ridge Parkway, ca. 1940.
(vintage postcard: Davis)

Figure 11. Chickamauga Chattanooga National Military Park.
(HAER 1997)

As part of a major reorganization of government bureaus in 1933, the NPS inherited several parkways and park road systems in the Washington, D.C. area, including Rock Creek Park, Rock Creek and Potomac Parkway, George Washington Memorial Parkway, and the drives along the National Mall and Potomac Park. The same government reorganization gave the NPS authority over most of the nation's military parks. These unique reservations, intended to preserve and commemorate significant battlefields such as Gettysburg, Shiloh, and Vicksburg, were previously administered by the War Department. Their roads had been developed by a variety of special commissions to showcase historic battlefields and associated commemorative elements. Bridges, road surfaces, and related features were generally constructed to very high standards due to the reverence accorded these symbolically important sites. The Park Service attempted to preserve the character of these reservations while upgrading their road systems to accommodate automobile traffic and increased visitation.

The impressive quality and extent of the roads completed during the Golden Age of park road development reflected both the design expertise of the NPS and BPR and the changing technologies of road building. The invention of dynamite and adoption of gasoline- and diesel-powered machinery enabled the NPS to overcome obstacles that had stymied earlier road builders. New Deal programs also played an indispensable role in NPS road-building efforts from 1933-1942. While private contractors conducted most of the highly technical work, the Civilian Conservation Corps (CCC) and its predecessor, the Emergency Conservation Work (ECW) program provided invaluable sources of manpower. The labor-intensive work of grading and revegetation provided employment for thousands of CCC enrollees. CCC workers constructed many miles of guard wall, guardrail, and stone-lined gutters, along with campgrounds, picnic shelters and other visitor facilities.

World War II put a temporary end to NPS road building activities. When recreational travel resumed in the late 1940s, the NPS was not prepared to accommodate the influx of traffic. New facilities were needed to handle the ever-increasing numbers of park visitors and years of neglect had created significant maintenance backlogs. The situation worsened during the early 1950s, as expanding automobile ownership, increased leisure time, and rapidly improving highways brought unprecedented crowds into the parks. The NPS responded with an ambitious ten-year development program called Mission 66, which was intended to bring the parks in line with contemporary needs in time for the agency's fiftieth anniversary in 1966.

Mission 66 resulted in a comprehensive upgrading of roads and related facilities, along with a significant increase in the number of parks and a resulting expansion in total road mileage. Few new roads were built in existing parks, but many prewar roads were widened, straightened, and paved to accommodate larger, faster, and more numerous automobiles. Parking lots, campgrounds, and visitor facilities were expanded and a number of older bridges were replaced with new

Figure 12. Mission 66 roadway, Natchez Trace Parkway, 1959. (NPSHPC)

structures better-suited to modern traffic demands. The rustic design policies that dominated prewar park development gave way to an explicitly modern approach that embraced contemporary architectural styles and materials. The new roads and road improvements were clearly modern as well, with wider, straighter pavements and relatively unadorned bridges.

While Mission 66 enabled the National Park System to accommodate vast increases in visitation, the program was controversial at the time and continues to be regarded with ambivalence today. By the mid-1950s, environmentalists and wilderness advocates were protesting the program in general and park road development policies in particular. In addition to complaining about stripped-downed Modernist esthetics, critics contended that the NPS was building too many roads and "improving" others to the point where they lost their scenic beauty and romantic appeal. The most controversial of these projects was the reconstruction of Yosemite's Tioga Road, which was ardently opposed by Ansel Adams, the Sierra Club, and other wilderness advocates. While this project proceeded as planned, environmentalists successfully opposed road development in other locations, curtailing a number of projects such as the extension of the Blue Ridge and George Washington Memorial Parkways, the improvement of the Denali Road, and the creation of a parkway along the historic Chesapeake and Ohio Canal.

By the mid 1960s the Park Service was beginning to reexamine its road-building policies. In many new parks in the Pacific Northwest and Alaska, construction was limited to minor approach roads that did not penetrate into the heart of undeveloped areas. In 1967 the Park Service assembled a multidisciplinary panel to develop a new series of road policies and design standards. The panel concluded that additional road development should be kept to a minimum and issued guidelines intended to ensure that future improvement and rehabilitation programs would reflect the spirit of prewar park roads. The panel also advised the NPS to begin looking at ways to facilitate alternative transportation, leading to the use of shuttle buses in some of the most crowded parks. The 1969 National Environmental Policy Act helped limit development by mandating rigorous environmental review for major construction projects.NPS park road managers addressed these challenge in many locations, devising alternative transportation systems for congested areas like Yosemite Valley and attempting to ensure that new projects were attractive, safe, and environmentally sensitive. The FHWA continued to provide technical support and design guidance. Constructed between 1979 and 1983, Blue Ridge Parkway's Linn Cove Viaduct exemplified the blending of modern design and technology with greater ecological awareness. In order to avoid scarring the hillside, the viaduct was built of precast concrete segments that were lowered into place by crane. The complex engineering and elegant, environmentally sensitive design received praise on technological, ecological, and esthetic grounds.

By the 1980s a growing awareness of the historical importance of park roads was beginning to spread throughout the cultural resource community. Many cultural resource managers began to recognize the importance of preserving historic roads and related resources, particularly those associated with the Golden Age of park-road-building between the two World Wars. Not only was there greater awareness that these roadways exemplified an important era in Park Service history, but for many park professionals and visitors alike, they epitomized the national parks' role in twentieth-century American life. The interest in historic roads was not limited to the grand tour roads of the classic "natural" parks. Growing appreciation for the historical significance of roadways has also been seen in military parks and historic sites. The role of circulation systems for park administrative and residential areas is also gaining attention. Roads built during the Mission 66 program are already being scrutinized for their significance as resources from an important period of NPS history.

A number of efforts have been initiated to help protect and preserve these vital historic resources while educating decision-makers and the general public about the historic significance and contemporary importance of America's national park roads and parkways. Recent preservation-related activities include a major documentation effort funded by the Park Roads Program and undertaken by the Historic American Engineering Record, a surge of nominations to the National Register of Historic Places, the pending development of a Historic Roads National Register Bulletin and the designation of Glacier National Park's Going-to-the-Sun Road as a National Historic Landmark. These efforts have encouraged park road managers to pursue policies aimed at reconciling modern standards of safety and efficiency with traditional conceptions of landscape aesthetics and resource stewardship. Glacier, Acadia, and many other parks have gone to great lengths to preserve the historic character of their road-related resources.

Figure 13. Linn Cove Viaduct, Blue Ridge Parkway, completed 1984. (HAER 1997)

Anatomy of a Park Road

The following outline of park road terminology should help historical landscape architects and cultural resource managers understand the ways in which roads are conceived, constructed, and evaluated. Improving communication among the disciplines involved in historic road stewardship is essential. Not only do engineers and landscape architects frequently seem to speak different languages, but they often use similar words to mean different things. This can be particularly confusing in regard to condition assessments and treatment recommendations. Road conditions that cultural resource specialists might consider "good" from the perspective of historic integrity frequently provoke "poor" ratings from engineers focused on technical performance. Terms like "reconstruction" and "rehabilitation" also have more pragmatic connotations for engineers, who are generally less concerned with maintaining original appearances than with enhancing safety and efficiency.

Employing a shared vocabulary and developing a greater awareness of highway engineering concerns will improve the quality of historic road CLRs while enhancing interdisciplinary collaboration between cultural resource specialists, historical landscape architects, and engineers. This brief overview of highway engineering concerns can also help researchers understand historic plans and design documents.

Highway engineers generally conceive of roads in terms of three basic components: **Plan**, **Profile**, and **Cross-Section**. These elements have various subcomponents, all of which may not be present depending on the age and technical sophistication of the road.

Plan

The basic components of a park road plan are location and alignment. **Location** refers to the macro-scale issue of the road's placement within a park. Location is determined through the establishment of **controls**, which are typically the significant natural or cultural features that a road is intended to access, either physically or visually; or conversely, to avoid, for technological, environmental, or economic reasons. In modern usage the term control often refers to additional non-geographical factors as well, such as design speed, vehicle length, traffic volume, and other cultural and technological issues. Once controls are established, road designers assess the best way to link the points, determining a general road location that balances aesthetic attributes with pragmatic engineering concerns. After this location is approved, surveyors establish a precise **center-line** for the actual roadway.

Horizontal alignment generally consists of a combination of curves and straight segments, which are characterized in road-related terminology as **horizontal curves** and **tangents.** Horizontal curves can either be simple **radial curves**, which are easier to design and construct but harder to negotiate at higher speeds, or **spiral curves** of constantly varying radius, which are technically more complex, but visually more appealing and better-suited for contemporary automobile traffic. Park road designers generally favored curvilinear alignments and sought to avoid prolonged tangents as unsightly and overly conducive to high-speed driving. While winding roads helped keep speeds within reasonable limits, the suggested **minimum radius** of curves was gradually increased as vehicles improved and drivers' expectations changed. Curves on historic park roads were often significantly tighter than the minimum radii employed on more heavily traveled general-purpose roadways.

Surveyors established the horizontal alignment of the road by surveying points at 100' intervals or **stations** along the centerline of the proposed roadway. These stations serve as a basis for all future road measurements, which are often expressed as the station number plus the number of additional feet, eg., station 12+25, 12+35, 12+35.82, etc

Profile

The **profile** of a road denotes the vertical dimensions of its location. As with horizontal alignment, vertical alignments, or profiles, were generally calculated to maximize scenic potential and driving ease while minimizing construction expense and environmental disruption. By carefully coordinating the plan and profile (horizontal and vertical alignments) to follow the lay of the land as closely as possibly, park road designers sought to create three-dimensional artworks that blended

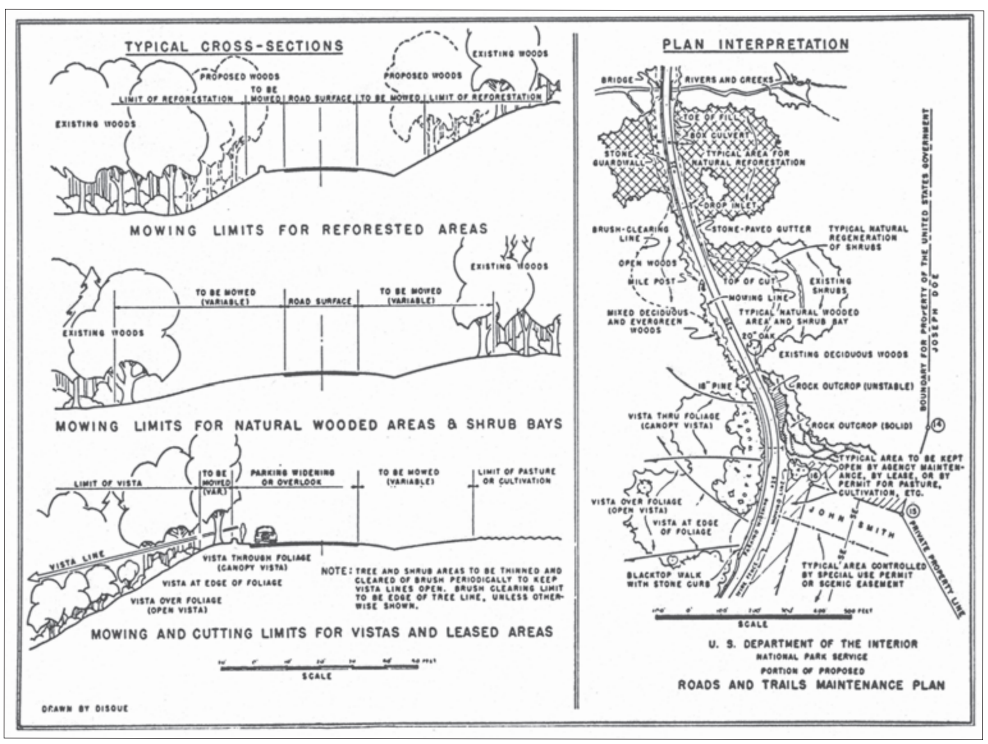


Figure 14. Typical Maintenance Plan and Section for Park Road or Parkway. (Bayliss 1957)

seamlessly with the surrounding terrain. When it was impossible to follow the natural contours of the land, designers tried to create a balance between **cuts** and **fills** in order to produce a relatively steady vertical angle or **grade** without resorting to hauling extra fill from **borrow pits** or having to dispose of excavated **spoils** through expensive **over-hauling** or unsightly **side-casting (**a practice that was putatively proscribed by the late-1920s but not entirely abandoned in practice). A **ruling grade** was generally established to excessively steep climbs and dangerous descents. For automobile roads in mountainous areas, a 5% ruling grade was generally considered desirable, though exceptions up to 8% were occasionally permitted. Grades were often lowered at curves to provide gentler **compensatory grades** designed to offset the loss in speed induced by tight curvature.

Cross section

A vertical slice taken across a typical section of the road is known as a **cross section.** The cross section identifies the dimensions, locations, and materials of the basic park road structure and characterizes its immediate surroundings (sometimes referred to as the **road prism**). Cross section components include pavement, base (or "subgrade"), shoulders, medians (if present), curbs, gutters or other drainage systems, side slopes, tree-line (or "clear-zone"), and additional features such as safety barriers, retaining walls, signs, lighting, etc.

A **typical section** is usually generated to guide the development of a roadway or component project; alternative sections are often developed to address changing topographical conditions or other design concerns. Cross sections for new construction generally depict the pre-existing ground level as a reference for grading or filling operations.

The typical pre-automotive park road **pavement** often began as a simple graded **dirt** surface. Most park roads were eventually improved with **gravel**, **crushed stone,** or **macadam** (crushed stone bound together with progressively finer particulates). Early accounts will occasionally refer to these processes as "metaling." On more substantial park roads, a crushed-stone **base course** or **sub-grade** enhanced the stability of the travelway. As automobiles rendered these surfaces obsolete, various binding materials were employed to create more durable pavements. **Penetration oil** and **asphaltic compounds** were applied directly to existing gravel or macadam surfaces, temporarily alleviating dust and deterioration problems and creating hybrid pavements such as **bituminous macadam**. More substantial **Portland cement concrete** pavements enjoyed considerable popularity in the 1920s-30s, especially for heavily trafficked parkways, where rigid concrete's enhanced durability and superior smoothness justified the additional cost. By the 1940s, **bituminous concrete** – crushed stone mixed with bituminous compounds either on site **(road mix**) or in

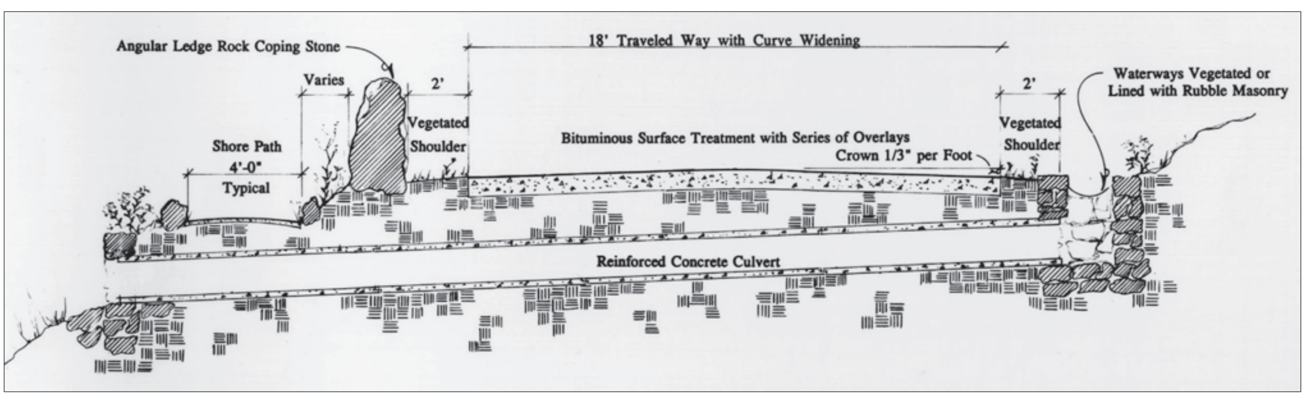


Figure 15. Illustrative section showing pavement, drainage, coping stone and path, Eagle Lake Motor Road, Acadia National Park, 1993. (Foulds/NPS 1993)

a central or portable plant (**plant mix**) – became the most common paving material, especially as durability and performance improved through additional research. All these surfaces required substantial and well-drained sub-grades.

In addition to specifying the width, thickness, and consistency of the pavement and base, the cross section characterizes the geometry of the surface. Pre-automotive roads were conspicuously convex, with a high central **crown** that shed water into roadside **ditches**. While raw, unimproved ditches were the norm for most early park roads, **paved gutters** lined with native rock or cobblestone were often constructed when erosion problems existed or appearance was a significant concern. The traditional crown-and-ditch configuration posed significant safety hazards as operating speeds increased, but improved pavements were capable of shedding water with a minimal central rise.

Traditional deep and narrow ditches gradually gave way to broader and shallower configurations that were more forgiving to errant automobiles. Replacing ditches and gutters with underground **drainage systems** further enhanced safety and roadside beauty. Curbs were often employed to channel water into **curb or drop inlets**, where it was directed away from the roadway using **drains** and **culverts**. Culverts were also used to channel minor water sources under the roadway. The visible component of the culvert, or **headwall**, was usually accorded a compatible treatment if it could be seen by the visitor. Higher speeds also necessitated the introduction of **superelevation**, or banking, which tilted the pavement in complex three-dimensional arcs to counteract centripetal forces.

Early park roads were barely wide enough to accommodate one carriage or stagecoach. By the mid-1920s, park road standards called for 18'-22'-wide driving surfaces, which were considered wide enough to allow oncoming autos to pass safely. As late as the 1950s, 22' was deemed a sufficient width for most two-lane park roads. Park road pavements were occasionally flanked by 3'-4' graded **shoulders**. Shoulders were often turfed after the construction process; in other cases, depending on the erosion potential, nature was simply allowed to take its course. Rural parkways typically followed park road standards for pavement and shoulder width, while

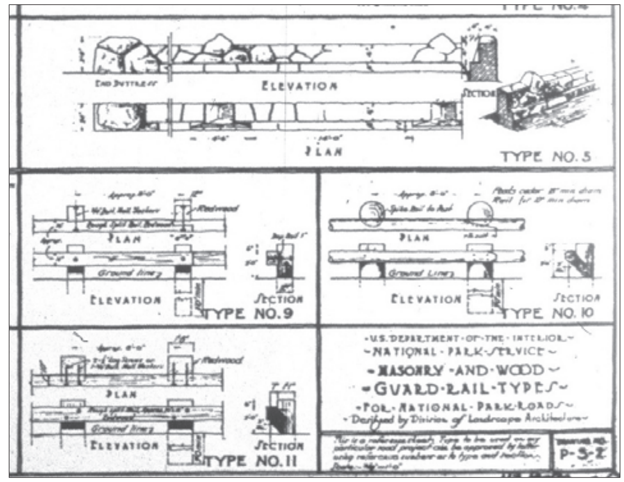


Figure 16. Typical guardwall details by Division of Landscape Architecture, ca. 1930. (NPS)

suburban commuter routes such as George Washington Memorial Parkway and Baltimore-Washington Parkway were constructed with four-lane pavements forty-feet or more in width. By the 1940s, planted **medians** of varying width separated opposing lanes of traffic on high-volume parkways.

Park road development often required cutting into slopes or filling depressions to provide a sufficiently wide and stable roadbed. The cross section typically provided a **grading profile** that stipulated the desired angle and contours of **cut slopes** and **fill slopes**. While conventional highway engineers favored flat slopes and steep 1:1 angles, park road designers preferred more gentle 2:1, 3:1, or even 4:1 slopes rounded to resemble natural topography. It was not always possible to maintain these ideals in steep and rocky terrain. Many park roads are bordered in part by nearly vertical rock cuts, **retaining walls** of hand-laid stone, cement-rubble, or rip rap, or by log, steel, or concrete **cribbing**, rock-filled wire-mesh **gabions**, or, more recently, **mechanically stabilized earth**.

Safety barriers are another component of the cross section. Typical historic park road safety barriers include **dry-laid stonewalls**, **mortared stonewalls**, and **log** or **timber guide rails**. Later modifications may include **stone-faced concrete-core walls**, **steel-backed timber guardrails**, **w-beams** of **galvanized** or **Cortan steel**, and **simulated stone** barriers comprised of reinforced concrete molded and colored to resemble authentic stonework. **Guardwalls** and **guardrails** are sturdily constructed to protect vehicles from roadside or median hazards. **Guiderails** and **guideposts** are generally less substantial and are intended to delineate the roadway or warn of roadside hazards. **Curbs** also help to delineate roadways, though their use is generally restricted to higher volume parkways, urban park roads, and developed areas such as parking lots, scenic pullouts, and visitor centers. Park roads may also be bordered by **ornamental fencing** of **stone**, **iron**, or **wood**. **Split-rail** fencing is particularly prevalent in southeastern parks.

The cross section may also depict the location of significant natural or cultural features, and delineate the desired setback of the **tree-line**, which can be varied for scenic effect. As speeds rose and safety concerns mounted, this line has generally been pushed further away from the travel surface to create a broader **recovery zone** free of obstacles that might endanger errant motorists. The placement of signs, lighting standards, and other roadside features can also be depicted in the cross section.

Major Structures

Bridges and other major structures are integral components of park road landscapes, but they are generally evaluated independently, both for maintenance purposes and to determine their cultural significance as engineered or architectural features. The CLR and related research activities should address these structures in regard to broader landscape concerns, detailed technical analyses or construction histories are generally unnecessary.

When analyzing a **bridge** for CLR purposes, it is important to describe its location and appearance and characterize its contributions to the overall park road landscape. Brief descriptions, construction chronicles, and contextual information relating specific structures to broader NPS trends should be sufficient in most cases. The basic structural system should be identified, the surface treatment described, dimensions noted, and siting issues discussed, along with any significant historical associations or modifications.

Viaducts share many design and construction characteristics with bridges but function primarily to carry roads over inhospitable terrain such as steep slopes and deep ravines, where they often pose attractive and environmentally appealing alternatives to extensive excavations. As with park bridge design, their visible components were often harmonized with the surrounding landscape with rustic stone veneers.

Tunnels can also minimize the visual and environmental impact of park roads, concealing their presence along sidehills and allowing road designers to bore through spurs and outcrops instead of drastically reconfiguring them. When a spur or outcrop was not considered significant enough to warrant the expense of tunnel construction, **daylighting** the roadway by leveling the outside of the cut opened up views and produced a more naturalistic appearance. Tunnel characteristics that should be noted include basic dimensions, **portal** configuration and materials, number and nature of windows or **adets** (if present), significant views from portals (if present), and overall landscape design and orientation considerations.

Associated Features

The following features can also contribute to the appearance and significance of park road landscapes. Their location, physical characteristics, and development should be addressed in park road histories, existing condition documentation, and treatment plans. The extent to which these features are discussed will depend on their perceived significance and impact on the park road landscape.

Scenic pullouts and **waysides** are integral components of park road landscapes. Their location, configuration, paving materials, drainage considerations, curbing and associated planting design should be described and analyzed in the same manner as the main roadways. Architectural features such as **comfort stations** and **wayside exhibits** ranging from simple resource identification to more elaborate interpretive efforts should also be considered. Even such mundane features as **picnic tables, benches**, **trash receptacles**, and **water fountains** should be described and evaluated for their design implications and historical significance.

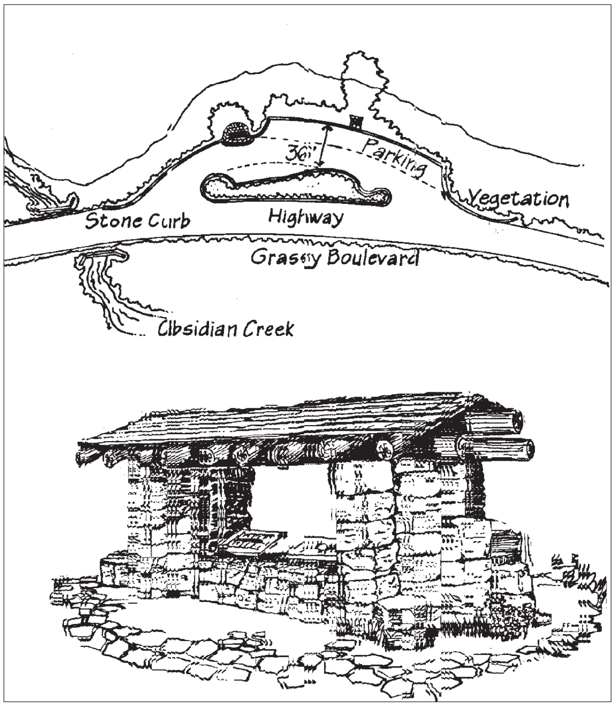


Figure 17. Obsidian Creek Interpretive Wayside, Yellowstone National Park. (HAER 2000)

Signs are fundamental aspects of park road landscapes. Their location, content, and design details should be described, along with any available information about their placement and evolution over time. **Entrance signs** can be particularly significant, in both visual and symbolic terms. Many parks retain historically significant entrance signs dating to park road development in the 1920s and 1930s. The significance of Mission 66-era signs and roadside interpretive strategies is also becoming increasingly appreciated. Historical parks — and commemorative military parks, in particular — often contain a higher density of informational signs and commemorative markers. These signs and **tablets** may have considerable historical significance. **Statues** and other **memorials** may contribute to the appearance and significance of park road landscapes and were often sited and designed in reference to circulation systems.

Roadside lighting is another associated feature that may affect the visual character of park road landscapes and can exhibit significant geographic and temporal variation.

Entrance stations, when present, are highly significant road-related features that play important roles in shaping visitors' perceptions of park road landscapes. While detailed consideration is best reserved for historic structures reports or independent determinations of eligibility, their location, appearance, and basic history should be related in the CLR.

Similar considerations apply to facilities such as **visitor centers**, **campgrounds**, and **maintenance areas**, which were often developed in association with park roads and significantly affect their location and related visitor experiences, but will generally merit independent analysis.

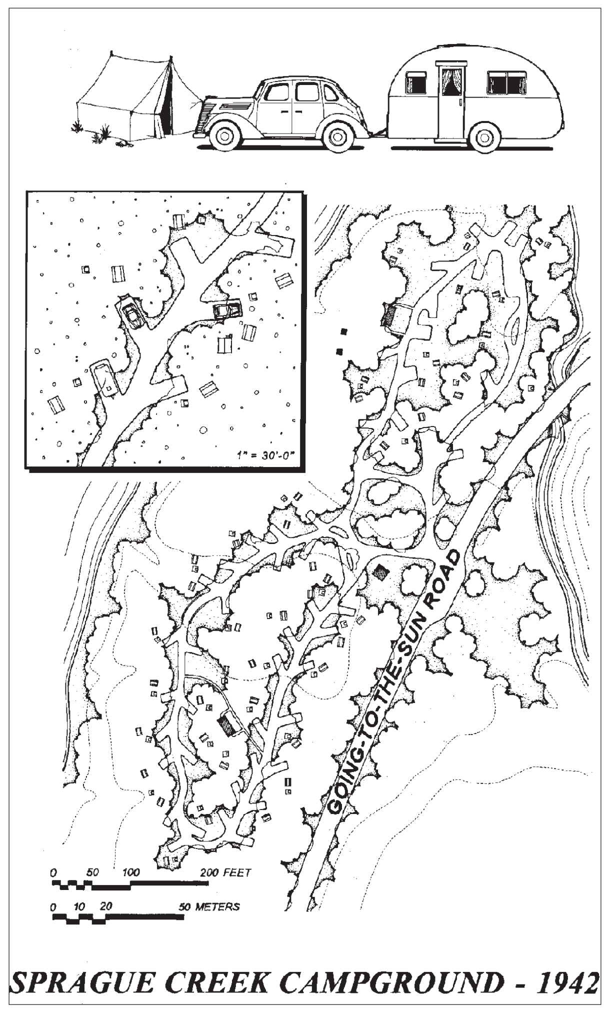


Figure 18. Sprague Creek Campground, Glacier National Park. (HAER 2000)

The View from the Road

The preceding elements all contribute to the motorist's impression of park road landscapes. Planting plans and vegetation management also play important roles in shaping the view from the road. The art of park road design entails manipulating these components to produce appealing visual effects. The various elements must be combined in a unified and harmonious manner that can be appreciated by motorists moving at slow to moderate speeds. Since road construction frequently disrupted the surrounding terrain, park road designers also employed remedial landscaping to conceal their interventions so that motorists could believe they were traveling through undisturbed natural and cultural settings.

The emphasis on native materials and naturalistic design also shaped the development of **planting plans** and **vegetation management** schemes. When planting or roadside **revegetation** efforts were called for, park road designers generally worked with native species arranged in naturalistic groupings – though definitions of these terms have evolved significantly over time. Many "native" materials were acquired from commercial nurseries and transported significant distances to supplement locally transplanted specimens. Historic planting designs occasionally incorporated **exotic plant materials**. In these cases, non-native roadside plants may have historical significance and should be treated accordingly.

Subtle variations in roadway alignment allowed for **specimen tree preservation** and the retention of other natural or cultural features. **Roadside cleanup programs** removed downed timber from the motorist's view, creating a more manicured appearance than is found in most parks today. Other tools for managing the view from the road included **scenic easements** and **agricultural leases**, which were intended to prevent conflicting land uses and promote traditional farming practices that reduced maintenance costs while enhancing the roadside's visual and symbolic appeal. While the resulting landscapes may appear natural to contemporary observers, evidence of these design practices can often be found in documentary sources and historic photographs.

Park road designers also employed sophisticated strategies to choreograph scenic effects. Inserting a slight tangent to produce prolonged **axial views** was a popular way of showcasing significant scenery, as was aligning the roadway so that compelling features appeared on the outside of curves. Natural rises and ridge crests could be used to provide sweeping **panoramas**. **Vista cutting** was a common means of creating attractive views in forested terrain. **Canopy views**, where only the lower branches were removed, afforded a more subtle variation of this strategy. While subsequent vegetation growth has occluded many of these **historic designed vistas**, their location and purpose can often be identified by historic documents, plans, and photographs. By manipulating alignment, profile, vegetation, and other roadside features park road designers also controlled the motorist's **sight distance**, balancing the desire to produce visual variety and picturesque intimacy with the need to ensure safety at reasonable driving speeds.

Understanding all of these elements – plan, profile, cross-section, major structures (bridges, viaducts, tunnels), associated features (scenic pullouts, waysides, historic wayside furnishings, architectural elements, lighting, entrance stations, visitor centers, campgrounds, maintenance areas), planting design, views and vistas – enhances the cultural landscape researcher's ability to identify historic park road characteristics and development patterns, evaluate their significance, and propose appropriate treatments and stewardship programs.

Historic Roads and the CLR

Managing America's national park roads has become an increasingly complex task. Not only has the number of visitors increased markedly, but most park roads were designed for significantly shorter and lighter vehicles moving at slower speeds than are common today. Technical challenges have been exacerbated by the fact that many historic roads are showing their age and require extensive maintenance, repair, and rehabilitation. New engineering standards, enhanced liability concerns, and multiplying regulatory frameworks require contemporary road managers to be conversant with a broad range of technical, legal, and bureaucratic issues. Changing visitor expectations also place conflicting demands on historic road managers: while some motorists relish the opportunity to experience the intimate scale and leisurely pace traditionally associated with park travel, others are intent on arriving at the next destination as quickly as possible.

The Cultural Landscape Report (CLR) can play an important role in the treatment of historic road resources. In addition to proposing specific solutions to immediate resource challenges, the CLR's historical narrative, site survey, analysis, and treatment recommendations can contribute to the development of General Management Plans, Environmental Impact Statements, and National Register Nominations and Determinations of Eligibility. The CLR's primary purpose, however, is to formulate a comprehensive stewardship plan that guides specific landscape treatment activities and sets broader, long-term preservation goals.

The decision to develop a CLR for a historic road will be based on the resources' perceived significance and the degree to which it constitutes a distinctive cultural landscape in relationship to the broader context of the park. In many cases, historic roads can be considered contributing elements to larger cultural landscapes, in which case they are most appropriately discussed in the circulation section of more broadly scoped CLRs. If the historic road possesses a distinct character as an identifiable cultural landscape in its own right, or constitutes a complex managerial challenge that requires specific treatment solutions that may not be applicable on a park-wide basis, then an independent CLR is probably warranted. In situations where a historic road is the dominant feature of a park, the road CLR may be the most appropriate framework for addressing treatment options for associated landscape elements.

The scope of a historic road CLR will depend on the nature of the resource, the availability of research materials, and the park's general management goals and specific road-related concerns. The CLR should define the site boundaries, document the road's history and current conditions, articulate its character-defining features, identify the range of stewardship challenges to be addressed, and outline a treatment plan that proposes appropriate solutions that conform to all relevant managerial goals, policy guidelines, and regulatory frameworks.

The historic road CLR should include an introductory overview, a site history, existing condition descriptions, an analysis and evaluation section, a treatment component, a record of treatment, and associated bibliographies, graphic material, and supplemental documentation. The general format and content of the CLR are described in more detail in *A Guide to Cultural Landscape Reports: Contents, Processes, and Techniques*. This *Landscape Line* supplements the basic CLR guidelines with information tailored specifically to the challenges of historic park road stewardship.

A CLR will be more effective if it is completed before the planning and design phases of related road projects are finalized. The CLR team should work closely with park staff, regional cultural landscape specialists, and the NPS Park Roads and Parkways Program in order to identify upcoming projects that might impact historic park road resources. Ideally, a CLR should help set the broader goals and specific treatment recommendations for road projects, and not serve as a remedial document calling for amendments to proposals developed along more narrowly technical grounds.

Unless a road has been determined eligible for the National Register of Historic Places, however, cultural resource specialists do not typically have an official role in park road projects. When cultural resource specialists are included in the planning process, their ability to implement preservation-oriented treatment plans is generally more limited than when dealing with resources over which they have more independent control. Fortunately, park road management has become an increasingly multidisciplinary process. By collaborating in the planning and design process, cultural resource specialists can help produce more historically appropriate and context-sensitive solutions.

Since park road management is a complex multidisciplinary endeavor, it is important to examine materials and consult specialists in relevant fields such as history, archeology, natural resource management, planning, compliance, and interpretation. Sidebar 1 provides a list of planning, management, research, and

Sidebar 1: Plans, Reports, and Inventories that may provide technical data or planning guidelines of use in developing the CLR.

General Management Plan [GMP]. As the first phase of planning for a national park service unit, a GMP ensures that each park has a clearly defined direction for long-term resource preservation and visitor use. GMPs typically contain mission goals and management prescriptions that address the preservation of park resources, types and areas of development, visitor carrying capacities, and potential boundary modifications. Historic roads stewardship concerns should be addressed when developing new GMPs.

Historic Resource Study [HRS]. A HRS for a park evaluates cultural resources within historic contexts. Through documentary research, typically led by a historian, and field investigations, the HRS narrative describes the resource's history, integrity, authenticity, associative values, and significance. The HRS includes National Register nominations for qualifying resources and is a principal tool for completing more detailed studies.

Historic Structures Report [HSR]. A HSR is the primary guide to treatment and use of a historic structure. The purpose, content and use of the report parallel that of a CLR. HSRs may exist for bridges, tunnels, entrance stations, and other major structures. The treatment and use of a major road feature, such as a bridge or tunnel, or associated road feature, such as an entrance station, should be determined in conjunction with the overall stewardship strategy of the road.

List of Classified Structures [LCS]. The LCS is an evaluated inventory of all prehistoric and historic structures in the National Park System having historical and/or architectural/engineering significance. The LCS provides baseline data for a park, including the location of prehistoric and historic structures, description, historical significance, and management decisions. Any constructed historic park road feature may be found on the LCS.

Cultural Landscape Inventory [CLI]. The CLI is an evaluated inventory of all cultural landscapes in the National Park System that are listed in or eligible for the National Register of Historic Places. The CLI provides baseline data for a cultural landscape, including roads and road-related resources. Information recorded in the inventory includes location, physical description, historical chronology, period of significance, landscape characteristics, and management decisions.

Archeological Overview and Assessment. This report describes and assesses known and potential archeological resources in a park area. The overview summarizes existing archeological data while the assessment evaluates the data. Further investigation requires an archeological identification and evaluation study to identify the location and characteristics of some or all sites in an area. Data is entered into the Archeological Sites Management Information System (ASMIS).

Ethnographic Overview and Assessment. This document reviews existing information on park resources valued by associated traditional communities. The information comes from archives, publications, and interviews with community members and other stakeholders.

National Register of Historic Places. The National Register of Historic Places lists numerous park roads and related features. The National Register Information System (NRIS) database should be consulted for relevant listings. The full text of nominations and copies of supporting documentation can be obtained by contacting the National Register or may be available in park files.

Historic American Engineering Record (HAER). From 1988 to 2002 HAER conducted an extensive survey of National Park Roads and Parkways. HAER reports typically include a comprehensive narrative history, individual reports on bridges and tunnels, measured and interpretive drawings, and extensive large-format photographic documentation. The HAER collection should be consulted to determine if the road under consideration has received this level of documentation.

Road Inventory Program (RIP). The FHWA's Federal Lands Highway Program (FLHP) maintains a videographed inventory and associated condition assessment for all paved NPS roads. A pavement surface-condition rating is also provided. The videos often contain information on historic features, landscape character, and general road conditions.

Bridge Inspection Program (BIP). The FHWA also inventories and inspects NPS bridges. An evaluation of each bridge's load-carrying capacity is performed to determine if any deficiencies exist; if necessary, appropriate action such as warning signs, bridge closing, rehabilitation or replacement, is recommended. In addition to basic structural data, BIP reports may contain information on historic aspects, materials and conditions.

Servicewide Traffic Accident Reporting System (STARS): STARS is a NPS Park Roads Program database that provides information on the location, frequency, and severity of traffic accidents. This information is critical for maintaining road safety. It can also demonstrate historically low accident rates for park roads or park road segments that can be used to justify design exceptions or counter proposed "upgrades" that adversely impact historic road features.

Traffic Monitoring System: The NPS Park Roads Program monitors traffic in thirty-three of the most heavily used park units. The selection of parks is periodically adjusted in response to visitation trends. If the road under study is part of this group, the data can be useful for formulating treatments and policies.

inventory documents that can contribute to the development of a historic road CLR. All of these materials may not be available for every historic road resource, but efforts should be made to locate and examine relevant studies early in the CLR development process.

Formal public outreach is generally beyond the scope of the CLR, but it is important to consider visitor perspectives and the needs of adjacent communities. Involving the public in the planning stages of park road stewardship is generally a wise and effective strategy. When the public is not informed until late in process, ill feelings may occur and treatment may be delayed while differences are resolved. In many cases, public opinion can also play an important role in fostering support for the preservation of historic park road landscapes.

By synthesizing a wide range of technical, cultural, and natural resource-based material and carefully evaluating resource capabilities and programmatic concerns, the historic road CLR provides a broad-based framework for ensuring that park road stewardship embodies technically appropriate, context-sensitive, and historically informed design solutions and management strategies.

Historical Research

The successful stewardship of park roads requires a thorough understanding of the history of the resources under consideration. By discovering the site-specific concerns and broader contexts that motivated road-builders, establishing the initial "as-built" conditions of the resources, tracing their evolution over time, and understanding the ways in which earlier visitors experienced and valued them, historical research can help contemporary road managers evaluate the significance and integrity of historic roads and formulate appropriate policies for their stewardship and interpretation.

Historical research should be conducted to determine the original condition of the site; the goals, methods, and results of the initial road-building project or projects; the subsequent evolution of the road(s), road-related features, and surrounding cultural landscapes; the social, technological, aesthetic, and bureaucratic contexts in which these developments occurred; and the ways in which designers, park managers, visitors, and other commentators responded to the road-building process and products. Once these factors are clearly understood, it is possible to make informed judgments about a historic road's character, significance, and integrity–key components of the CLR, the National Register of Historic Places review process, and cultural resource management in general.

Park road histories should be developed by researchers or teams of researchers with demonstrated expertise in historical research and writing. Depending on the character of the historic road and the resources available, other professionals may be involved, including highway engineers, historical landscape architects, horticulturalists, historical architects, and cultural anthropologists. The historical report should be peer-reviewed and edited to conform to current professional standards. Additional information on the preferred format can be found in *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques*.

The park road history should generally take the form of a chronological narrative tracing the resource's inception, development, and evolution. When writing the history of a park with multiple roads, it may be easist to provide a general context covering road development issues on a park-wide basis and then trace the evolution of individual roads in separate sections. In the case of particularly long roads such as national parkways, an overview of the broader goals and history of the project should be followed by sections on discrete segments of the resource divided according to logical administrative, geographic or temporal boundaries. After tracing the development of individual sections, it is generally advisable to assess the project's impact and reception as a whole, chronicling subsequent modifications and management issues on an as-needed basis. Sidebar 2 provides a checklist of concerns that should be addressed in the history portion of the CLR.

While the historical narrative will reflect the individual nature of every project, the concerns that the historian should attempt to cover include: the broader cultural currents and site-specific issues that gave rise to the project; the major agencies and individuals involved; the evolution of the design scheme or schemes; the details of the construction process with particular attention paid to unusual, innovative, or paradigmatic practices or technologies; the ways in which these practices accorded with or differed from standard engineering procedures and broader trends in park road development; and the basic dates and legislative and financial parameters of the project. Original completion dates and as-built conditions should be described, along with related ceremonies or reactions to the project or its components. Similar information should be presented for roads that were developed by non-NPS entities or individuals, insofar as available sources permit

Since park roads and their surroundings tend to evolve over time, it is important to trace subsequent alterations along with the social, environmental, or technological factors that influenced these changes. Gauging popular responses to park road building practices by surveying tourist literature, travel diaries, and similar sources can provide important insights into the ways in which park roads were experienced and given meaning by their intended audiences. These reactions help establish the historical significance of a road or related resource. Popular and professional commentary often played an important role in shaping subsequent alterations to park roads and related resources.

Important primary sources for park road research include park legislation and the records of related hearings, superintendent's reports, planning documents, construction reports, correspondence between key figures, and maintenance and management reports that chronicle post-construction changes and concerns. Historic plans and construction photographs afford invaluable insights. The quality and availability of these documents vary considerably. Some parks have maintained extensive and well-cataloged historical collections; others have not. In general, it is easier to find documentation for projects completed prior to the 1950s, but significant amounts of later material can often be found. Documentary sources for roads that were developed by other agencies and individuals prior to NPS acquisition are generally harder to locate, if they exist at all.

Park archives often contain the most pertinent information, but supplementary material can frequently be found in state and local historical collections, university libraries, and independent research centers. These repositories may be particularly useful for researching pre-NPS road development. The National Archives and Records Administration (NARA) center in College Park, Maryland, the various regional NARA repositories, and regional Park Service collections and records centers should be checked for official correspondence and other records. The NPS Denver Service Center's Technical Information Center (TIC) is an important source of design drawings along with related textual materials. The National Register of Historic Places database should also be consulted to determine whether or not roads and related features are listed, in which case the nominations may provide considerable information.

It is generally useful to look beyond the official administrative record and try to find accounts of park road development and related issues in contemporary newspaper and magazine articles, in travel books, and in tourist brochures, automobile club bulletins and related ephemera such as postcards, scrapbooks, diaries, and letters. Local libraries and historic collections can be particularly valuable sources in this regard. Oral histories may be available for some projects, especially those involving the Civilian Conservation Corps.

A number of professional journals and popular periodicals routinely covered park road-relates subjects. These include: *American Civic Annual, American Forests, American Highways, American Planning and Civic Annual, American Motorist, City Planning Civil Engineering, Engineering News-Record, Landscape Architecture Quarterly, Parks and Recreation, Public Roads, Traffic Quarterly, Transactions of the American Society of Civil Engineers.*

Historians should conduct as much original research as the project's scope permits, but it is advisable to make use of secondary sources to maximize efficiency and avoid redundancy. The bibliography lists a number of key works on the history of American parks, landscape architecture, highway engineering, and related social trends. Valuable information can often be found in NPS-produced secondary sources such as historic resource studies, administrative histories, special resource studies, historic structures reports, cultural landscape reports, archeological surveys, HAER documentation, and National Register nominations and Determinations of Eligibility.

NPS theme studies provide valuable contextual information and should be consulted and invoked where appropriate. Some of the most pertinent for park road research include *Landscape Architecture in the National Park Service*, *Rustic Architecture in the National Park Service*, *the Civilian Conservation Corps*, *Mission 66 Visitor Centers*, and the forthcoming *Mission 66 Planning, Architecture, and Landscape Design*. A brief history of NPS road development accompanied by extensive graphic documentation and construction details can be found in *America's Park Roads and Parkways: Drawings from the Historic American Engineering Record* (Davis, Croteau and Marston 2004). While it is important to summarize contextual information, the historian should not attempt to provide a comprehensive history of these topics within the scope of a CLR.

Since CLRs address resources that are potentially eligible for listing on the National Register of Historic Places, it is important for historians to be aware of the procedures, concerns, and terminology that factor into this process. Explicitly linking a road's development to authoritative theme studies and identifying primary periods of significance will facilitate subsequent evaluation procedures. It may also be desirable to make connections with the broader themes and patterns of American history articulated in various National Register and NPS Park History program publications. These alternative themes may be particularly useful for contextualizing roads that do not fit the pattern of classic tour road development.

Historical research should provide practical guidance for maintenance, preservation and rehabilitation activities. Archival research can help identify the appearance and location of historic features, playing a key role in existing condition surveys and condition assessments. Historic design details and construction processes can be used to repair or reconstruct lost or impaired features.

CLR research may also lead to a park road's recognition as a National Historic Landmark, a National Historic Civil Engineering Landmark, a National Scenic Byway or an All- American Road. All of these designations will have important implications for subsequent management practices and for the development of specific treatment plans.

Park road research can also serve important educational and public relations functions. Building a broad constituency for historic roads is a crucial component of park road stewardship. Public presentations of park road history through various interpretive media can raise public awareness of the historic attributes and cultural significance of these under-appreciated resources. Popular support for park road preservation can be particularly effective in the case of major reconstruction projects for which the National Environmental Policy Act requires mandatory public review.

Sidebar 2: Historical Research Checklist

Historic Context

- Themes or associated events (social, political, economic, environmental) that influenced road development or use ° Adherence to local, regional, or national design standards

Development History

- Evidence of prehistoric use or associated sites
- Agencies and individuals involved
- Legislative and financial parameters of the project
- Evolution of design scheme
- Designers and builders of the road, design intent, width, grade, origin, route or alignment, destination, views, natural features, cultural sites, dates of construction
- Materials used and sources
- Tools and equipment used for construction and maintenance; unusual, innovative, or paradigmatic construction techniques or technologies; ways in which these practices accorded with or differed from standard engineering procedures and broader trends in park road development
- Types and extent of features such as paving materials, drainage systems, retaining walls and barriers, tunnels and bridges, plant materials
- Completion dates, as-built conditions, ceremonies held, responses in popular and professional publications

Management History

- Location and frequency of road repairs or rationale for closures and reroutes
- Successes and failures of maintenance solutions
- Changes in location, design, materials, or use, along with information about social, environmental, or technological factors influenced these changes

Existing Conditions Documentation

The documentation of a historic road's existing condition is a critical component of the CLR process. Existing condition documentation should be based on detailed fieldwork and provide a comprehensive survey of the site's features along with assessments of their current condition. By providing a precise record of significant landscape features, the existing condition survey makes it possible to evaluate a site's historic integrity, identify stewardship concerns at both macro and micro levels, and provide a baseline for the treatment recommendations and subsequent implementation and monitoring activities.

Before conducting the survey, the CLR team should review existing historical information and graphic materials. Historic plans, maps, and photographs should be consulted to assist in the identification and evaluation of road features. Contemporary data sources such as maintenance reports, the Cultural Landscape Inventory (CLI), the List of Classified Structures (LCS), Facility Management Software System (FMSS), and the FLHP's Road Inventory Program (RIP) may provide further guidance. Park resource managers, engineering personnel and maintenance staff can offer invaluable assistance based on their firsthand knowledge of historic road resources.

This background information should be consolidated and compiled in formats that allow easy reference in the field. The location and character of key features such as vistas, pullouts, bridges, drainage systems, safety barriers, and other associated landscape elements should be noted for inspection in the field. If a road system is complex, or excessively long it may be desirable to divide the road into discrete segments according to logical geographic boundaries or historical development patterns. The CLR team should consult with park administrators, who may have already divided the road into management subunits. Consistent boundaries, terminology, and resource identification will facilitate all phases of the CLR process and make the results more useful for park staff and other potential partners.

A clean base map is essential for developing existing condition documentation. Depending on the scale of the road system or individual road, a USGS map of 1:24,000 or a more detailed map may be appropriate. In some cases, both scales will be useful. At the general survey level for a park road system, park road, or parkway, base maps should portray basic information such as road alignments, typical pavement widths, bridge locations, safety barrier types and locations, significant road features, principal vistas, and distinguishing landscape characteristics for various road segments. It is critical to keep precise records that identify the name of the road or road segment, the location of features (either in distance from a prominent intersection or, for more precision, in reference to official station numbers found on engineering documents) and their materials, dimensions, construction style, and condition.

For a comprehensive inventory or to guide specific treatment actions, more detailed maps and drawings may be needed to adequately depict each road segment, associated feature, or characteristic landscape type. Site plans, measured drawings, and sketches can document road alignments, cross sections, construction details for pavements, guard walls and other engineered elements, along with roadside landscape characteristics and contributing features such as signs, pullouts, bridges, and entrance stations. Deviations from historic conditions should be noted and problem areas described in both graphic and narrative form. Since the length of most park roads precludes precise mapping of the entire road corridor, an effective strategy is to articulate representative roadway cross-sections and character-defining landscape views while reserving measured drawings for significant subcomponents and contributing features. Examples of this type of graphic documentation can be found in *America's Park Roads and Parkways: Drawings from the Historic American Engineering Record*.

Photographic documentation plays an essential role in the existing conditions survey. Key features should be photographed to document character-defining details and depict their overall contributions to the historic road landscape. Since park tour roads were intended to provide calculated visual experiences, photographs should capture the motorist's perspective along with planned views from associated scenic lookouts. Videography can be a useful research tool, and sequenced stills might be incorporated into the CLR to demonstrate visual progressions and scenic variation. Both digital and traditional photographic technologies can be employed. Consideration should be given to using color media, especially when documenting the ways in which historic road-builders attempted to harmonize structures with native landscapes. For practical reasons, however, most CLRs will be printed in black and white.

Geographic Position System (GPS) units, measuring wheels, and digital measuring devices are useful in calculating distances and defining the precise locations of documented features. Computer technology, including Computer-Aided Design (CAD), Geographic Information Systems (GIS) and GPS can be useful in documenting historic road features and presenting the results of both historical and existing condition research. With GIS technology, many kinds of data can be linked together, including photographs, drawings, databases, and textual descriptions. This information can then be manipulated to illustrate original development patterns, subsequent alterations, existing conditions, and proposed treatment plans.

The end result of the existing conditions documentation phase should be a precise, detailed, and accurate record of the historic road's current physical status. This graphic and narrative record should be annotated to denote alterations that have occurred since the road was

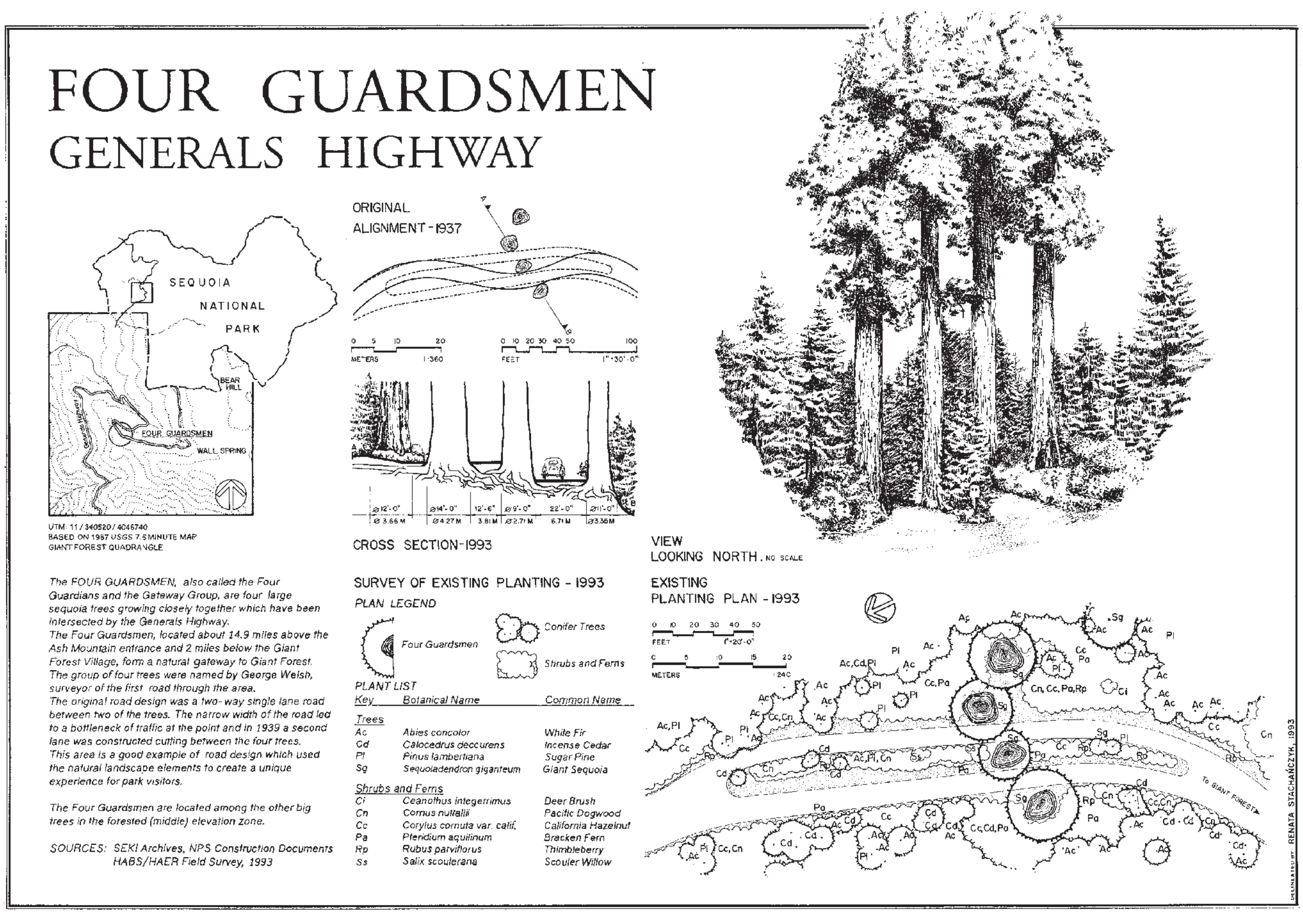


Figure 19. Documentation of significant road feature on Sequoia National Park's Generals Highway, showing general location, plan, section, interpretive view, and historic alignment changes. (HAER 1993)

completed and/or after the conclusion of revisions undertaken during its designated period of significance. Whether these changes were the result of natural processes, intentional actions, or unplanned activities, the existing condition survey will serve as the basis for evaluations of historic integrity and the development of cultural landscape treatment plans. Deviations from original conditions should be clearly noted on a feature by feature basis as well as for the overall resource.

A Guide to Cultural Landscape Reports provides additional information on existing condition survey formats and terminology. Sidebar 3 provides suggestions for evaluating historic park roads through the CLR's standard framework of thirteen landscape characteristics. Rigid applications of these taxonomies are not mandatory, however, and the existing condition survey should employ terms and categories that are bested suited to the resource under examination.

Sidebar 3: Evaluation of Landscape Characteristics for Roads

Natural Systems and Features

Summarize the natural systems (geomorphology, geology, hydrology, ecology, climate, vegetation, etc.) that influenced road development and the physical form of the road corridor.

- Describe the broad natural character of the region or regions through which the road passes (alpine, desert, rain forest, coastal, etc.) and discuss the impact of these characteristics on design, construction, and experience (deserts or rocky terrain will produce a different landscape character and require different engineering measures than a temperate alluvial plain or region of rolling hills, etc.)
- Identify any distinctive natural features that affect the road's location and disposition (the desire to showcase an attractive lake or peak, the need to take advantage of a mountain pass or cross a canyon or river, the presence of other natural attractions or obstacles,etc.)
- Discuss how local climatic concerns or other natural processes influenced the road's development and evolution (the need to accommodate excessive water-runoff, for instance, or the conscious arrangement of roads and vegetation to facilitate snow melt)
- This should be done at the macro scale of the road's general location and the micro scale of the design and location of individual features and roadway segments

Spatial Organization

Describe the three-dimensional organization of the road corridor's physical forms, emphasizing the ways in which these characteristics define the spatial and visual character of the roadway landscape

- Document the road's current location and identify historic alignments that may have been altered, bypassed or abandoned
- Determine the boundaries that will be used for CLR purposes (generally this will be a corridor including the road surface, shoulders, and all bordering areas that bear evidence of grading, planting, and other interventions; boundaries may also include contiguous viewsheds and their logical physical limits; scenic pullouts, waysides, and roadside service areas should be included; associated campgrounds and visitor facilities may be included in the park road's boundaries or considered independently, depending on their scope and development history; in some cases, especially with parkways, a historic park road's boundaries may coincide with NPS property lines)
- Distant views and landmarks should be identified and analyzed for their impact on the roadway's location, design, and visual experience, but generally should not be included within the boundaries of the historic road CLR
- Document the road in terms of plan, profile and section, demonstrating how the alignment and roadway prism shape the physical and experiential character of the park road landscape: describe the character and frequency of the road's curves and straightaways (tangents); describe the nature and extent of grades: is the road primarily flat or hilly? Is the profile consistent, gently undulating, bumpy and irregular? Document the dimensions and character of the road prism, including travel surface, shoulders, side slopes and treeline
- Since most park roads exhibit considerable variation in spatial character and geometry, it is often desirable to identify representative roadway segments and document their distinguishing characteristics in terms of plan, profile, section, and overall experience
- Identify changes that have occurred since the original design or period of significance
- Any horizontal expansion of the travel surface, shoulders, or roadside clear zone should be carefully noted; changes in profile and alignment should also be closely monitored
- Speed, scale, and sight distance are crucial elements of a park road's spatial organization; changes in any of these variables should be carefully noted, since they can have exponential impacts on the experiential character of park road landscapes

Land Use

Describe the patterns of human activity that have influenced the landscape of the road corridor

- Typical land uses might include agriculture, logging, mining, and recreation; if present, identify the nature, appearance, and social and ecological impacts of these activities
- Park-related land uses should also be considered, including passive and active recreation, commemoration, historic preservation, interpretation, parking, lodging, maintenance, and administration
- Describe any current or historic management activities aimed at retaining, restoring, or remediating the impact of land uses (such as agricultural leases, concessions, mowing, and revegetation)
- Land uses that occur beyond park boundaries should be described if they are visible from the road or associated viewpoints; changes between historic and contemporary views should be noted, along with any broad trends or specific developments that will impact historic viewsheds; scenic easements and other existing or proposed viewshed management practices should be described

Cultural Traditions

Identify practices of construction, design, and use associated with cultural traditions and ethnographic groups that influenced the development of the road corridor. These may include:

- Historic, prehistoric, ethnographic or vernacular sites, structures, and artifacts that influenced the road's location and overall design
- Historic, prehistoric, ethnographic or vernacular building practices that provided design cues for the park road landscape (typical examples include "vernacular" split rail fences, "Appalachian-style" visitor facilities, and "adobe" walls, signs, and structures; Colonial Parkway's rough-aggregate concrete pavement designed to mimic historic marl roads is an exceptional example of road-builders intentionally evoking local traditions; Colonial Revival elements could be categorized as reflections of cultural traditions, as could explicitly "Modern" materials and motifs)
- The influence of historic tourist practices should also be considered in this category: tourist practices can influence the location, alignment, design, and materials of park roads. For example, roads designed to be enjoyed from small vehicles at slow speeds by visitors on extended vacations will exhibit different characteristics than roads designed to be experienced at higher speeds by visitors on more compressed schedules; the frequency, location, and design of lodgings and other visitor facilities will also reflect historical tourist practices
- Evolving cultural traditions also affected the location and content of roadside interpretation, which became more extensive as guided tours gave way to independent motor travel; the emphasis of interpretive texts may vary from the celebration of scenic wonders to folksy history to more rigorously interpreted ecological and cultural information

Cluster Arrangement

Describe the location of buildings, structures, and support facilities along the road corridor and identify the patterns that govern their placement

- Identify the historic and current location of structures, pullouts, parking lots, campgrounds, individual campsites, etc
- Describe the relationship between these facilities and the ordering principles that determined their layout, identifying variations that may reflect different eras or development strategies

Circulation

Since a park road is, by definition, a circulation element, the emphasis should be on identifying the ways in which it accommodates basic circulation functions and the individual road or road segment's relationship to broader park-wide or even regional circulation networks

- If the road or roads predated park development, describe historic circulation function(s)
- Describe the basic circulation function the road is intended to perform in the park (does it connect scenic features, recreational features, historic sites, administrative elements, etc? — or combinations thereof?)
- Describe the road's relationship to other roads within the park or surrounding area, both in general terms and in regard to intersection locations and designs (noting any changes that have occurred)
- Describe the road's relationship to other circulation systems such as sidewalks, foot paths, bridle trails, boat launches, maintenance networks, fire roads, etc.· Identify seasonal variations in circulation, such as the influence of snowfall, rainy periods, visitation patterns associated with natural cycles like foliage or cultural factors such as holidays and special events
- If more than one road is being examined, articulate the relationships between the various segments, identifying historic and contemporary travel patterns, hierarchies of use, interpretation, or management

- Identify major changes that have occurred to the circulation system, including full or partial closures, bypasses, changes between one- and two-way traffic, the addition of multiple lanes, the impact of new roads, bridges, tunnels or other developments altering historic travel patterns or design concerns, etc.
- Describe relevant external influences on the park road's circulation functions, such as increased or decreased traffic loads due to surrounding development or road construction
- Identify other impacts on the road's circulatory function, such as changing vehicle standards, visitation numbers, and usage patterns

Topography

Detail how the road relates to specific topographical conditions

- How is the road located in response to topographic features such hills, valleys, ridges, passes, ravines, lakes, watercourses, etc?
- How do the location and design of the roadway reveal, conceal, and/or showcase topographic features (and how are these techniques sequenced for varied scenic effects?)
- How does the horizontal and vertical alignment (plan and profile) relate to topographical conditions? Does the road climb steeply or gradually? With many switchbacks or fewer longer curves? Where and how are curves located? Does the road generally follow natural contours, winding around obstacles, or does it slice through the terrain on notable cuts and fills? How else does the basic topography affect the design and experience of the roadway? Does the topography necessitate bridges, viaducts, retaining walls, guardwalls, etc?
- When cuts and fills are necessary, are the slide slopes harmonized with the natural topography or are disturbances to the natural topography plainly evident? If rock ledges were cut, is this obvious or were the cut surfaces "naturalized" by concealing drill marks, coloring, etc?
- How are scenic pullouts, parking areas and other associated features sited in relationship to topography?

Vegetation

Characterize the roadside vegetation and its impact on the road's development and visual character

- Describe the basic massing and character of the existing vegetation; identify both general patterns and individual species
- Describe the ways in which designers placed the roadway and manipulated the character and massing of surrounding vegetation help define the park road experience, paying particular attention to the ways in which designers manipulated these elements through planting, clearing, trimming and other techniques
- Distinguish between indigenous and non-native species, noting whether non-native species were associated with road's development or pre-existing land uses, or reflect post-development processes
- Try to distinguish between vegetation that was present during the period of significance and subsequent alterations stemming either from natural processes or management policies: have historic views been occluded, clearings grown in, or treelines moved forward or back?
- Determine the health of the vegetation: have disease, invasive species or other influences affected the health of the vegetation?
- Identify changes and threats to vegetation that may not be contiguous but plays a significant role in constituting the view from the road

Buildings and Structures

Identify the location, character, and basic dimensions of buildings and major structures found along the roadway, including:

- Engineering structures such as bridges, viaducts, retaining walls and other slope stabilization devices, guardwalls, guard rails, and drainage features including culverts, culvert headwalls, and gutters
- Park-related constructions such as entrance stations, entrance arches, wayside kiosks and other interpretive facilities, comfort stations, visitor centers, administrative buildings and maintenance facilities
- Pre-existing resources such as historic buildings and agricultural structures, statues, and monuments
- For each building or structure, briefly note its condition and impact on the park road landscape

Views and Vistas

Describe the views and vistas that collectively comprise the park road's scenic character

- Describe the general view of and from the road, which may exhibit considerable variation: what does the roadside scenery consist of? Are vegetation and other objects close to the travel surface, distant, at various distances? Is there a general sense of enclosure, openness, exposure, variation? Are there notable sequences? Does the road provide sweeping panoramic vistas, occasional glimpses of scenic attractions, intimate proximity to natural or historic features, etc? How do the road and associated features contribute to the landscape experience? How are all these impressions created through combinations of road design, topography, and vegetation?
- Identify designed views and vistas intended to showcase exceptional scenery, either from a stationary position such as a pullout or overlook, or displayed in motion as highlighted through axial alignments, curves or other design elements; describe both the nature of the scenery and the techniques used to display it
- Identify and describe view-framing devices such as vista-cutting, canopy views, and tunnel portals or adets
- Determine if changes in vegetation have impacted intended views and vistas (either by obscuring planned views or by opening up new ones)
- Determine if changing land uses or other factors have altered views, either within the study area, the broader park, or the surrounding locale
- Identify general trends or specific projects that may impact park road viewsheds

Constructed Water Features

Identify constructed water features that contribute to the park road landscape

- Describe the location and character of dams, canals, constructed waterfalls, ponds, or reservoirs that are constituents of the park road landscape
- Identify instances in which stream courses and other "natural" water features have been manipulated to enhance the appearance or function of the park road corridor
- Describe changes that have occurred since the road's development, either through natural processes or managerial actions

Small-scale Features

Document the location, character, age, and condition of small-scale features that contribute to the appearance and/or pragmatic function of the park road landscape, which may include

- Park development-related features such as road signs, interpretive signs, other directional and administrative signage, fences, water fountains, watering stations for horses or automobiles, curbs, lane-striping, reflectors, picnic tables, benches, trash receptacles, etc.
- Pre-park development-era features such as historic fences, monuments, tablets, and displays; vernacular landscape features such as stonewalls or other agricultural relics; other small-scale features reflective of previous land uses

Archeological Sites

The CLR survey should note the location and condition of known surface and subsurface sites of prehistoric and historic activities within the road corridor or associated with the historic road, including

- Prehistoric sites such as Native American architecture, mounds, trails, and other sites
- Historic sites and structures related to specific events such as battles, migrations, encampments, celebrations, etc
- Historic roads and related structures pre-dating park development
- Historic sites and structures related to pre-park activities such as settlement, agricultural, logging, mining, and transportation (including trails, railroads, and canals)
- Historic sites and artifacts related to park roads and associated developments, including: overlaid pavements and associated road features directly within the current road prism; archeological evidence of former plantings or landscape management practices; abandoned road segments and fragments (such as travel surfaces, ditches, culverts, curbing, retaining walls, guardwalls, etc.); abandoned bridges, bridge abutments, and fragments; road construction or maintenance camps and facilities; quarries and borrow pits; travel-related sites and artifacts such as parking areas, campsites, food & lodging concessions, gas stations, stagecoach loading platforms, etc. (most of these associated facilities should be noted in brief unless they are either within the road corridor or contribute strongly to its significance)

ANALYSIS AND EVALUATION

This component of the CLR compares existing resources to historical conditions in order to assess the integrity of historic park roads and related resources, establish their significance, and identify principle preservation concerns.

This procedure involves articulating the park road's significance, identifying aspects of the park road landscape that define its historic character, and then evaluating the current condition of the resource to determine whether or not it possesses sufficient integrity to convey its historic character and significance. This process is an important step toward developing specific treatment plans and broader stewardship policies.

The analysis and evaluation section begins by establishing the road's significance in relation to broader themes in American history. While the general historical section traces the road's entire evolution in considerable detail, this component takes a more selective and analytical approach, identifying the most important aspects of the road's design, use, and development.

The basic approach for making determinations of significance is outlined in the National Register bulletin *How to Apply the National Register Criteria for Evaluation*. Additional guidance in applying National Register criteria to cultural landscapes can be found in the National Register bulletins *How to Evaluate Historic Designed Landscapes* and *Guidelines for Evaluating and Documenting Rural Historic Landscapes*.

Park roads are most likely to qualify under the National Register Criteria A: Association with events that have made a significant contribution to the broad patterns of our past; and/or C: Design/ Construction. Other criteria may also contribute to a park road's significance. A significant designer or administrator may have been associated with its development, for instance, or an important figure may have had some relationship to the site, making it eligible under Criterion B. For road's predating park development, significance may be associated with historical patterns of migration or commerce, or with a specific event such as a military engagement, political action, or cultural event. Many roads are likely to be eligible under several categories and should be evaluated accordingly. The ways in which the road embodies these criteria should be clearly demonstrated, along with the road's relationship to recognized contexts and theme studies.

The National Register and the NPS Park History Program have identified a broad array of historic themes and developed detailed context studies for many of them. Contexts and areas of significance that may prove useful for evaluating park roads include: Architecture, (especially "NPS Rustic Architecture"), Community Planning and Development, Conservation, Engineering, Entertainment/Recreation, Landscape Architecture (see context studies on "Landscape Architecture in the NPS, 1916-1941), Politics/Government, Social History, and Transportation. Sidebar 4 highlights several National Register nominations that demonstrate various approaches to the evaluation and registration of historic park road resources.

It is important to remember that a road need not possess national significance in order to be eligible for the National Register. Many park roads have considerable significance at the state or local level. If a historic road is a representative example of its type within a park, NPS region, or state, it may merit listing in the National Register and concomitant attention in the CLR.

Establishing the period of significance is a critical aspect of the evaluation process. Periods of significance should reflect historically-based dates of development or use, rather than arbitrary applications of the National Register's fifty-year eligibility standard. The "fifty-year rule" is not an absolute cut-off date, moreover. Consideration can be given for newer roads and related features of exceptional significance. If the majority of a road's resources were constructed more than fifty years prior to the evaluation, there is no need to demonstrate exceptional significance for contributing features from a later period as long as it represents a continuum of the historical development scheme. CLR preparation should also consider the prospects of roads that are approaching the fifty-year threshold. Many Mission 66-era park roads will soon be reaching the point of potential eligibility and CLRs should be developed with this fact in mind.

After identifying the context and period of a park road's significance, the next step is to delineate its character-defining features. Not all existing features are likely to be historic, nor will all historic elements necessarily qualify as character-defining features. Character-defining features are those aspects of a historic resource that are essential for conveying its identity and significance. In the case of historic park roads, character-defining features might include engineering factors such as pavement width, composition, curvature, and cross-section; structural elements such as bridges, culverts, signs, and guardwalls; broader landscape considerations such as vegetation, grading, roadside views, and designed vistas; and cultural associations or social practices such as motor tourism, auto-camping, public history, and commemoration.

Since road design standards change over time and landscape components may have been added or modified for various reasons, it is necessary to identify the features that defined the park road experience during the period of significance. Their historic characteristics and contributions to the overall park road landscape should be described in detail. Saying that a road "lies lightly on the land" or exhibits "naturalistic design" is not sufficient: specific dimensions, design techniques, materials, and landscape experiences should be articulated as precisely as possible. Subsequent deviations from historic standards should be carefully noted, along with the addition or removal of landscape elements. These determinations are essential for distinguishing between contributing and non-contributing features, assessing condition, and evaluating the overall integrity of park road landscapes. Seemingly minor variations in alignment, width, design speed, and vegetation management patterns can dramatically alter the character and integrity of historic park roads.

The National Register defines integrity as the ability of a resource to convey it historic significance. While integrity is often related to physical condition, the two terms are not synonymous. A resource may be in good condition from a maintenance standpoint, yet have little historic integrity, whereas a resource with high historic integrity may appear deficient from a purely functional standpoint. This distinction is particularly important for historic road evaluation, because measures intended to improve practical performance frequently compromise historic fabric and experiential character. This dichotomy should be kept in mind when interpreting materials that apply modern engineering standards to historic park road resources. In these documents, aspects of a road that the CLR might characterize as essential to its significance and integrity are often cited as technical problems in need of remediation. Technically-oriented condition analysis plays a role in the development of CLR treatment proposals, but the analysis and evaluation phase focuses on determining historic integrity as defined by National Register principles rather than by conformance to modern engineering standards.

In order to have integrity by National Register standards, a resource must retain sufficient physical evidence of its appearance during the period of significance for visitors to understand its historical character and significance. The National Register has identified seven qualities that must be evaluated in order to assess the integrity of a historic resource: location, design, setting, materials, workmanship, feeling, and association. Guidelines for applying these criteria to historic resources and cultural landscapes in general can be found in the previously cited National Register bulletins. The following paragraphs provide more specific guidance for evaluating the integrity of historic park roads.

Location is a fundamental aspect of a park road's integrity. To possess integrity a park road should generally occupy its original location, following the same route and providing access to the same sights and experiences that prevailed during the period of significance. While original location is a key concern, minor variations may be permissible, especially when they do not markedly alter the general park road experience. A modest relocation that carries the traveler through essentially the same terrain and maintains a similar relationship to the surrounding landscape might be allowable, as might minor reconfigurations of intersections or realignments of short road segments, unless the intersections or individual sections themselves are deemed inherently significant. Greater latitude should be allowed for lengthy park roads extending through relatively undifferentiated terrain than for comprehensively designed parkways where all aspects of location, alignment, and surrounding landscape development were more precisely planned and controlled.

Design incorporates the entire corpus of engineering, architectural, and landscape architectural techniques that establish a road's physical structure and experiential character, from the technical and aesthetic attributes of individual components to the appearance of distinctive sections to the general character of the park road as a whole. Key concerns include alignment, plan, cross-section, landscape design, and associated features, both large and small. It is important to consider both the condition of individual elements and the overall appearance of the park road landscape. All aspects of the road's designed landscape should be evaluated for conformance to historical appearances. Since concepts such as "NPS Rustic" or "Naturalistic Design" exhibited considerable regional and temporal variation, evaluation criteria should be location-based and time-specific. Selective alterations to individual components do not necessarily impair the integrity of the park road as a whole, but the overall impression produced by the park road's design should remain consistent with historical precedents. While technological upgrades can be accomplished in a context-sensitive manner, the cumulative effect of seemingly minor alterations in alignment, pavement width, guardwall height, and roadside grading and landscaping can severely compromise a park road's historic integrity. Strict conformance with historical appearances will be more important for parkways and other comprehensively designed roads nominated under Criteria C than for roads whose significance rests primarily in their association with historical events or their relationships to more general social patterns or processes.

Setting encompasses both the immediate roadside corridor and the broader environment visible from the travelway or associated viewpoints. While evaluation of the immediate roadway environment is closely related to the assessment of design, setting also applies to less overtly manipulated roadsides, whose character may be established by natural processes, agriculture, or other social practices. Historic photographs or written descriptions can often be consulted to evaluate the degree to which contemporary roadsides convey historical conditions. Setting also refers to the roads' relationship to broader landforms, landscapes, and cultural features. Integrity of setting can be compromised by natural processes such as floods or fires, or by social practices like logging, mining, or residential development, all of which can dramatically impact the view from the road. The cessation of traditional farming practices can adversely affect the setting of park roads intended to showcase agricultural heritage. Integrity may also be compromised if a road's significance is tied to its role in providing access to natural sites or cultural features that have been significantly altered or are no longer used according to historic patterns.

Materials clearly play a prominent role in establishing a park road's appearance and communicating its historical character. Assessing the degree to which the repair or replacement of original construction materials impairs a park road's integrity can create difficult judgments. Most park roads have been periodically resurfaced, so as long as the new surface retains the historic character (similar color, texture and basic composition), replacement should probably be condoned. The issue becomes more complex when evaluating masonry features such as guardwalls, gutters, curbs, and retaining walls. Modest repairs are usually unavoidable, but new materials and patterns should closely resemble historic fabric. Large-scale reconstructions and rehabilitations require careful consideration, especially when materials such as simulated stone are employed or the height, pattern, or coloration of the masonry is changed. The overall impact on the park road experience should be the determining factor. The relative significance of the feature should also be weighed. For roads where masonry guardwalls or traditional rail fencing contribute strongly to historic significance and character, material changes may have more profound effects on integrity than for roads where such features play less prominent roles. While vegetative materials clearly have finite lifespans, general massing and species composition should be consistent with historically significant conditions. Since vegetation is a dynamic resource, reasonable allowance should be made for natural evolutionary processes, which may have been envisioned by the original designers. The occlusion of planned vistas, encroachment of open spaces, and presence of invasive species are sources of concern, though these conditions can often be remedied through treatment.

Workmanship, or the visible evidence of group or individual craftsmanship, is another factor in evaluating the integrity of park roads. While most roads were produced through mechanized processes, traditional craftsmanship values were expressed in the construction of associated features such as guard walls, guard rails, culvert headwalls, signs, and other timber and masonry accouterments – much of which represents the historically significant handiwork of CCC enrollees. Replacing original hand-built features with mass-produced materials such as steel beams or simulated stone can seriously degrade the integrity of component resources and the park road as a whole. Even when hand labor is employed, deviations from historic masonry patterns and the use of rectilinear dimensioned lumber rather than hand-shaped timbers can have an adverse effect. On a more subtle level, modern grading practices can produce a cruder and more mechanistic appearance than was historically achieved through hand labor. Replacing slightly irregular field-based alignments with scientifically calculated curvature could also be seen as diminishing evidence of historic construction techniques and workmanship.

Feeling is a critical factor in evaluating the integrity historic park roads. In order to possess integrity of feeling, existing physical features must convey the road's historically significant character. While some modifications to original materials, workmanship, and location are permissible and perhaps inevitable, the overall impression conveyed by the park road landscape should enable modern viewers to partake in the same sensations that defined the park road experience during the period of significance. Since the park road experience is a dynamic impression produced by a complex combination of factors, the cumulative impact of incremental changes and seemingly minor alterations must be closely scrutinized. Speed and scale are important variables to consider along with more obvious changes to vegetation and constructed features. Studies have shown that minor increases in the width of the pavement, road prism, and rate of travel dramatically impact perceptions of the surrounding landscape. The traditional park road experience of winding slowly along a narrow pavement in close proximity to natural features is significantly compromised when speeds increase and the pavement or surrounding clear zone is perceptibly widened. If the park road's significance is tied to a specific period, design standard, and mode of experience, the historic impression as interpreted from plans, photographs, and contemporary accounts should form the basis of evaluation; the fact that a modernized park road follows a more or less historic alignment and is more attractively configured than a contemporary highway is not sufficient grounds to ascribe integrity of feeling.

Association, or the ability of a historic resource to provide a mental link to a historic event, period, or person, is a more abstract quality, but it also requires the presence of physical attributes that retain the ability to evoke past experiences. Location and setting may be more significant in this regard than materials and specific design attributes, but existing features must still communicate the essential character of the road's historic identity. Both the nature of the road's significance and the condition of character-defining features should be considered. A historic alignment may allow contemporary motorists to trace the same route as earlier visitors, but a high-speed modernized roadway flanked by imposing safety barriers and broad clear zones may not evoke the sense of adventure and accomplishment associated with early park travel. A reinforced concrete simulated-stone guardwall may be more attractive than a jersey barrier or steel w-beam, but it would be a stretch to claim that it conveys associations of traditional rustic construction practices or CCC-era social history. As with the evaluation of feeling, the overall impression afforded by the park road landscape, rather than the status of individual features, should guide the ultimate determination.

A historic road need not demonstrate integrity in every aspect to merit an overall positive evalution. The relative importance of the various aspects will depend on the nature of the roadway and its identified significance. A road that is listed primarily for its design and construction would be expected to exhibit considerable continuity in form, materials, and workmanship, while the integrity of a road that is linked to a specific event or individual may be evaluated more in terms of its location, setting, association, and feeling. It is important to remember that the feelings and associations generated by historic sites and locations are never enough to justify a positive determination of integrity on their own: tangible physical evidence of a road's historic character must be present and readily visible in the contemporary landscape.

The National Register process also calls for the identification of contributing and non-contributing features. While this terminology is less critical for the CLR, the concept is useful for evaluating integrity and developing treatment plans. Generally speaking, aspects of the park road landscape that have been significantly altered or postdate the period of significance will not be considered contributing features, nor will period-correct elements that do not play significant roles in defining the resource's essential historic character. In some cases, historic features may have lost their individual integrity yet continue to play important roles in sustaining the overall character of the park road resource. A replacement guard wall, for instance, would possess no integrity of its own, but if it were reproduced convincingly, it could contribute to the overall historic appearance of the roadway. Landscape elements that have lost their historic character may also be returned to contributing status through remedial efforts outlined in the treatment section. Historic views could be reopened through selective cutting, original vegetation could be replanted, and various structural elements can be returned to their historic appearance. Where alterations are significant and irreversible, it may be necessary to designate entire sections of a road as non-contributing. This approach should be used sparingly, and only in situations where the broader park road landscape retains sufficient integrity to provide a strong sense of its historic character and identity.

While National Register guidelines should form the basis of the evaluations of significance and integrity, the CLR is not meant as a substitute for a National Register nomination or Determination of Eligibility (DOE). The CLR can build on or help to amend pre-existing nominations. When a DOE or nomination does not already exist, the research, documentation, and analysis conducted for the CLR can play an invaluable role in developing a formal submission. The CLR team should consult park and regional cultural resource specialists, National Register personnel, and State Historic Preservation Office staff to determine whether or not this would be a desirable course of action and then work closely with these experts to share research findings and collaborate in the preparation of any resultant DOEs or National Register nominations.

While the CLR analysis and evaluation process can assist in the preparation of National Register nominations and DOEs, its primary purpose is to identify resource management needs and set priorities for subsequent treatment plans. Understanding the significance, condition, and integrity of historic park road resources is a fundamental step in developing appropriate preservation plans and stewardship policies. The process for moving from research and analysis to the development of specific treatment recommendations is covered in the following section of this *Landscape Line*.

Historic Park Road Treatment

The treatment section of a historic road CLR builds on the research and analysis phases to produce a comprehensive park road stewardship strategy. The goal of the treatment plan is to retain the historically significant qualities of the park road, or, if necessary, to devise a program for returning the road and/or its component features to historically accurate conditions. The treatment plan must consider contemporary management concerns along with changing physical and technical factors, and may require innovative solutions to reconcile modern challenges with historical imperatives. It also needs to be sustainable, both environmentally and economically. Resource availability must be considered when proposing treatments that require significant initial outlays, long-term maintenance commitments, or unusual materials or technical expertise. The plan should articulate general policy goals, provide specific guidelines for the treatment and management of significant cultural resources, and propose measures for documenting treatment actions and evaluating their short and long term impacts.

The treatment plan should be devised in consultation with park staff and representatives from the various agencies involved in park road management. While all cultural resource specialists work within an ever-

Sidebar 4: Examples of Roads Listed on the National Register or as National Historic Landmarks

Glacier National Park's **Going-to-the-Sun Road** was listed on the National Register in 1983. Since this was a relatively early park road nomination, the resource was categorized as a structure and the nomination emphasized engineered features such as bridges and tunnels, with limited reference to broader landscape characteristics. Boundaries were set at 15' on either side of the center line. The listed area amounted to just over 177 acres, stretching 48.7 miles from the eastern park boundary to an intersection several miles from the western boundary that represented a significant change in the historic location. The road was listed under the themes of engineering and park development, with a period of significance reflecting the original planning, design, and construction dates of 1921-1933. In 1997 the Going-to-the-Sun Road was designated a National Historic Landmark District. The NHL registration expanded the boundaries to 30' on either side of the center line and extended the period of significance to 1952, when the road was fully paved with bituminous concrete. The road was listed under NHL Criteria 1 & 4 and National Register Criteria A & C, with significance in landscape architecture, transportation, and politics. Greater emphasis was placed on broader landscape, planning and design concerns. The original width and alignment of the road were cited as retaining a high degree of integrity, along with the bridges, tunnels, substantial portions of the guardwalls, and the surrounding views and vegetation.

The 1987 National Register nomination **Multiple Resources for Zion National Park** included several roads and road-related features. The Zion-Mt. Carmel Highway (1926-1930) was listed as a contributing site with four major contributing resources: Zion-Mt. Carmel Highway Tunnel, Zion-Mt. Carmel Highway Switchbacks, Virgin River Bridge, and Pine Creek Bridge. Entrance signs, comfort stations, and the East Entrance Checking Station were listed as individual buildings. National Register Criteria A & C provided the basis of the road-related listings, for which the themes of landscape architecture, transportation, and NPS Rustic Style were invoked. A detailed addendum supported the 1996 listing of the scenic **Floor of the Valley Road** (1932-1942), which had been excluded earlier on the grounds that it lacked the engineering distinction of the Zion-Mt. Carmel Highway. The red-tinted pavement and native sandstone masonry were identified as character-defining features and retaining walls, drainage features, parking areas, and viewpoints were documented as contributing resources.

Shenandoah National Park's **Skyline Drive** was listed as a National Register Historic District in 1997. The extensively documented nomination supported its significance under Criteria A and C, emphasizing the areas of landscape architecture, transportation, social history, recreation, politics, engineering, conservation, and community planning and development. The 1931-1951 period of significance encompassed the drive's original planning and construction, along with important subsequent modifications prior to Mission 66. The drive's topography, vegetation, engineering, architecture, landscape design, and associated features were described at length. Recently reconstructed concrete-core guardwalls with hand-laid stone veneer created by splitting the original rockwork were deemed not to compromise the drive's historic integrity, despite their greater height and length and the switch from dry-laid to mortared construction.

Colonial Parkway, the primary circulation system of Colonial National Historical Park, was listed as a National Register Historic District in 2001, under Criteria A and C, with a period of significance stretching from 1930-1958. The latter date reflected the completion of final aspects of the parkway's development. Since primary development occurred during the 1930s, no exception was deemed necessary to qualify it as a resource achieving significance in less than fifty years. Colonial Parkway's significance rests in its role as an embodiment of park development and recreational trends of its period and in its status as an exceptionally intact example of 1930s landscape architecture and parkway design. Both the roadway itself and the broader parkway landscape were judged to possess a high degree of integrity. While several new grade-separation structures have been added, their massing and brick veneer harmonized with historic design standards. Bridge and pavement reconstructions similarly upheld traditional patterns. The Colonial Parkway nomination is an excellent illustration of a comprehensive landscape-based approach to park road documentation and evaluation.

The Natchez Trace Parkway in Mississippi contains several listed sections of the **Old Natchez Trace**, demonstrating the manner in which road-related sites predating NPS development have been recognized for their historic significance. A portion of the old trace in Madison County near the site of one of the earliest inns along the route was listed in 1976 for its significance in the areas of transportation, communication, and education. Another Madison County section including the **Old Natchez Trace and Choctaw Agency Site**, was listed in 1994. Of the 3.3 miles listed segment, which is distinguished by the remains of a 30'-wide surface that is occasionally sunken between high earthen banks, 1.4 miles are within parkway boundaries. This segment qualified for listing under Criteria A & D, on the grounds that the unpaved sunken roadway and overhanging vegetation evoke strong associations of the Old Natchez Trace, while both the Choctaw Agency site and the trace itself contain significant archeological resources.

expanding matrix of regulations, policies, and programmatic concerns, historic park road stewardship is further complicated by the array of agencies, authorities, and legal, technical, aesthetic, and ecological issues involved. In addition to complying with NPS planning regulations, General Management Plan prerogatives, and federal preservation and environmental protection laws, historic road CLRs must address the technical standards, policies, and protocols that inform contemporary highway engineering practice. This is particularly important in the treatment section of the CLR, where proposals must take into consideration national highway design standards along with the practical concerns and procedural requirements of the NPS Park Road Program (PRP) and its partners in the Federal Highway Administration's (FHWA) Federal Lands Highway Program (FLHP).

PRP staff and the regional FLHP coordinator should be closely consulted when developing the treatment component of the CLR. In addition to serving as liaisons with FHWA staff who will play a major role in implementing road projects, they can provide important guidance on technical and administrative matters, particularly in regard to coordinating CLR recommendations with PRP activities and published design standards.

Park Road Standards

The NPS has articulated its approach to park road design and management in a series of technical and administrative briefs dating back to the service's inception. The 1984 NPS *Park Road Standards* bulletin is the most recent publication in this series and should serve as the starting point for considerations of contemporary perspectives on design, function, and safety concerns. While the design specifications provided in the 1984 *Park Road Standards* adhere closely to general federal standards, the publication emphasizes that park roads are unique environments intended for leisurely recreational travel. Preserving the quality of the park road experience is an explicitly stated goal. When accommodating current or projected demands would entail measures that might compromise a park road's unique qualities, *Park Road Standards* recommends adopting policies to control incompatible uses. The CLR can call attention to these published policy goals to help make the case for context-sensitive park road stewardship.

While *Park Road Standards* promotes flexibility over the rigid application of formulaic technical criteria, the influence of such standards remains pervasive. The principal source of standards for road development in the United States is the American Association of State Highway and Transportation Officials' *A Policy on Geometric Design of Highways and Streets.* Commonly known as the AASHTO Green Book, this publication provides specifications, or "AASHTO standards," for virtually every aspect of road construction, from pavement width, curvature, and sight distance to guardwall location, height, and composition. While AASHTO standards are legally binding only for roads within the officially designated federal highway system (or where otherwise adopted by the governing agency), the Green Book's depth, breadth, and rigorously tested technical data make it the primary reference for highway engineers and transportation planners engaged in road-building and rehabilitation activities throughout the country. AASHTO's *Roadside Design Guide* provides additional information on roadside safety treatments, with extensive details on safety barriers, clear zones, and related matters that bear directly on park road management.

In proposing treatments for historic park roads, it is important to recognize that the solutions called for in modern engineering publications are not always compatible with efforts to maintain or restore historic integrity. The potential for conflict between historic values and contemporary technical criteria is greatest when applying standards prepared for modern highway construction to historic roads designed for different eras, different purposes, and different technical constraints. Since Green Book solutions may occasionally seem incompatible with traditional park road values, it is important to underscore that AASHTO standards are intended to serve as general recommendations rather than as inflexible stipulations. Unless a historic road is part of the federal highway system, it is permissible for the CLR to propose alternative solutions that are more historically appropriate and context-sensitive. The Green Book acknowledges that recreational roads have unique requirements and endorses the use of site-specific design criteria "intended to protect, and enhance existing aesthetic, ecological, environmental, and cultural amenities." AASHTO standards for recreational roads with design speeds under 60 kph (37 mph) permit more horizontal curvature, narrower shoulders and recovery zones, and a greater diversity of safety barriers than called for in utilitarian highway development (AASHTO 2001; 443-53; quoted, p. 443).

The FHWA has similarly recognized the value of context-sensitive design and provided guidance for taking advantage of the inherent flexibility of AASHTO standards in its 1997 publication, *Flexibility in Highway Design.* Additional assistance in understanding AASHTO standards and coordinating them with historic preservation concerns can be found in Paul Daniel Marriott's *Saving Historic Roads: Design & Policy Guidelines* (Marriott 1998).

Since road standards are geared to projected use patterns, the manner in which a park road is officially classified plays an important role in defining standards and determining appropriate solutions. Both the NPS and AASHTO recommend different treatments depending on the functional classification and expected traffic burdens of a roadway. As outlined in the 1984 *Park Road Standards*, the major categories of NPS park roads are Principal Park Road/Rural Parkway, Connector Park Road, Special Purpose Park Road, and Primitive Park Road. Administrative roads have two subcategories and Urban Parkways and City Streets are also accorded separate guidelines. Where conditions warrant, it may be possible to reclassify a historic road to facilitate compliance.

In some cases, it may be desirable to propose solutions that exceed standard interpretations of flexibility. For legal and administrative reasons, it is necessary to document alternative treatments through what is known as the "design exception process." Demonstrating reduced travel speeds, light traffic volumes, and lower-than-normal accident rates can help make the case for context-sensitive design exceptions aimed at preserving the character-defining features of historic roads. All recommendations to explore the design exception option should be made in close consultation with park staff, PRP personnel, and regional FHWA officials. While the process can be time-consuming and challenging on technical, aesthetic, and bureaucratic levels, it can lead to creative solutions that harmonize the complex goals of resource protection, safety, and sustainability.

Compliance

Park road treatment proposals must also take into account the various compliance procedures that regulate development practices on federal lands. The National Environmental Policy Act (NEPA) and Section 106 of the Historic Preservation Act (Section 106) should be considered from the outset of the CLR process to avoid unnecessary problems when it comes time to implement treatment recommendations. Although the CLR does not legally require public input, the potential for treatment recommendations to affect visitors, neighbors, and natural resources suggests that the CLR scope of work consider the possibility of complying with the NEPA public input process. When an environmental assessment (EA), environmental impact statement (EIS), or Section 106 compliance process is required to implement the proposed treatment recommendations, all affected parties should be included in the CLR development process to facilitate subsequent administrative procedures.

In addition to these general compliance procedures, park road projects are potentially subject to review under Section 4(f) of the Department of Transportation Act of 1966, which declares it public policy to "preserve the natural beauty of the countryside and public park and recreation lands" and prohibits federal approval of transportation projects that use public parks, historic sites, recreation areas, or wildlife refuges unless there is "no feasible and prudent alternative" and the proposal "includes all possible planning to minimize harm" to the site. For 4(f) purposes, "use" is defined broadly enough to include noise and other indirect environmental impacts. Since 4(f) focuses specifically on a road's use of parkland, treatment recommendations that call for lane-widening, altered alignments, or the development of additional features may trigger 4(f) review. The CLR team should consult with the park FHLP coordinator throughout the report's process to ensure compliance. While Section 4(f) has the potential to be a strong ally in historic road preservation efforts, varying interpretations of the legislation's key phrases can limit its effectiveness. Treatment recommendations should conform to the act's intentions. Section 4(f)'s planning requirement also makes it a potential source of funding for CLR development.

Given the extent of many park road systems, it may be advantageous to develop programmatic agreements to resolve compliance issues rather than deal with separate but similar sites on an individual basis. Standard roadway cross-sections, pavement widths, guard wall patterns, and vegetation management procedures can be generated to guide treatment activities along an entire roadway or sub component. Compliance agreements for individual sites with unique requirements should be developed independently.

Since road projects have limited funding for compliance-related activities, it is essential to work with the PRP and other potential partners to understand what projects are being scheduled, which have the potential to effect historic park roads, and when compliance mandates might help fund CLR development. PRP managers are beginning to recognize the merits of undertaking cultural landscape research to assist their park road projects and are coordinating with the regional cultural landscape programs to accomplish this effort.

DEVELOPING A MANAGEMENT PHILOSOPHY

The treatment section of the CLR should provide a management philosophy statement that defines the principle objectives of the historic road stewardship plan and outlines the general nature of the treatment activities required to achieve these objectives. This management philosophy statement should articulate both long-term stewardship strategies and specific treatment goals. It should clearly express the road's historic significance and outline the preferred approach to preserving the landscape's essential physical characteristics. The management philosophy should be consistent with general park resource management concerns, with FHWA requirements, and with the Secretary of the Interior's standards for the treatment of cultural landscapes.

The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes defines four general approaches to landscape stewardship: Preservation, Rehabilitation, Restoration, and Reconstruction. While one of these approaches will generally be defined as the principle treatment philosophy for the overall resource, individual segments and component features may require various treatments depending on existing conditions and management goals. It is important to remember that the highway engineering community employs similar terminology to describe different and in some cases contradictory processes. Communications with engineering staff should clearly establish which definitions of these terms are being applied and what the results of the proposed actions will entail.

Preservation retains the existing character and fabric of the historic park road landscape with the highest possible degree of integrity in regard to materials, setting, design, feeling, and location. Preservation-based treatment plans typically emphasize maintenance and stabilization regimes aimed at ensuring the longevity of existing features. Measures may be taken to protect and stabilize historic road resources, and limited and sensitive upgrading of technical systems is permissible, but distinctive materials, features, and design elements should not be substantially altered or replaced. When original features or materials have deteriorated to the point that they compromise the historic character or safety of the site, limited replacement-in-kind is permitted. Discreet stabilization measures designed to reinforce or extend the longevity of historic features can also play a part in preservation plans. These minor interventions should not impact the overall character and integrity of the historic park road landscape.

The ever-changing demands placed on park roads make strict preservation a difficult goal to achieve. Modern traffic burdens and safety requirements – along with general age-related deterioration of heavily used functional features – frequently mandate technical upgrades and material replacements that, even when kept within context-sensitive limits, exceed standard definitions of preservation. If a historic park road's design has been deemed extraordinarily significant (through NHL designation, for instance), or current use can be maintained at or returned to levels commensurate with historic patterns, then preservation is a more viable option. Some historic roads or road segments have been preserved by restricting travel to one direction, regulating vehicle size, or reserving them for non-motorized travel.

Rehabilitation aims to protect the essential character of the park road landscape while accommodating compatible uses that may require modest alterations to the resource's physical fabric and design qualities. Rehabilitation allows for the replacement of deteriorated features on a wider scale than preservation-based treatments, along with more extensive substitution of compatible materials designed to meet current needs. Because rehabilitation-based treatment plans respond to current demands while safeguarding key historic values, they often provide the most acceptable means of resolving the inherent tensions of park road stewardship. The primary challenge in devising rehabilitation strategies is to identify character-defining features and ensure that planned alterations do not compromise the road's overall historic character.

Rehabilitation allows for minor lane-widening and alignment improvements, updating paving materials and technical systems, and the addition of compatible safety measures. It provides more flexibility for replacing hard-to-find plant species and construction materials, such as locally gathered stone, which is often no longer available due to changing environmental regulations. Modifications must be carefully considered and meticulously specified to ensure that they do not detract from the road's overall character and that remaining historic materials, features, and spatial relationships are protected.

Restoration focuses on returning a historic road to its appearance during the period of significance. This process may include the reconstruction of damaged or missing features and the removal of elements from other eras that detract from the historic scene. Limited upgrading of technical systems is permitted as long as these interventions are discreet and compatible. Existing features from the period of significance will be retained and stabilized. All changes should be carefully researched and specified to ensure that they are historically accurate in regard to design, materials, and overall impression. A long-term management plan should be devised to maintain the desired historical appearance.

Given the evolving demands on park roads, comprehensive restoration to historic periods is usually impractical, unless future use can be limited to compatible functions. Restoration may be a viable strategy for bypassed road segments or for roads where current use does not threaten the integrity of the resource. For historic road segments that function apart from the main visitor circulation system – such as the vernacular lanes of military parks or abandoned sections of the Old Natchez Trace – restoration may be a desirable and practical strategy. More limited restorations can play an important role in park road stewardship: vegetation can be restored to historic patterns, designed views can be restored through selective trimming, damaged or missing walls, signs and smaller features can be repaired or replaced in historically accurate patterns, and incompatible elements can be removed to reproduce historic appearances.

Reconstruction is the process of recreating a non-surviving site, structure, feature, or landscape. This approach should only be employed when the non-surviving resource is deemed exceptionally significant and sufficient documentary evidence exists to ensure an accurate replication of the historical antecedent. Because of the inherent technical challenges and philosophical implications, reconstructions require extensive consideration and high-level review, culminating with written approval from the NPS Director. If reconstruction is deemed a suitable strategy, the artificial nature of the landscape should be explicitly identified and interpreted.

While large-scale reconstruction will rarely be an appropriate strategy for historic park road management, it may occasionally be desirable to reconstruct short segments that have been lost through natural processes or administrative actions. A landslide may destroy a section of historic road, for instance, or an earlier alignment may be brought back into use for various reasons. The reconstruction of small-scale features can contribute to comprehensive stewardship plans guided by other treatment philosophies. Even minor reconstructions should be carefully documented and conform to the Secretary of the Interior's standards.

Given the size and complexity of most historic park roads, it is likely that park road treatment plans will incorporate various treatment philosophies to address the range of conditions encountered along the roadway corridor. It is generally desirable to choose a primary stewardship philosophy based on the character and significance of the resource as whole and then articulate the nature and extent of site-specific treatments. The cumulative results of individual treatment recommendations should clearly reflect the guiding principles of the overall plan.

Developing the Treatment Plan

Once the overall treatment approach has been defined, a detailed historic road treatment plan should be developed. The treatment plan should outline the overall philosophy, provide general guidelines for treating common resource management issues, and include detailed specifications for the treatment of sites, features, and broader landscape or planning elements that have been identified as requiring restoration, preservation, rehabilitation, or reconstruction. Maintenance regimes should be outlined, both for resources currently deemed in satisfactory condition and to ensure the success and longevity of proposed enhancements. The treatment plan can also propose interpretative measures designed to enhance visitor awareness of the road's general history and significance or call attention to specific features or preservation measures.

The treatment plan should clearly articulate proposed alterations, material specifications, construction techniques, and maintenance directives, being sure to employ terminology and graphic conventions familiar to highway engineers, road construction contractors, and maintenance personnel. The "Anatomy of a Road" section should be consulted for clarification when necessary. Standard sections, plans, and profiles should be prepared according to the scope of the proposed interventions. Reproductions of historic plans, design details, and construction photographs can be useful for demonstrating design proposals and workmanship techniques. Additional information on the general form and content of the treatment plan, including cost estimates and project agreement forms, can be found in *A Guide to Cultural Landscape Report*s and the accompanying *Landscape Lines*.

Sidebar 5: Historic Park Road Treatment Guidelines

- Preserve as much of the historic road corridor as possible, including constructed features and associated landscape settings
- Consider managerial solutions before proposing physical alterations to historic road landscapes
- Promote alternative transportation to reduce traffic volume and control circulation patterns
- Maintain historic road alignments, cross-sections and profiles as closely as possible
- Realign roads only when absolutely necessary and try to retain historic character, views, width, and curvature
- Retain original road width where possible; consider alternative techniques such as stabilized shoulders
- Preserve, rehabilitate, or find compatible replacements for original paving materials
- Preserve, restore, or replace-in-kind historic features such as barrier walls, fences, and guardrails, curbs, gutters, culverts, signage, scenic pullouts, bridges, and tunnels
- Limit the construction of new barriers or systematic rehabilitation to areas with demonstrated safety hazards
- Use materials and construction methods that replicate the effect of historic building practices
- Modern materials and construction methods that reduce costs and enhance durability should only be used where they do not detract from historical character
- Choose materials and methods that are sustainable, compatible, and cost-effective in the long term
- Maintain and restore historic vegetation patterns, especially in regard to corridor-width, canopies, and planned vistas
- Protect associated scenic, natural, and cultural features that are part of the character of the road system including rock formations, vegetation, water bodies, views, agricultural areas, buildings, structures, markers, and monuments
- Preserve ethnographic resources and protect archeological sites
- Develop interpretation programs to enhance public awareness of park road history and build support for historic road preservation

While the CLR team or individual preparer will bear primary responsibility, the treatment plan should be developed in cooperation with park staff, PRP personnel, and the FHWA's regional FLHP coordinator. The State Historic Preservation Office should also be consulted when dealing with roads listed on or eligible for listing on the National Register. NPS regional staff can also provide guidance on various technical, programmatic, and philosophical matters. Valuable information can often be obtained from staff in parks that have extensive experience in historic park road management, such as Glacier, Acadia, Yellowstone, and Yosemite. Collaborating with all the relevant professional staff, partners, and regulatory officials throughout the CLR development process will greatly facilitate approval and implementation phases.

Historic Park Road Treatment Considerations

This section provides an overview of some of the most common treatment concerns associated with historic park road management. While a range of topics and potential solutions are discussed, this brief survey is neither comprehensive nor definitive. Every historic road presents unique challenges requiring individualized, site-specific solutions, while treatment techniques and stewardship philosophies are constantly evolving in response to new demands, new technologies, and ever-changing social, administrative, and financial concerns. While every historic park road project entails unique solutions, the following survey covers many of the ways in which the NPS and FHWA have collaborated to preserve and maintain America's national park roads and parkways.

Location and Alignment

Park road designers took enormous care to locate roads in relationship to natural and cultural features and produce alignments that combined beauty and utility through subtle adaptations to local conditions, scenic features, and administrative concerns. Any changes to these basic attributes should be carefully considered. While site-specific remediation may be merited to accommodate new programmatic demands, adapt to changing natural conditions, or alleviate demonstrated safety hazards, the systematic alteration of historic curvature to conform to contemporary design standards can significantly compromise a park road's experiential qualities and historic integrity. Original design intent can be illustrated with historic design documents and invoked to justify variations from current codes. Low accident history records can be employed to demonstrate the functional safety of roads that do not meet contemporary standards for minimum curvature. Regulatory measures such as lower speed limits, restrictions on vehicle length, and one-way circulation patterns can reduce potential hazards with minimal physical impact on historic resources.

These techniques were employed on Mount Rainier's Eastside Highway, where a proposed realignment would have significantly altered a historic bridge and its designed approaches. The significance of the original design was demonstrated and speed regulations and improved enforcement were combined with a modest increase in curve radius to produce a solution that reconciled contemporary safety concerns with park road preservation. In Sequoia National Park, tour bus companies agreed to stop using a particularly circuitous portion of the Generals Highway, making it possible to retain a series of tight curves that contribute significantly to the road's historic character and significance. In Yellowstone National Park, however, historic tour road

Figure 20. Classic park road with tight curvature calculated to provide thrilling views of natural scenery; changing historic alignment to conform to modern standards not recommended; Glacier Point Road, Yosemite National Park. (Davis 2000)

alignments were systematically modernized to accommodate contemporary traffic. While both horizontal and vertical curves were lengthened and regularized, spiral transitions were employed to evoke the historically winding alignment.

Profile

Since most existing park roads were designed with relatively gentle and consistent grades to accommodate mid-twentieth century automobiles, there is generally less pressure to alter their vertical alignment. The most common reasons for altering historic profiles are to reduce excessive vertical curvature that restricts sight distance or to smooth out "roller-coaster" dips and bumps. Minor regrading to eliminate dangerous blindspots can often be accomplished without dramatically altering overall road quality, but achieving complete conformance with contemporary standards in the mountainous terrain of many parks may require excessive excavation and/or dramatic relocations. While smoothing out minor irregularities may afford a more consistent and comfortable ride, excessive standardization can eliminate the sense of serendipity and dynamic interaction with the landscape that differentiates park road travel from ordinary motoring.

Historic bridges can produce profile irregularities that restrict sight distance or create sudden and potentially dangerous bumps, the effects of which are often rendered more hazardous by accompanying lane-width constrictions. During the rehabilitation of the White Bridge at Vanderbilt Mansion National Historical Site, the vertical alignment was raised and flattened to eliminate an abrupt roller-coaster profile that caused excessive wear and tear on vehicles, their occupants, and the bridge itself.

Pavement

Pavement rehabilitation is one of the most common and challenging aspects of historic park road management. Pavements wear out. Subgrades deteriorate. Vehicles get longer, wider, and heavier and many motorists want to drive faster and more effortlessly. Engineering standards evolve to accommodate these new demands, calling for wider travel lanes and broader shoulders. These alterations are often implemented during resurfacing projects, since FLHP funding for functional rehabilitation is generally accompanied by requests to adhere to prevailing standards.

Adding lanes, widening existing lanes, and expanding or adding shoulders may enhance travel flow, but at considerable cost to the historic integrity and experiential character of traditional park roads. Even seemingly minor lane-widening and shoulder adjustments can adversely affect historic character by increasing the pavement's domination of the forward view, creating greater separation between motorists and their surroundings and producing an incentive toward higher speeds, which further compromises the park road experience and may cause additional safety hazards.

Cultural resource specialists should work closely with park management, PRP staff, and FLHP engineers to underscore the importance of historic pavement configurations and ensure that pavement-widening is kept to the minimum consistent with visitor safety. Alternatives such as signage, speed reductions, and vehicle restrictions should be thoroughly explored. Minor widenings at curves and other hazard points, along with the introduction of occasional pullouts for slow-moving traffic, can alleviate many problems. Where systematic lane-widening is ruled unavoidable, the impact on the resource should be duly noted, even if this means acknowledging the loss of historic integrity.

The expansion or addition of paved shoulders can be a means of effectively widening the travel surface. This approach should be carefully reviewed, however, since the visual and perceptual results are similar to straightforward pavement widening. A less visually obtrusive means of enhancing safety and overall performance is to provide stabilized earth, gravel, or turf shoulders. Stabilized shoulders allow vehicles to recover from minor deviations or pull safely off the main travelway, yet they are less noticeable and more permeable than paved shoulders, reducing excessive water runoff concerns.

Modern motor traffic places tremendous demands on historic pavements, many of which were built with minimal sub grades and primitive surface materials.

(A)

(B)

(C)

(D)

Figure 21. Comparative views showing effects of changes to alignment, road width, and clear zone: (A) Classic narrow winding park road laid lightly on the land with tight curvature, relatively steep grade, and no shoulders, (Hawaii Volcanoes National Park); B) Longer curves, gentler grade, and slightly wider pavement, with minimal gravel shoulder and vegetation approaching the edge of travelway, (Yosemite National Park); C) Recently rehabilitated road with longer curves, wider paved shoulders and expanded clear zone, (Yellowstone National Park); D) Four-lane dual roadway with median in high traffic area. (Yellowstone National Park) (Davis 1996-2001)

While historic dirt, gravel, macadam, brick, and cobblestone surfaces should be preserved whenever possible, mid-twentieth-century concrete or bituminous aggregate pavements can often be replaced with improved modern materials without compromising the road's overall integrity. Major repaving projects often afford the opportunity to improve subgrades and drainage systems, further enhancing the performance and longevity of historic park roads. When historic surfaces have a distinctive tint, texture, or composition, these qualities should be reproduced with compatible modern materials. The red-tinged pavements that harmonize many Southwestern park roads with their surroundings have been retained through multiple resurfacings. When sections of Colonial Parkway required rehabilitation, considerable effort was made to emulate the original rough-textured concrete pavement, which was itself a 1930s attempt to evoke historic shell road surfaces in modern materials. A recent resurfacing project at Acadia National Park employed a coarse final "chip coat" layer to restore a rustic crushed-stone appearance that had been compromised by multiple overlays with conventional bituminous concrete.

A common paving practice that should be avoided is the repeated layering of new material over existing surfaces. The accumulation of multiple pavement courses over time alters the relationship between the travel surface and its surroundings, effectively lowering the height of safety barriers or creating potentially dangerous dropoffs that are rendered more hazardous by the narrow lane-widths and minimal shoulders of historic park roads.

Drainage

Properly functioning drainage systems prevent water from accumulating on park road pavements or undermining the basic road structure. Most paved park roads employ a slight crown to shed water. On curves, a banked or "superelevated" pavement may direct water to the inward or downhill side. Pavement rehabilitation programs should retain historic configurations unless they have proven ineffective, in which case minor improvements can generally be made without compromising the road's historic character.

A variety of techniques were used to accommodate surface runoff and channel other water sources such as intersecting streams, springs, and waterfalls. Shallow swales or ditches positioned at the edge of the road shoulder were often sufficient in areas with modest rainfall, permeable soils, and moderate terrain. Where conditions were more extreme or a more finished look was desired, gutters lined with local rock or stone pavers afforded durable and attractive options. Stabilizing gutters in this manner was a labor-intensive process, so this technique is more likely to be found in commemorative military parks and on roads where the CCC was involved in construction or rehabilitation efforts.

Historic ditches, swales, and gutters require ongoing maintenance to remove obstructions and preserve their appearance and structural integrity. Many ditches and gutters become seriously clogged over time, requiring more extensive remedial efforts. Much gutter damage is due to natural processes, but historically significant stone gutters have also been compromised by over-pavement with bituminous concrete. While such modern surfaces may be less expensive to apply and easier to maintain than historic materials, this treatment is not desirable and should be reversed wherever possible. Care should be taken to restore the original configuration and preserve historic paving materials as much as possible. Replacement-in-kind is the preferred treatment for lost or damaged materials.

Figure 22. Attentive maintenance is necessary to ensure that historic drainage features such as these stone-lined gutters in Acadia National Park do not become obstructed by vegetation, siltation or other natural processes. (Foulds 1993)

Culverts are another means of controlling surface runoff and containing water sources that intersect the roadway. When culverts are used to divert surface runoff, they are often employed in association with drop inlets or curb inlets that collect water from the road surface. In some cases culverts may extend a significant distance from the roadbed to ensure that exiting water does not cause damaging erosion. Dimensions range from less than a foot in diameter for smaller culverts and underdrains to ten or twelve feet in span or diameter. Wider spans are generally referred to as bridges, though definitions vary considerably. In many cases the terms are used interchangeably. Historic construction materials include wood, stone, cast iron, vitrified clay, galvanized steel, and concrete. Headwalls, which help

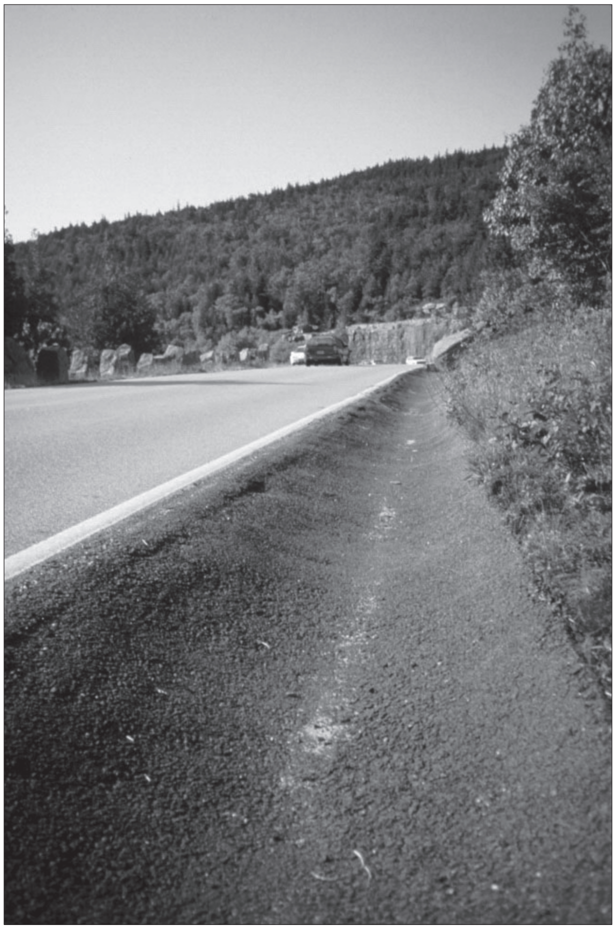


Figure 23. Many historic gutters have been overlain with bituminous concrete to ease maintenance and repair; such inappropriate treatments should be reversed whenever possible. (Foulds 1993)

channel water, secure the culvert, and stabilize the surrounding fill, were frequently constructed of native stone masonry or stone-faced concrete, especially when visible from the roadway or associated circulation networks.

Historic culverts may require a variety of treatments. They can clog with debris, collapse from excessive loads or material failure, and be undermined, dislocated or washed away by chronic or catastrophic flooding. Inlet grates, linings, and headwalls deteriorate, especially in the harsh environments of many national park roads. Road widening and realignment can also necessitate culvert replacement, extension, and relocation.

When culverts require treatment due to structural failures or roadbed alterations, there is usually no objection to replacing subterranean sections with modern materials or more efficient configurations. Exceptions may occur in the case of historic wood or masonry culverts whose materials and craftsmanship contribute measurably to the road's character and significance. When the actual materials and craftsmanship are deemed significant, as may be the case with hand-constructed culverts on some carriage drives or military park roads, or when the barrel of the culvert is visible to park users, then treatments should employ compatible materials and construction methods.

Most culvert treatment recommendations will concern headwalls, since these are usually the most visible and highly crafted elements. The preferred alternative is to preserve historic headwalls in place, stabilizing them and replacing lost or damaged materials in-kind using similar workmanship. On road-widening projects, it may be possible to relocate historic headwalls by moving them as integral units or by dismantling them for reassembly in conjunction with new or lengthened culverts.

If original headwalls are too deteriorated, or additional culverts are required for various reasons, existing headwalls, historic photos, or original plans can be consulted as the basis for reproductions, which should follow historical precedents as closely as possible. Since current laws generally prohibit quarrying within parks, imported materials should be matched as closely to historic stonework to avoid visual discrepancies. To save time and reduce on-site skill requirements, entire headwall assemblies can be precut and delivered to the site.

"Simulated stone," or reinforced concrete poured in forms designed to emulate traditional masonry, can be an economical alternative to hand-laid stone headwalls. The concrete surface should be tinted to harmonize with historic rockwork, either in the original mix or with surface color applications, which may be varied for greater naturalness. Though less desirable than authentic stonework, simulated stone is generally preferable to unadorned concrete. Some parks may consider it an acceptable solution, especially for less visible headwalls or locations where motorists will be passing at moderate speeds.

Neither simulated stone nor neo-rustic hand-crafted stonework is appropriate for headwalls or other features on park roads that historically displayed alternative masonry techniques. Colonial Parkway designers employed a Flemish-bond brick veneer to evoke historic masonry traditions, for instance, and some later parkways and park roads adopted a "streamlined" aesthetic of unadorned concrete, which should be retained for reasons of visual consistency and historic authenticity. Historic design motifs, colors, textures, dimensions, and construction techniques should be emulated as closely as possible when treating these headwalls.

Figure 24. Historic stone culvert headwall salvaged and numbered for reassembly after road-widening is completed, Yellowstone National Park. (Davis 1996)

Retaining Walls

Many historic park roads contain retaining walls and other structures designed to support the roadbed and stabilize slopes above or below the roadway. Generally constructed of locally quarried stone masonry, historic retaining walls vary from minor grade correctives a few feet in length and inches in height to immense structures towering hundreds of feet above steep cliffs and roaring rivers. Most range somewhere in between and, like headwalls and other examples of NPS rockwork, were designed to harmonize with their surroundings. In some cases, such as Glacier National Park's Going-to-the-Sun Road, retaining walls are spectacular structures that contribute substantially to the road's visual character and historic significance. In other cases, they are all but invisible to motorists, lying below the travelway or disappearing behind subsequent plant growth and soil accumulation.

Figure 25. Modern pre-cut stone headwall awaiting installation on road rehabilitation project, Yellowstone National Park. (Davis 1996)

Retaining wall treatments may range from minor repairs to significant structural rehabilitation to wholesale replacement when catastrophic failure occurs or road-widening or realignment requires changes in length, height, or location. Minor repairs should be aimed at preserving and stabilizing the original historic fabric. Permanently lost or damaged materials should be replaced in-kind whenever possible. Major stabilization efforts will generally require extensive collaboration with engineers and geotechnicians, especially when the original structure has exhibited signs of mechanical failure or the surrounding terrain has slumped or shifted. If significant alterations are required, rehabilitation measures should not detract from the appearance of walls and slopes that are visible to the public.

When natural forces, road-widening, or realignment projects necessitate the reconstruction, relocation, or extension of historic stone retaining walls, efforts should be made to salvage and reuse historic materials and emulate original design patterns and masonry techniques. Since the additional cutting and filling that often accompanies road-widening and realignments generally increases the need for retaining walls, salvaged materials will rarely be sufficient. Historical research can sometimes identify the location of original quarries, which can serve as sources of compatible material if quarrying within the park is allowed. Some parks have been able

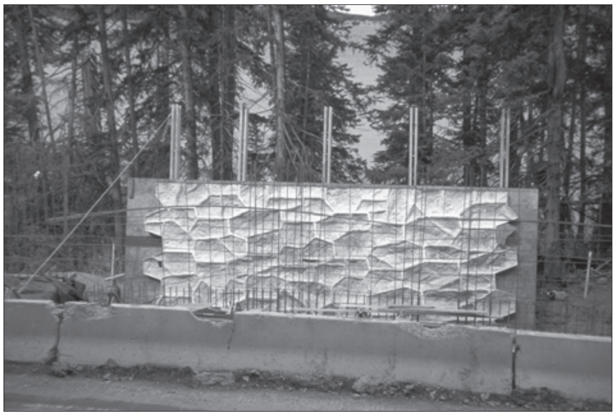


Figure 26. Formwork and foundation for simulated stone retaining wall, Yellowstone National Park. (Davis 1996)

Figure 27. Simulated stone retaining wall with integral culvert and crenellations: this treatment is best restricted to areas where visitors do not come close enough to discern the artificial nature of the materials, Yellowstone National Park. (Davis 1996)

to develop modest reserves of compatible material by collecting suitable stones from landsides and other naturally occurring rockfall. When rock must be imported from quarries outside the park, it should match the color, texture, and shapes of historic materials as closely as possible.

While traditional stone masonry techniques are preferable, stability factors and budgetary concerns may persuade parks to pursue other options. Reinforced concrete retaining walls faced with hand-laid stone veneer are generally more compatible with the historic character of park roads than simulated-stone fabrications, though the latter may be more economical in some situations. In either case, the scale, color, texture, and patterning should be based on local historic precedents, not on generic prototypes. For simulated stone, it is sometimes possible to ensure greater veracity by casting forms from historic rockwork. Joints between concrete sections will be less visible if they follow the "rock" contours and are tinted to match the "mortar" of the poured concrete. Tints can be applied to the simulated stonework, as well. When employed with skill and subtlety this technique can appear quite realistic to casual observers. As with culvert headwalls, the inauthenticity of simulated stone retaining walls will be less apparent if they are only used in areas where visitors are restricted to their cars and driving at moderate speeds.

Safety Barriers

Safety barriers such as guardwalls, guardrails, guiderails, and guideposts are common components of many historic park roads. Whether comprised of rugged boulders, hand-laid stone masonry, rough-hewn timbers, or hand-split rails, rustic safety barriers have long been character-defining features of national park road landscapes. While many of these barriers were intended to deflect vehicles traveling at relatively low speeds, their function has always been as much perceptual as physical. In addition to delineating the edge of the roadway, their rugged appearance provides psychological reassurance, while their rustic associations recall America's pioneer roots. Given their widespread presence, visual appeal, and compelling historical associations, rustic safety barriers can be considered character-defining features not just of individual park roads, but of the National Park System in general

While the historical significance and character-defining nature of traditional safety barriers is incontestable, developing appropriate treatment plans is one of the most challenging aspects of park road management. Not only is there considerable pressure to accommodate evolving engineering standards, but many historic walls and rails are showing their age. The normal deterioration of wood and masonry structures is often exacerbated by the harsh climates to which many park road barriers are subjected. Rockfall, avalanches, landslides, and vehicle impacts can cause problems ranging from minor damage to major failure. The need to develop preservation-oriented alternatives to

Figure 28. Historic stone safety barriers have functioned successfully in the low-speed, low-volume context of most park roads; Cadillac Mountain Road, Acadia National Park. (HAER 1995)

Figure 29. Motorists generally adapt their driving to park road conditions, making extensive guardwall construction unnecessary in locations with documented low accident rates such as this Lassen Volcanic National Park highway. (Davis 2001)

potentially incompatible rehabilitation or replacement programs is most pressing when severe physical deterioration is coupled with changing user demands and/or heightened managerial concerns for conforming with conventional engineering standards.

The CLR can be a persuasive vehicle for promoting treatments aimed at retaining or restoring historic guardwalls or guardrails, or, when absolutely necessary rehabilitating them in ways that retain the experiential character and historic integrity of park road landscapes. While visitor safety is clearly paramount, it is not always necessary to comprehensively upgrade historic barriers to conform with standards calculated for non-park roads. Preservation, minor rehabilitation, or replacement in-kind will be sufficient treatment alternatives in many cases. This is particularly true when low or non-existent accident history rates indicate that historic barrier systems have safely accommodated local demands. Not only do historic park roads generally experience lower speeds and traffic volumes than comparable non-park arteries, but park motorists typically adjust their driving behavior to accommodate the tight turns, narrow lanes, and steep side slopes that frequently characterize the park road experience. From a standard highway engineering perspective, these characteristics would normally mandate extensive retrofitting with new or improved safety barriers, but the inherent "traffic calming" nature of the park road experience has been demonstrated over decades of remarkably safe use.

While general AASHTO standards are often cited to support extensive guardwall rehabilitation and new construction on historic park roads, the official NPS *Park Road Standards* bulletin calls for a more conservative and context-sensitive approach. Observing that "Guardrail or guardwalls should be installed at points of unusual danger such as sharp curves or steep embankments, particularly at those points that are unusual compared to the overall characteristics of the road," the 1984 *Park Road Standards* advises that "The criteria used for warranting guardwall installation on high-speed, high-volume highways do not apply to low-speed, low-volume conditions found on most park roads" (NPS 1984, p. 32).

Interpretations of what constitutes unusual danger and acceptable criteria vary considerably from park to park and from profession to profession, which is why safety barrier treatment recommendations should be developed in consultation with park staff, PRP representatives, and FHWA engineers to ensure that all parties agree on a preferred course of action. The targeted construction of improved safety barriers in demonstrated problems areas may be necessary, in which case every effort should be made to harmonize with historic prototypes. Less physically obtrusive alternatives such as lowered speed limits, vehicle-size restrictions, and one-way traffic patterns should also be explored. The final decision on all such matters is the responsibility of the individual park superintendent.

The NPS and FHWA have worked cooperatively to develop a variety of safety barriers that meet contemporary standards while emulating historic design precedents to varying degrees. These treatments have been employed where existing barriers were considered unsafe or where additional safeguards were deemed necessary. In many cases, mutual decisions have been made to preserve, restore or replace historic guardwalls without major alterations so that the historic character and significance of roadway remains uncompromised. The degree to which guardwall additions and alterations will affect the overall historic integrity of a park road will depend on the nature of the revisions and the extent to which safety barriers serve as character-defining features.

Masonry Walls

Masonry guardwalls are among the most common and characteristic features of the national park road system. Some reflect the efforts of the Army Corps of Engineers and other pre-NPS proprietors, but most date from the "Golden Age" of park road-building between the two world wars, embodying the principles of rustic design propounded in contemporary plan books and discussed at length in various publications on NPS design history. Within the general rustic framework, there is considerable variety in size and shape, including flat-topped walls, various crenellated compositions, and large, independently-placed boulders. Rock size, conformation, and joinery vary considerably, generally reflecting local building patterns and native materials. Both dry-laid and mortared masonry were common. In some cases, unadorned concrete was used to harmonize with the surrounding terrain, evoke Southwestern adobe building styles, or produce an intentionally modern appearance.

Masonry guardwalls suffer various forms of physical failure. Individual stones and small segments can be damaged or dislocated by rockfall, vandalism, vehicle impact, and general weathering processes. Entire sections can be lost to landslides, avalanches, flooding, and major crashes. Road relocations, pavement-widening projects, and increased safety concerns can also create a need for wall rehabilitation, construction, or reconstruction.

For guardwalls that are in generally good condition, preservation accompanied by stabilization and routine maintenance is almost always the preferred policy. Where minor to moderate repairs are necessary, limited restoration with compatible materials and workmanship is generally the most desirable treatment. Suitable rock should be acquired through salvage or local quarrying from historic sources, or, if necessary, by matching sources beyond park boundaries. Dry-laid stone should not be repaired with mortared masonry techniques and concrete should never be substituted for mortar. Stone size, orientation, and coloring should match as closely as possible. Ideally, the weathered surfaces of stones should face outward to help harmonize repair work with historic fabric. Various weathering agents can be applied to speed the process if necessary. Tool marks from quarrying or cutting operations should not be visible.

Where the extent of the damage is more severe, or where major rehabilitation or new construction projects are being implemented, developing appropriate treatment strategies can be more challenging. Most of the techniques and concerns associated with headwalls and retaining walls also apply to historic guardwalls. The ideal solution from a preservation standpoint will generally be reconstruction or replication with in-kind materials and techniques, but practical, economic, and regulatory concerns may render alternative measures more compelling. Suitable stone and masonry expertise may not be available, costs associated with traditional materials and hand labor may be excessive, or the desire to accord with contemporary safety standards may mandate more substantial protection measures. In many cases, all these factors will come into play. Whatever the motivation, the adoption of new materials and techniques should be accompanied by a firm commitment to ensuring that these measures harmonize as closely with the existing physical fabric as possible and not impinge on the road's historic character and integrity.

Stone-faced reinforced concrete core guardwalls have been used on a number of park roads and parkways as a means of combining traditional park road aesthetics with modern safety standards. This technique can be effective on both accounts, but care must be taken to ensure that masonry patterns, materials, and broader design considerations are appropriate for the historical character of the roadway. If the new walls are substantially higher, wider, or longer than their predecessors, if their overall extent or placement is significantly altered, if the stonework does not match, or if there is no local precedent for masonry structures, then the mere presence of hand-laid stone veneer does not automatically constitute context-sensitive design and significant degradation of historic integrity and experiential character may occur.

Similar concerns apply to the use of simulated stone guardwalls. Color, texture, “masonry” patterns, massing, and location should emulate local historical precedents. The most challenging harmonization issues occur where concrete simulations directly abut historic stone walls or natural rock formations. When simulated stone walls are employed on a large scale, their uniform massing can call unwanted attention to their artificiality. Vehicle impacts and rockfall can also shatter the illusion of authenticity by exposing the concrete and reinforcing steel beneath naturalistically sculpted facades. While minor repairs to traditional rock walls are often almost invisible, matching the form, tint, and texture of simulated stone walls may prove more difficult,

(A)

(B)

(C)

(D)

Figure 30. Masonry treatment options: A) The preferred treatment for deteriorated stone walls is to repair or replace in-kind with compatible materials and workmanship; this wall has been spot-repaired with historically accurate dry-laid stonework, (Robert Page 1992); B) Mixing drylaid and mortared construction is not ideal, but in this Skyline Drive example, considerable care was taken to match materials and masonry patterns, (Robert Page 1992); C) Stone-faced reinforced concrete core guardwalls can meet contemporary safety standards while maintaining a rustic ambience, (Davis 1994); D) Newly constructed hand-laid stone guard wall and curb at scenic overlook, Yellowstone National Park, (Davis 1996); E) Simulated stone was employed on Yosemite Park’s El Portal

especially as the original material ages. The longevity of the tinting compounds employed to naturalize concrete surfaces may also become a treatment issue over time.

As with retaining walls and culvert headwalls, the artificial nature of simulated stone guardwalls will be less apparent if they are only employed in areas where visitors are unlikely to approach them closely. Some parks have constructed authentic stone walls at scenic pullouts and other parking areas while using simulated stone in intervening areas where motorists are unlikely to leave their cars.

Timber Barriers

Rustic timber barriers are another classic component of park road landscapes. Log guardwalls and guide rails were erected alongside many park roads to protect motorists and evoke cherished cultural traditions. Log and timber rails, sunken posts, and split rail fences were also used to control traffic on side roads and in administrative areas, to define parking areas, campgrounds, and pedestrian paths, and, in a more conceptual sense, to evoke America's agrarian heritage and pioneer spirit.

(E)

(F)

(G)

(H)

Road to replace extensive sections of historic stone walls lost in the 1997 flood; F) Precast simulated stone guardwalls on Baltimore-Washington Parkway were designed to provide a more formal effect, with regular coursing and a distinctive coping motif, (Lou DeLorme 1993); G) Long sections of simulated stone guardwall can appear unnaturally uniform, especially when contrasted to historic stone guardwalls, as in this reconstructed portion of Yosemite National Park El Portal Road, (Davis 2001); H) Rockfall and accidents can expose the artificiality of simulated stone construction, El Portal Road, Yosemite National Park. (Davis 2001)

(A)

(B)

Figure 31. Steel-backed timber guardrails closely resemble historical precedents while meeting contemporary safety standards; (A) Detail showing blockout and steel reinforcement; (B) Steel-backed rounded log rail in use, Yellowstone National Park. (Western Federal Lands Highway Division)

Timber barrier treatments must reconcile the desire to maintain traditional appearances and preserve aging handcrafted structures with need to provide appropriate safeguards for modern motorists. The safety issue will be of greater concern on main roadways than for campgrounds, pullouts, and administrative areas, where timber barriers serve mainly to contain and direct traffic. In these cases, it will generally be more admissible to employ a more strictly preservation-oriented approach. Even when preservation, replacement-in-kind, or context-sensitive rehabilitation are chosen as preferred treatment options, it may be difficult to find compatible materials or replicate the labor-intensive construction processes that produced the vast majority of original guardrails during the CCC-aided construction campaigns of the 1930s.

In many cases, deteriorated wood safety barriers have already been replaced with steel guardrails. Modern steel guardrails are also a common choice in situations where realignments, road-widening, or heightened safety concerns mandate new barrier construction. Steel guardrail is generally not the preferred choice from a preservation standpoint, but if this option is selected, brown paint or a pre-weathered material such as Cortan steel is preferable to conventional galvanized steel. Anchoring the beams with brown-stained wooden posts will provide a more context-sensitive approach than 100% steel construction. The State of New York has adopted a brown-toned steel-box beam guardrail for use on the Taconic State Parkway that more closely resembles wood construction and may be appropriate for some NPS applications.

Steel-backed timber guardrail provides a more context-sensitive solution and has been successfully employed in many parks to replace or augment historic log barriers. Milled timber rails provide a reasonably approximation of traditional NPS log construction and the steel-backing provides sufficient strength to satisfy contemporary safety standards for speeds up to 50 mph. For higher-speed applications, crashworthiness can be improved by adding a wooden spacer between the rail and post. This "blocked-out" configuration reduces the likelihood that vehicles will snag on a support post, producing a smoother, safer barrier. Rounded-front steel-backed timber guardrails have not received as extensive testing, but they also provide a high degree of safety with even greater historical veracity.

Major Structures

The treatment of major structures such as bridges, viaducts, tunnels, entrance stations, and visitor centers will generally be beyond the scope of the CLR. The CLR should consider the impact of alterations to these features, however, and may suggest general design principles to help ensure that proposed changes do not detract from the historic character and integrity of the overall park road landscape.

The CLR should emphasize that park bridges are not simply individual engineered structures but elements of larger landscape compositions. Whether intended to harmonize with their natural surroundings, evoke local vernacular precedents, or contribute to the dignity of commemorative military parks, they were designed to fulfill practical requirements while answering deeply felt aesthetic and symbolic needs. Preserving their original form, function, and fabric should be the first priority.

If changing demands produce pressure to replace or significantly alter a historic structure, managerial solutions such as vehicle-size limitations and alternative traffic patterns should be thoroughly explored. For exceptionally significant bridges, it may even be warranted to construct a companion structure to accommodate modern traffic, preserving the historic span as a low-volume alternative or pedestrian route. If this option is pursued, a key question is whether to build the bypass in close proximity in order to showcase the historic structure and minimize additional road-construction, or locate it at a sufficient distance to fully preserve the setting and character of the original crossing.

Major rehabilitation or replacement projects should normally follow historical precedents as closely as possible. Recent NPS bridge rehabilitations and replacements have evoked historical precedents by employing hand-laid stone facing, simulated stone abutments, and historicist-inspired massing and details. Care must be taken to ensure that such practices truly

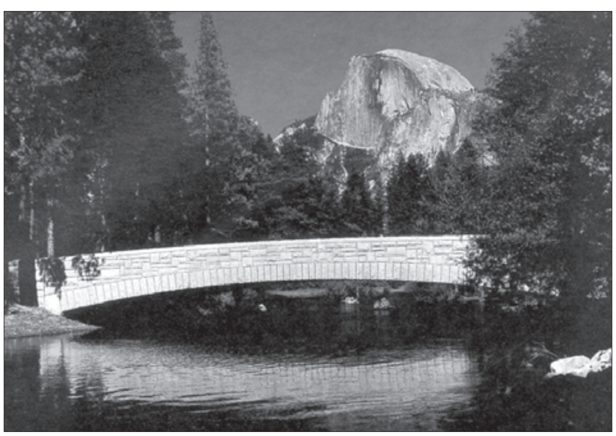


Figure 32. The 1994 reconstruction of Yosemite's Sentinel Bridge used masonry facing and a traditional arch profile to contextualize a modern concrete girder structure. (FHWA 1994)

reflect local precedents and that materials and workmanship harmonize with historical features and the surrounding natural landscape.

Proposals to remove historic bridges or other road-related features in order to manipulate or "restore" associated ecological systems should carefully weigh the impact of such decisions on the historical integrity of the road and the broader cultural values of the affected park.

Minor Structures and Road-related Features

Minor structures such as signs, wayside exhibits, and comfort stations contribute to the overall character and integrity of park road landscapes. The classic routed wood signs – and even their brown metal successors – provide a sense of consistency and historical continuity both within individual parks and throughout the National Park System as a whole. Stone curbing around parking areas and scenic lookouts, "rustic" comfort stations, picnic shelters, water fountains, and interpretive kiosks may seem insignificant in and of themselves, but they help establish the tone and tenor of park road landscapes.

In some cases, minor structures may possess considerable significance in their own right. This is particularly true of entrance signs and waysides from the classic period of park development between the two world wars. The 1930s Obsidian Cliff wayside interpretation kiosk on Yellowstone National Park's Grand Loop Road, for instance, is independently listed in the National Register of Historic Places. Since motorist-oriented wayside interpretation played a major role in Mission 66 planning and design efforts, features from this era should be carefully evaluated and appropriate treatment measures devised.

When developing treatment recommendations for signs and other minor features, it is important to recognize that considerable variety exists within the general NPS rustic framework. Materials, architectural styles, sign fonts, and other design elements vary geographically, thematically, and temporally. Variations may occur not just from park to park, but within portions of a single park road system developed at different times or for different reasons. CLR research should identify the correct historical precedents for specific sites and recommend appropriate treatments. Where variation is notable within an individual site or broader park road landscape, decisions must be made about whether to restore the consistent appearance of a single development period or preserve existing differences to illustrate changing historical practices.

Just as overtly modern intrusions may clash with traditional park road aesthetics, care should be taken not to impose inappropriately "rustic" features on park road landscapes where these elements have no historical precedents. Commemorative military parks and Colonial Revival-themed historical sites are obvious examples of this concern, but the distinctive forms of Mission 66 signage and associated structures should be respected as well. Even newer features, such as elements associated with the 1976 bicentennial celebration or other prominent cultural developments should be evaluated and treated in view of their potential future significance.

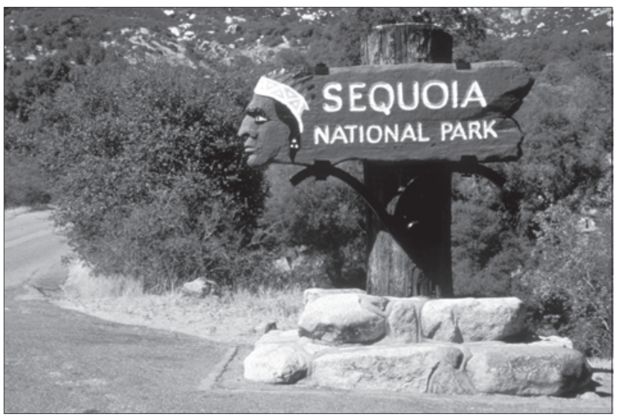


Figure 33. Sequoia National Park's classic rustic entrance sign was constructed by the CCC in 1935 and is listed on the National Register of Historic Places. (Robert Page n.d.)

Figure 34. Yellowstone's 1966 East Entrance Station epitomizes Mission 66's creative mingling of modern and rustic styling but is no longer able to accommodate the largest recreational vehicles, which must be routed around the structure. (Davis 1999)

Roadside Landscaping

Naturalistic roadside landscaping was one of the hallmarks of classic park road design. Great efforts were made to harmonize park roads with their surroundings by camouflaging signs of construction and blending engineered features with adjacent natural and cultural landscapes. Alignments were calculated to minimize topographic disruptions and preserve cultural resources. Where excavations were necessary, side slopes were gently graded and roundly sculpted, mimicking natural contours, promoting plant growth, and affording greater resistance to erosion. Rock cuts were fractured along inherent fault lines and drill marks were minimized to produce a more natural effect. Specimen trees were often preserved in close proximity to the roadway and treelines were generally varied to avoid the artificial appearance of a uniform corridor. Planting programs further enhanced the motorist's experience and concealed signs of construction. Native species in naturalistic groupings were preferred, but exotics such as Japanese honeysuckle were sometimes employed to reduce erosion. Vegetation management activities also included vista clearing to expose attractive views and agricultural leases to promote traditional land uses.

While these roadside landscape qualities may be subtler and harder to evaluate than the engineered structures and architectural features that often dominate historic road analyses and treatment plans, they play equally important roles in establishing the character and significance of park road landscapes. The CLR should provide comprehensive recommendations for ensuring the preservation, rehabilitation, or, if circumstances warrant, restoration, of historically significant roadside landscape characteristics.

Grading

Changes to historic alignments, profiles, and road-widths will often have significant impacts on historic roadside landscapes. Judicious planning, clear specifications, and strict contract supervision are essential to minimize adverse effects on landforms, vegetation, and constructed features. Relocation and rehabilitation projects should follow the same principles that guided historic park road development, carefully coordinating horizontal and vertical curvature to ensure that modern revisions "lay lightly on the land" with minimal disruption of the surrounding terrain. Where substantial grade modifications are unavoidable, rock cuts should be naturalized and road banks sloped and rounded in conformance with traditional park road landscaping practices.

Vegetation Management

Vegetation management should promote the retention of historic plant materials, design schemes, and general landscape characteristics by outlining routine maintenance practices, proposing long term stewardship policies, and providing rehabilitation and restoration plans for areas that have been disturbed by natural disasters or construction-related activities.

Maintenance guidelines should outline the routine procedures required to preserve and stabilize roadside landscapes. These measures may include mowing, pruning, watering, invasive species control, and, in some cases, arrangements such as agricultural leases that rely on other parties to help maintain historic landscape qualities. Some parks have developed comprehensive maintenance regimes tied to detailed site plans. In some cases, such as the Blue Ridge Parkway, these maintenance plans date back to the original design and development period. In other cases, roadside landscape maintenance procedures are passed down by oral tradition and observation. Long-term maintenance personnel can be invaluable sources of assistance for identifying and formalizing historical landscape management practices. Historic photographs, plans, and written descriptions can also be used to identify desirable landscape qualities and develop appropriate maintenance procedures.

Figure 35. Native plant nursery for propagation of revegetation materials, Glacier National Park. (Davis 1996)

The adoption of new maintenance practices motivated by changing management priorities should be carefully reviewed for their impact on traditional landscape values. Allowing grassy areas to grow unchecked for extended periods may be economically and ecologically appealing, for instance, but the results may conflict with original design intentions and distort historically significant landscape qualities.

Revegetation

Where construction activities or natural processes produce a need for revegetation, CLR treatment recommendations should establish appropriate goals and procedures. While current NPS policies strongly favor indigenous species, historical precedents may mandate alternative approaches. Archival research and existing condition documentation of comparable landscapes will help determine what approaches, species, varieties, and configurations are most appropriate. In some instances, it may be possible and desirable to substitute more sustainable and indigenous plant materials if similar effects can be attained.

Since revegetation projects often involve both natural and cultural resources personnel, it is important to avoid misunderstandings about terminology and policy goals. For cultural resource management purposes, "restoration" means reestablishing the type of vegetation that existed during a specific historic period in order to convey past design practices and cultural values. For

Figure 36. Roadside revegetation with native plants, Glacier National Park. (Davis 1996)

natural resource specialists, "restoration," has more ecological connotations, and aims to establish environmentally appropriate plant associations that will become sustainable components of surrounding ecosystems. Natural resource personnel employ the term "reclamation" for more utilitarian revegetation practices designed to provide stable cover for disturbed areas such as roadsides. In reclamation-oriented revegetation, hardiness and visual appearances take precedence over indigenous ecological values. Since similar philosophies governed most historic roadside landscaping programs, natural and cultural resource personnel may find common ground with this approach.

Some parks have developed extremely sophisticated roadside revegetation practices in which seeds are collected from the immediate vicinity of projected disturbances and then propagated to reestablish native plant communities after the roadwork had been completed. Glacier National Park has been a leader in this movement, with strong support from the NPS Denver Service Center.

Clear Zones

In addition to combating the loss of historic vegetation caused by changes in pavement width and alignment, a common concern for many historic park road managers is the pressure to expand the clear zone on either side of the travelway. Widening the clear zone improves sight distances and affords additional room for motorists to avoid accidents, but increasing the distance

Figure 37. Traditional park road landscapes with vegetation extending close to the edge of the pavement create a unique travel experience where motorists are intimately surrounded by nature, Hawaii Volcanoes National Park. (Davis 1999)

Figure 38. Cutting a broad clear zone can improve safety by providing motorists more room to recover from potential accidents, but this approach markedly alters the motorist's perspective and produces greater separation between visitors and their surroundings, rehabilitation of East Entrance Road, Yellowstone National Park. (Davis 1996)

between the traveler and the treeline significantly alters the historic driving experience by eliminating the sense of intimacy and enclosure that serves as a distinguishing characteristic of many historic park roads. Extending sight distances and expanding recovery areas can also encourage motorists to drive faster, further compromising historical feelings and associations and negating gains in public safety.

Historic park road treatment recommendations should generally seek to preserve the original relationship between the roadway and treeline. Where treelines must be reconfigured, they should be arrayed in irregular patterns to avoid an artificially uniform appearance, unless local vegetation patterns or historical precedents suggest alternative approaches. Herbacious plants and shrubs can further naturalize the transition between the road corridor and its surroundings.

Planned Vistas

Most park tour roads were designed to provide pleasing successions of subtly orchestrated views. Variations in alignment focused attention on scenic highlights, roadside vegetation was often cleared to open up extended vistas, and minor pullouts or elaborate wayside developments were constructed so that motorists could pause to enjoy the most spectacular scenic compositions.

Many of these planned vistas have been lost over time because of unintended plant growth. Expansive panoramas and carefully calculated views have been obscured by impenetrable curtains of greenery. Unconstrained growth has engulfed many roadside areas that were intentionally cleared to provide scenic variety, contrasts of openness and enclosure, or subtle glimpses into surrounding woodlands. In some cases, scenic pullouts replete with interpretive signage have been completely cut off from their intended views.

Whether caused by constraints on maintenance, lapses in institutional knowledge about design intent, or ecologically motivated decisions to "let nature take its course," the loss of planned views significantly compromises the historic integrity and experiential character of designed park roads.

The CLR should identify planned views that have been obscured by plant growth and recommend procedures to restore intended landscape effects. Potential conflicts with natural resource agendas may have to be addressed at the park management level. In some cases, the problem vegetation is comprised of non-native species, in which case removal will accord with both natural and cultural resource agendas. When native vegetation is the primary culprit, historic plans, photographs, and design directives can be mustered to help make the case for restoring scenic vistas.

Vista management may also include the selective planting of historically appropriate new vegetation.

(A)

(B)

Figure 39. Vegetation management is required to maintain views from historic designed vistas, both along roadsides (A) and at designated overlooks (B), Blue Ridge Parkway. (Davis 2001)

Figure 40. Development on adjacent lands can significantly affect planned vistas; if scenic easements cannot be enacted, new plantings such as those visible on the far side of this highlighted railroad corridor can screen objectionable views. (Davis 2001)

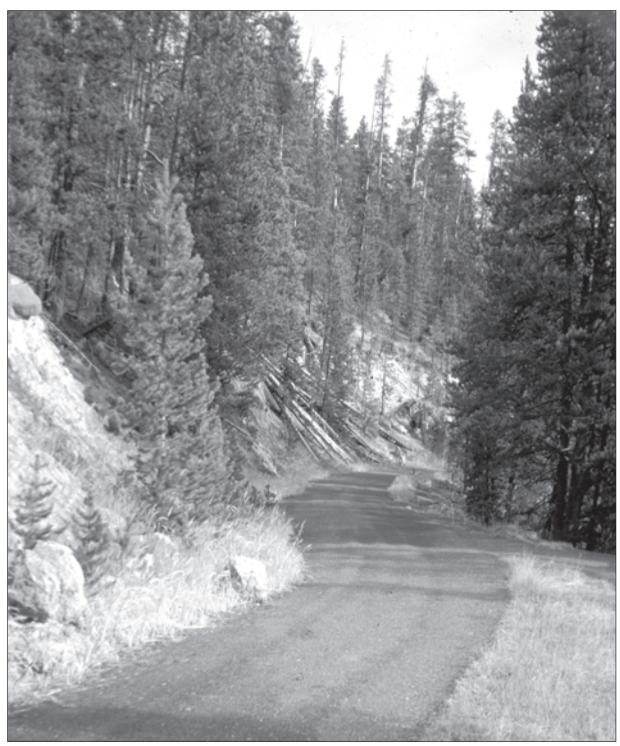
(A)

Figure 41. Regulatory measures can help to preserve historic road resources by creating an appropriate balance between resource capabilities and designated use: (A) Vehicle size limits enabled Glacier National Park to take a more preservation-oriented approach to managing the Going-to-the-Sun Road, (Davis 1996); (B & C) Yellowstone National Park preserved the historic "Silver Gate" geological feature by constructing a bypass for larger vehicles and limiting traffic to one direction, (Davis 1996); (D) Part of Yellowstone National Park's historic Mount Washburn road is preserved as a low-speed unpaved access road; the upper section is restricted to pedestrian use, (Davis 1996); (E) This segment of Yellowstone National Park's Grand Loop Road has been bypassed and converted for pedestrian use. (Davis 1999)

(B)

(C)

(D)



(E)

When adjacent land uses have evolved to produce scenes that are incompatible with park values, new plantings may be desirable to screen visitors from objectionable views.

Management Solutions

When modern demands conflict with historic park road values, managerial solutions often provide preferred alternatives to irreversible physical interventions. Speed limits, vehicle-size restrictions, and one-way traffic patterns can reduce pressures to widen and straighten historic roads or replace historic safety barriers with modern designs and materials. One-way traffic patterns and alternative transportation technologies such as shuttle buses can decrease crowding while increasing the effective carrying capacities of park roads and related facilities. Bypasses can be constructed to accommodate contemporary demands while preserving exceptionally important road segments or individual features. In some cases, it may even be desirable to close historic park roads to vehicular traffic and transform them into pedestrian paths or multi-use trails.

The desire to embrace creative approaches should not preclude careful evaluation of the potential effects of alternative solutions on historic park road resources. Some alternative transportation technologies may require wider, straighter, and more substantial roadbeds

(A)

(B)

(C)

(D)

Figure 42. Alternative transportation systems can reduce pressure to alter historic road resources by helping to accommodate increased demands: (A) Conventional shuttle, Tuolumne Meadows, Yosemite National Park, (Davis 2001); (B) Propane-powered people mover, Yosemite Valley, (Davis 2001); (C) Proposed light rail vehicle for Grand Canyon National Park, (Grand Canyon National Park 1997); (D) Modern tour bus designed to resemble classic 1930s park transportation. (Glacier National Park 2004)

than conventional vehicles, for instance, and bypass construction may have significant impacts on natural and cultural resources. The NPS is currently working with private partners to develop appropriately scaled shuttle buses based on historical prototypes and experimenting with various other technologies to lessen the impact of ever-increasing demands on historic park road resources.

Education and Interpretation

Education and interpretation can play important roles in creating supportive environments for park road preservation. Park personnel, FHWA staff, and the general public are more likely to support park road preservation efforts when they are given sufficient information to understand the significance of historic park roads and encouraged to appreciate their distinctive characteristics.

The research and evaluation components of the CLR can form the basis of internal briefings designed to educate park staff and cooperating professionals about historic park road preservation issues. Archival materials, historic film footage, vintage tourist literature underscoring the popular appeal of traditional park roads, and contemporary secondary sources and interpretive graphics such as the drawings produced by the Historic American Engineering Record's NPS Park Roads and Bridges documentation project can be used to make a strong case for the cultural significance and responsible stewardship of historic park roads.

Similar material can be used to develop public programs, interpretive kiosks, and educational literature about park road history and related preservation concerns. While a few parks have begun to interpret their historic park road resources, most visitors never learn about the design concepts, administrative achievements, and construction feats that produced these magnificent American landscapes.

When visitors and resource professionals learn to appreciate park road history and understand the challenges posed by park road preservation, they are more likely to support measures designed to balance contemporary desires with long term stewardship values.

Conclusion

Historic park road stewardship is one of the most pressing challenges facing the National Park Service today. The impressive mileage of historic park roads that extends throughout the National Park System is one of America's most beloved landscape legacies, yet these increasingly fragile resources must accommodate ever-evolving demands that were in many cases unimagined by the system's original creators. Developing appropriate solutions that reconcile contemporary circulation concerns with historical values is a complex process involving many agencies, individuals, and areas of technical expertise. The CLR can play a vital role in the development of sound stewardship practices by providing crucial historical information, conducting detailed surveys of existing conditions, and proposing comprehensive strategies for evaluating, treating, and interpreting these cherished American landscapes.

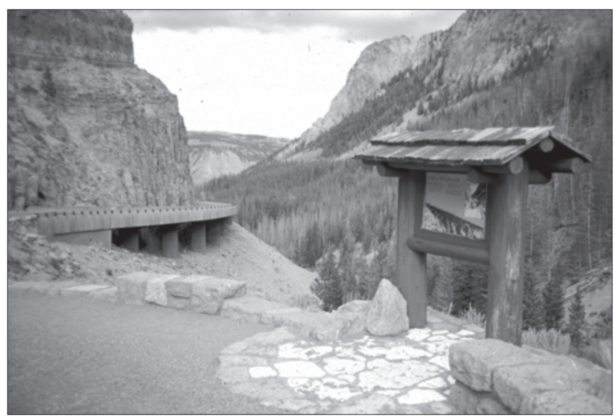


Figure 43. Educating the public about park road history can build support for stewardship measures: wayside exhibit providing history of Golden Gate Viaduct, Yellowstone National Park. (Davis 1996)

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U.S. Department of the Interior
National Park Service
Cultural Resources

Park Historic Structures & Cultural Landscapes

Cultural Landscapes & NPS Facility Management

Prepared by John Auwaerter, SUNY College of Environmental Science and Forestry Partner, National Park Service Olmsted Center for Landscape Preservation

Introduction

For its second century, the National Park Service is renewing its call to achieve a standard of excellence in cultural resource stewardship that serves as a model throughout the world.[1] The preservation planning methods contained in Cultural Landscape Reports, Cultural Landscapes Inventories, and Preservation Maintenance Plans continue to define best practices for preserving and enhancing the nation's landscape legacy. Successful implementation of these plans, including long-term sustainability, requires close coordination between planners and maintenance staff to address the many preservation challenges facing historic landscapes, from funding and staffing to natural dynamics of growth and decline (fig. 1). Until recently, however, there was no systematic means within the park service for translating preservation plans into the actual work of facilities management. Differing objectives

Figure1. Assessing the condition of a historic apple tree that is part of the maintained landscape at Sagamore Hill National Historic Site, 2010. (NPS Olmsted Center)

and data structures between cultural landscape preservation and facility management has long made it difficult to bridge the two programs.

Today, the Facility Management Software System (FMSS), developed to improve the effectiveness of facility operations, has the capability of serving as a powerful tool for landscape preservation. With proper data input, FMSS allows facility managers access to information about the historic significance and treatment of cultural landscapes, and to use that information for determining operational and funding priorities. The integration of cultural landscape data into FMSS is enhancing stewardship of the vast array of historically significant landscapes in the national park system, from gardens, farms, and country estates, to parkways, trails, and campgrounds.

While park facility managers have the primary responsibility for managing FMSS, Park Cultural Landscapes Program staff can play an important role in helping parks successfully integrate cultural landscape data into the system. *Landscape Lines 17: Cultural Landscapes and Facility Management,* has been developed to advance this role by fostering understanding of the relationship between facility management and cultural landscapes preservation. This brief provides cultural landscape professionals with an introduction to facility management concepts and terms (section 1); addresses how existing cultural landscapes data from Cultural Landscapes Reports (CLR), Cultural Landscapes Inventories (CLI), and Preservation Maintenance Plans (PMP) can be integrated into FMSS (section 2); and offers guidance on adapting CLRs to better address the data needs of FMSS (section 3). Preliminary recommendations are also provided for CLIs and PMPs (sections 4 and 5). Improved alignment between facility management and cultural landscapes preservation will enable parks to fund and implement the critically important facility work necessary to preserve and enhance their landscape heritage.

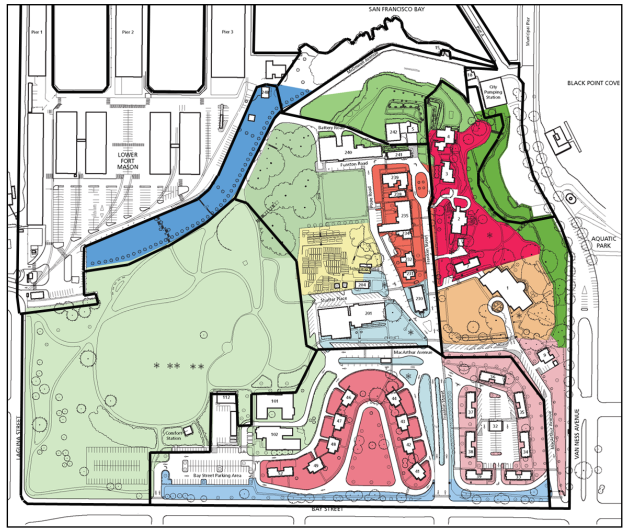

Figure 2. The cultural landscape of Fort Mason at Golden Gate National Recreation Area showing differing organization: bold black lines by the Cultural Landscapes Program, and colored areas by Facility Management. (NPS Olmsted Center)

1. Overview of Facility Management in the National Park Service

Facility Management and the Park Cultural Landscapes Program share the same National Park Service mission to conserve resources unimpaired for future generations. Yet the two programs have distinct ways of achieving stewardship. For example, Facility Management uses different terms to identify resources and activities, and the two programs organize landscapes differently to achieve their respective goals (fig. 2). While the Park Cultural Landscapes Program addresses all aspects that comprise a cultural landscape, the focus of Facility Management is on those that require ongoing maintenance.

A facility is property the NPS maintains to preserve value and function over set life cycles. A facility in turn is composed of assets such as buildings and structures, utility systems, signage, and landscapes (fig. 3). Facility Management encompasses work needed to operate, maintain, rehabilitate, and enhance park facilities. Certain capital improvements, such as construction of a new building or parking lot,

Figure 3. Tree care underway at Fort Yellowstone National Historic Landmark District, Yellowstone National Park, 2008. Facilities Management is responsible for upkeep of the historic architecture and cultural landscape assets. (NPS Olmsted Center)

may also be included. The NPS relies on standards of the facilities management industry to assess condition, determine maintenance requirements, and estimate costs. These standards, however, generally do not include historic preservation as a knowledge base. Therefore, the NPS has adapted the FMSS system to incorporate additional cultural resource data to meet federal preservation laws and the mission of the National Park Service.[2] A CLR and CLI serve as sources for such data on cultural landscapes, along with the List of Classified Structures (LCS), Historic American Landscape Survey (HALS), and other databases. When facilities are historic, the management goal is preservation - or in facilities language, extension of life cycles in perpetuity. For example, facilities industry standards typically call for replacement of an asset that is beyond its expected life and where repair costs exceed replacement costs. A historic asset, however, is repaired to preserve it through continuous life cycles (fig. 4).

Over the past several decades, the formal connection between the Park Cultural Landscapes Program and Facility Management has been the Preservation Maintenance Plan, which guides cyclical and long-term maintenance work needed to retain contributing features and sustain the historic character of a cultural landscape. Preservation Maintenance Plans, along with similar reports including Landscape Stabilization Plans and resource-specific management plans such as Historic Orchard Management Plans, are used to implement and sustain the treatment recommendations in a CLR or the stabilization measures in a CLI. With just under forty Preservation Maintenance Plans and related reports completed to date, however, few parks have such guidance for their cultural landscapes.

Since its widespread application began over the past decade, FMSS has provided parks with the capability of integrating cultural landscape data into facility operations at a level not previously possible through printed reports. The origins of FMSS extend back to 1986, when the NPS Maintenance Management System was adopted to improve the accountability of facility management in the national park system. This has evolved into today's Asset Management Process, which serves as the foundation of park Facility Management. Using the NPS mission of stewardship at its

Figure 4. Repair of stone steps on a historic but heavily deteriorated trail at Hopewell Furnace National Historic Site, 2009. This illustrates facility work designed to preserve historic assets. (NPS Olmsted Center)

core, the process involves four basic steps: Asset Inventory, Work Identification and Planning, Work Performance, and Evaluation (fig. 5). FMSS is the tool, built on IBM Maximo® as a standard software platform, that the NPS uses to implement the Asset Management Process (Appendix 2: FMSS sample screens). All NPS units are responsible for using FMSS to manage facilities data, information, work management, and reporting.[3] However, beyond baseline requirements, the organization of data and level of detail at which FMSS is implemented varies by park.

To achieve the agency's mission of stewardship for historic assets, the Asset Management Process accommodates cultural landscape data in the first two of four phases: *Asset Inventory* and *Work Identification & Planning*. FMSS allows park staff to plan and track preservation maintenance needs by including cultural landscape data in the asset inventory; by incorporating condition assessments that consider preservation goals and objectives; and by developing work orders that can address stabilization, maintenance, protection, repair, and reestablishment of historic landscape features. FMSS includes a work order application that can detail preservation techniques, schedules, materials,

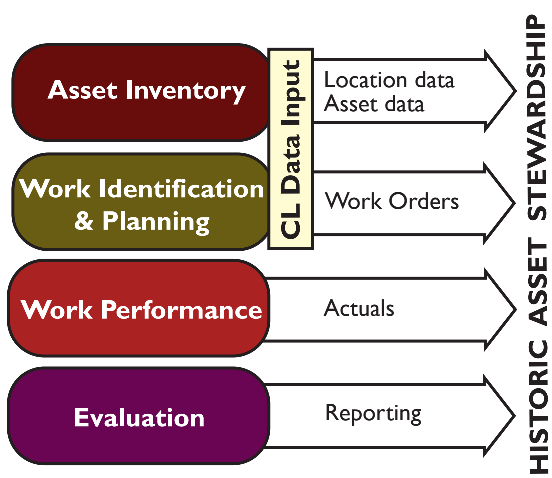

Figure 5. The four stages of the Asset Management Process showing input of cultural landscape data that is necessary to achieve the goal of historic asset stewardship. (SUNY ESF, based on Eppley, FMSS Student Manual, 2011)

replacement strategies, labor, and cost estimating to help parks plan for and obtain funding. The program is integrated with the NPS Project Management Information System (PMIS) via an interface called the Project Scoping Tool (PST), part of the Project Bridge.

Asset Inventory

Cultural landscapes are inventoried according to the hierarchy of Landscape-Characteristic-Feature, while FMSS uses Site-Location-Asset. There is no one-to-one correlation between the two hierarchies.

Site in FMSS is a management area comprised of one or more Location records, often of different Asset Types.[4] Small parks may include their entire property as one Site record, while larger parks may use multiple Site records to differentiate areas.

A Location record is comprised of maintained property, also known as a "facility," that the NPS wishes to track as a distinct entity. Locations are defined by Asset Types, which are categorized by name and numerical code, such as 1100 Roads, 2100 Trails, 3100 Maintained Landscapes, 4100 Buildings, 5400 Electrical Systems, and 7100 Monuments (list of Asset Types in Appendix 3).

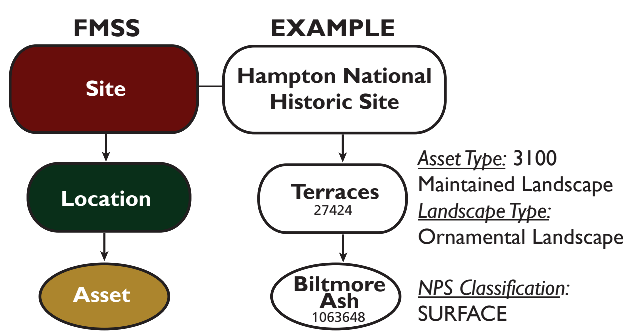

Figure 6. Example of an FMSS asset hierarchy for a 3100 Maintained Landscape Location at Hampton National Historic Site. The inventory numbers for the Terraces Location and Biltmore Ash Asset are assigned through FMSS. (SUNY ESF)

Figure 7. The Terraces at Hampton National Historic Site, an example of a 3100 Maintained Landscapes Location record, photographed 2010. Component Asset records of this Location include the turf, specimen trees, and marble urns. The mansion is a separate 4100 Buildings Location record. (SUNY ESF)

The Asset Type most closely aligned with cultural landscapes is 3100 Maintained Landscapes. At Hampton National Historic Site, the "Terraces" is a 3100 Maintained Landscapes Location record that encompasses the estate's formal landscape, and the Mansion at its core is a separate 4100 Building Location record (figs. 6, 7). As evident in this example, a cultural landscape may have assets that are categorized under several different Asset Types in the same geographic area. In addition, there is no one-to-one correlation between the boundaries of a 3100 Maintained Landscapes Location record and the boundaries of a cultural landscape. For example, the single cultural landscape documented in the CLR for the Mansion Grounds at Marsh-Billings-Rockefeller National Historical Park contains six 3100 Maintained Landscapes Location records (fig. 8).

Asset Types are subdivided into set categories known as Facility Type. Under 4100 Buildings, for example, "Warehouse" is a Facility Type. For 3100 Maintained Landscapes, there is just one Facility Type (Maintained Landscape), but each record can also be categorized as one of twenty-two different attributes known as Landscape Type. Examples include Agricultural Landscape, Ornamental Landscape, Burial Landscape, Picnic Area, and Trail Corridor. The Hampton "Terraces," for example, are the Landscape Type "Ornamental Landscape." There is no direct correlation between FMSS Landscape Types and landscape characteristics (e.g., Spatial Organization, Circulation, Vegetation), which are the broad components and processes of a cultural landscape.

Location records are composed of Asset records, which roughly parallel cultural landscape "features." Asset records in the Hampton "Terraces" Location record include the Biltmore Ash along with the Terrace Lawn, Terrace Specimen Trees, and Small Marble Miscellany (marble urns visible in fig. 7). Assets may be organized according to a parent-child hierarchy within each Location record. This tool is sometimes used to track a particular asset at a higher level, such as a high-maintenance flower garden that needs to remain associated with the surrounding landscape, rather than being defined as its own separate Location record.

Each Asset record, regardless of Asset Type, is classified according to the NPS Asset Classification

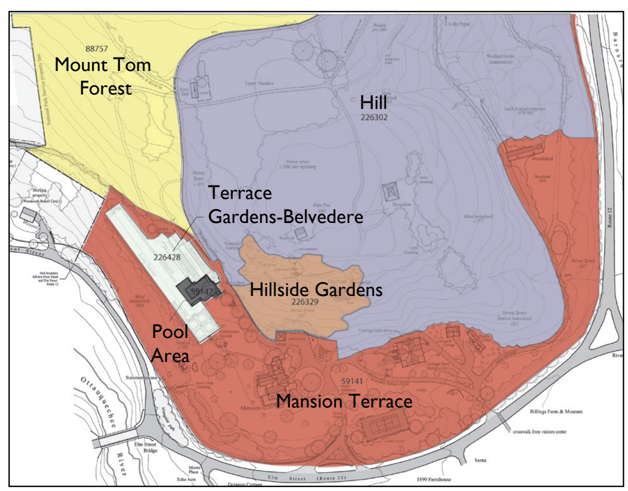

Figure 8. A CLR existing conditions plan of the Mansion Grounds cultural landscape at Marsh-Billings-Rockefeller National Historical Park showing its division into six FMSS 3100 Maintained Landscape Location records. (SUNY ESF and NPS Olmsted Center.)

Hierarchy. These are categories based on function and link to specifications. Parent asset classifications often found in cultural landscapes include Archeological, Barriers & Fencing, Electrical, Exhibit, Furnishing, Signage & Marking, Structure, Surface, and Water Control (see Appendix 4). These in turn are broken down into Sub-Parent Classifications, such as Railing under Barrier & Fencing. In the Hampton "Terraces," for example, the lawn is classified as Surface/Turfgrass-Pasture Crop.

An FMSS Asset record may correspond to a single cultural landscape feature, or it may group or split features depending on other facility needs, such as funding and operations. Within the Hill, a CLR landscape character area at Marsh-Billings-Rockefeller, six Circulation features were grouped into four Asset records within the FMSS Hill Location record (fig. 9). The CLR Circulation features were grouped using a combination of geographic and asset classification factors. The Hill character area also includes many other Location

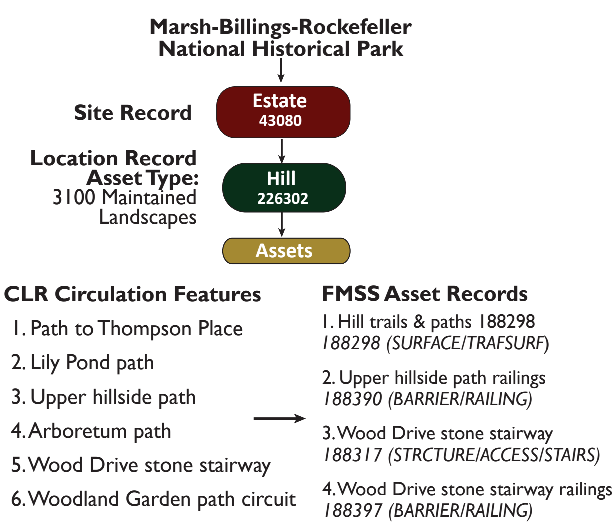

Figure 9. Example of conversion of six CLR Circulation features within the Hill at Marsh-Billings-Rockefeller into FMSS 3100 Maintained Landscape Asset records. The text in italics indicates FMSS record numbers and NPS Asset Classification categories for each Asset. The Wood Drive documented in the CLR is a road and was captured under the 1100 Road Location record. The park decided not to capture these trails and paths as 2100 Trails. (SUNY ESF)

records, including 1100 Roads, 2100 Trails, and 4100 Buildings, each of which have their own associated Asset records.

There are also differences in methods of evaluation. NPS cultural landscape methods are based on historical significance and integrity using the National Register of Historic Places Criteria, while FMSS evaluates facilities according to physical condition and the park's mission. These values are accommodated in FMSS according to the following four values assigned to Location records:

1. Asset Priority Index (API) is a value (1-100) assigned to a Location record that ranks assets in relation to a park's mission and management objectives as a measurement for allocating funding to a park's highest priority assets. The API is scored according to four criteria: resource preservation (natural and cultural), visitor use, park operations, and substitutability (uniqueness of the asset). Each criterion is then given one of four values—none, low, medium, or high—based on criteria listed in the API Scoring Guide (see definitions in Appendix 5). For example, a historically significant landscape may score high in the resource preservation category, but if it scores low in visitor use, park operations, and substitutability, it may receive a low API. This may be the case with a road that is part of historic designed landscape, but is not used by visitors or for park operations, and is paralleled by another active road.

2. Current Replacement Value (CRV) is an approximate industry standard cost estimate for current replacement of the entire location (minus real estate value), based on numbers updated annually by RS Means. For example, a park may have a CRV of $350,000 for a formal garden that comprises one Location record, which would be the cost for reconstruction if the garden and its assets were destroyed. Assignment of the CRV does not mean the garden will be replaced, but rather serves as a tool for parks to determine management costs. The CRV is determined using a calculator that figures the cost based on the Asset Type and Facility Type, or Landscape Types for 3100 Maintained Landscapes (Appendix 6: sample calculator screenshot). The calculator allows a user to add in additional costs associated with replacing historic or expensive features.

3. Optimizer Band (OB) is a number, 1-5, assigned to each Location record and is based on the priority of the Locations each band contains, and their importance to the park's mission. Banding suggests a certain level of base funding that should be allocated to assets in each band. Band 1 contains the highest priority Locations which are critical to the operations and purpose of the park or have high visitor use, therefore requiring the highest base funding.

4. Facility Condition Index (FCI) is a numerical measure of physical condition of a Location to help prioritize work and funding allocations, reflecting a ratio of the cost of work to remedy Deferred Maintenance and the Current Replacement Value (i.e., DM/CRV = FCI). If a park's formal garden with a CRV of $350,000 has deferred maintenance totaling $53,000 (work need to bring it up to good condition), it would receive an FCI of 0.15 (fair condition). An FCI less than 0.1 represents a location in good condition, while an FCI greater than 0.5 reflects a location in poor condition.

In addition to informing work planning, the FCI can influence how a park establishes its FMSS Asset inventory. At Acadia National Park, for example, the views along the historic motor roads were defined as a separate 3100 Maintained Landscapes Location record. If the views were part of the 1100 Roads Location record, the high CRV for the motor roads would result in a very low FCI for the Location, meaning the FCI would not be in a fundable range for project funds to support recurring maintenance on the views. This is due to the relatively small cost to maintain the views compared with the high cost to maintain the roads and their associated built components. A separate Location record also allows the views to compete more successfully against other facilities for project funding.

Work Identification and Planning

Once assets are inventoried and data is entered into FMSS, facility managers can generate work orders to preserve and enhance the character of a cultural landscape by correcting deferred maintenance and carrying out recurring maintenance. Work orders include job plans, time tracking, costs, and work completion data fields, along with a list of materials, tools, and labor needed to complete the work. Work is identified by cyclical condition assessments, CLI condition assessment and stabilization measures, and CLR treatment plans. Work orders are used to generate PMIS (NPS Project Management Information System) statements, when project funding is being sought.

Determining what work to do and what level of planning is needed should be based on the Asset Priority Index (API) and Facility Condition Index (FCI). These values create guidelines for the type of facility work a Location should receive (fig. 10).

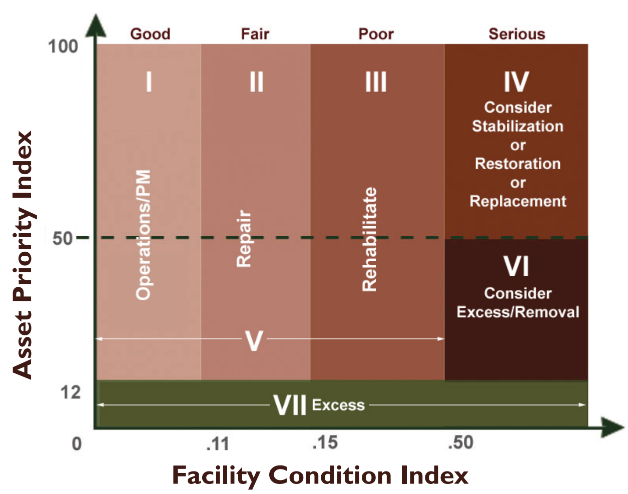

Figure 10. Chart showing use of the Asset Priority Index (API) and Facility Condition Index (FCI) to inform work planning priority related to a Location record. "PM" in the first column stands for Preventative Maintenance. (NPS, Asset Management Reporting System)

For example, a Location with a low FCI of .05 (good condition) and high API of 80 (high value) should be retained and receive maintenance to keep it in good condition. In contrast, a Location with a FCI of .50 and an API of 45 may be in such poor condition and of minimal resource value to the park that it could be considered for removal. Work Orders are also prioritized according to Risk Assessment Codes (RAC) for Health, Life, and Safety, which are values used to determine how quickly deficiencies should be remedied. Parks of course consider many other factors in work planning in addition to these values, such as funding, staffing, and public needs.

There are three broad categories of work as defined in FMSS: Facility Maintenance, Facility Operations, and Capital Improvement, each with a number of sub work types (Appendix 7: list of work sub types). Most cultural landscape treatment, preservation maintenance, and stabilization measures correspond to the Facility Maintenance sub-work types of Preventative Maintenance (PM), Recurring Maintenance (RM), Deferred Maintenance (DM), and Component Renewal (CR).[5] Preventative Maintenance is regularly scheduled maintenance within a year that typically includes inspections and minor adjustments such as draining an irrigation system, cleaning furnishings, and shearing hedges (fig 11). Recurring Maintenance includes activities between 1 and 10 years such as painting, sign replacement, and cyclic pruning (fig. 12).

Deferred Maintenance is defined as deficiencies or problems that are overdue for repair, such as rebuilding a slumping road, replanting a missing historic tree, or clearing woods to reestablish a historic field (fig. 13). Component Renewal, meaning the planned replacement of a component that has reached the end of its serviceable life, is often used for building assets such as roofs, but can also be applied to landscape features such as a gravel walk surface. Capital Improvement generally relates to construction of new features, such as the addition of a new visitor center, rest room facility, or parking area, rather than reconstruction of historic features.

Parks identify needed work in part through condition assessments, which are inspections used to generate work orders that inform work plans within FMSS. Condition assessments may be

Figure 11. Boxwood hedges at Adams National Historical Park that are due for shearing, 2012. This planned work is an example of Preventative Maintenance (PM) because it is performed more than once a year to preserve the geometric form of the hedges. (NPS Olmsted Center)

Figure 12. Cyclical pruning of a historic oak tree at Lyndon B. Johnson National Historical Park, 2007. This work is an example of Recurring Maintenance (RM), because it is work undertaken every few years to retain and perpetuate the historic form of the tree. The tree is also pruned for its health and the safety of visitors. (NPS Olmsted Center)

made by park staff, resource experts, and facilities maintenance contractors. The most basic level of inspection is Routine Assessments (RA), which are made on a daily, weekly, or monthly basis to identify minor deficiencies such as downed limbs or irrigation leaks, leaning fence posts, and pest damage. RAs support recurring maintenance such as pruning, mulching, and aerating, and also set short-term work plans and more in-depth assessments for long-term work planning.

The NPS uses two types of in-depth assessments for use in FMSS work planning:

Condition Assessments – Annual (CAA): Inspections made on a 1-year cycle to identify minor and major deficiencies such a broken fence or loss of a tree, and to inform work planning through creation of work orders for correcting deficiencies.

Condition Assessments – Comprehensive (CAC): Inspections made on a 5-year cycle to identify the same issues as the CAA, but at a more detailed level. In addition, CACs are used to validate FMSS asset inventories, update condition and life cycle replacement information, and provide a basis for long-range work plans and budget allocations.

CAAs and CACs are based on inspection guidance organized according to both Asset Type and NPS asset classification. For example, the inspection checklist for a specimen tree (Maintained Landscapes, classification "Surface/Plant") includes "soil compaction," "branch/limb problems," or "dead/missing." Certain checklists, which are based on industry standards of maintenance, may not take the special needs of historic landscapes in to account. For example, a historic bluestone sidewalk may be identified as deficient because the stone is cracked or because it is too narrow for accessibility standards. In contrast, a condition assessment could, based on recommendations in a CLR or input from park staff, identify an asset in good physical condition as having deficiencies due to loss of historic character (fig. 14). Business Practices developed for the Asset Types, including 3100 Maintained Landscapes, address how conditions assessments should take historic preservation into account.

Figure 13. Clearing of successional woods on a historic field at Sagamore Hill National Historic Site, 2011. This work is an example of Deferred Maintenance (DM) because it is addressing maintenance (mowing) that had ceased decades earlier, leading to growth of the woods. In cultural landscape terminology, this work is restoration. (NPS Olmsted Center)

Figure 14. The horseshoe hedge at the entrance to Saint-Gaudens National Historic Site, 1996. This overgrown hedge is an example of an asset in good condition, but which has a deficiency due to lack of historic character. The hedge, historically 3 to 4 feet tall and wide, was subsequently replaced to reinstate its historic dimensions. (NPS Olmsted Center)

2. Guidance on Integrating Cultural Landscape Data into FMSS

Despite shared outcomes, most cultural landscape documents do not readily correlate to FMSS due to differing methods and terminology. In order to facilitate preservation work, cultural landscape data needs to be readily transferable to the FMSS maintenance database. Park Cultural Landscapes Program staff can assist with transferring this data in a number of ways (Sidebar 1: summary of potential assistance)

Cultural Landscape Data for FMSS Asset Inventories

CLRs, CLIs, and Preservation Maintenance Plans can help populate a list of Assets in FMSS and provide information on determining the API and CRV (Sidebars 2, 3: cultural landscape data for an FMSS asset inventory). These reports may also inform the delineation of Location record boundaries. There is generally no one-to-one correlation between the two data sets because Location records and Asset records are defined by existing Asset Type definitions. However, CLRs, CLIs and Preservation Maintenance Plans provide information for completing Location and Asset records, as well as establishing preventive and recurring maintenance plans.

Definition of cultural landscape-related Location and Asset records should be undertaken as a team approach among facility managers, resource managers, and Park Cultural Landscapes Program staff. Cultural landscape input should occur early in the process, because it is difficult for facility managers to change an asset inventory, particularly with regard to Location boundaries, once the hierarchy has been established.

Parks with limited FMSS information may use cultural landscape data as a baseline for developing a list of Asset records. However, cultural landscape documents will only provide data for assets that

Sidebar 1: Summary of Potential Assistance by Park Cultural Landscapes Program

Asset Inventories

Data for Location Records

- Advise on identification of Asset Types in a cultural landscape
- Provide data to inform the delineation of Location boundaries
- Provide data to identify Location records as historic
- Participate with park management to assess the API Cultural Resource Value
- Describe historic character of Locations (Long Description)
- Identify Landscape Type for 3100 Location records
- Provide existing condition plans to graphically document boundaries of Location records

Data for Asset Records

- Provide the cultural landscape feature inventory to inform an inventory of Asset records
- Describe historic character of Assets (Long Description)
- Identify historic Assets lost to Deferred Maintenance

Work Planning

Condition Assessments

- Provide information on landscape condition and integrity issues
- Participate in field work for Comprehensive Condition Assessments

Work Orders

- Provide CLR treatment guidelines and tasks, and CLI Stabilization Measures to inform creation of work orders
- Identify preservation maintenance work as FMSS work types

Sidebar 2: Cultural Landscape Data for an FMSS Asset Inventory: Location Records

CL Data Source		CL Data for Location Records	Guidance
CLR	Existing Conditions	CLR existing conditions plan	The existing conditions plan may provide parks with a basemap to graphically document all Location record boundaries associated with the cultural landscape.
		Existing conditions narrative	Existing conditions narrative in a CLR will help parks assign the FMSS Landscape Types (such as 3100 Maintained Landscapes). Parks may need this information to complete data fields in FMSS and calculate the Current Replacement Value.
		Existing conditions documentation on dimensions, materials, and other data	Parks may need this information to complete Location record data fields in FMSS.
	Analysis and Evaluation	National Register documentation	National Register documentation will allow parks to identify Locations as historic, in addition to helping to determine Cultural Resource Preservation value for the API.
		Landscape evaluation summary (such as a summary table) that lists all landscape features	This list will help parks identify potential Asset Types in the cultural landscape. For example, a cultural landscape may contain a 3100 Maintained Landscapes Location record along with a historic driveway (1100 Roads), a historic summerhouse (4100 Buildings), and historic light standards (5400 Electrical Systems).
		Documentation of landscape character areas; or spatially related features under Spatial Organization, Cluster Arrangement, and Land Use	This data may help parks delineate Location record boundaries. For example, a hedge-enclosed garden space (landscape feature) may inform boundaries of a 3100 Maintained Landscapes Location record.
		Comparison of historic and existing extents of the cultural landscape	This will allow parks to identify currently unmaintained historic landscapes. For example, if a garden was twice as large during the historic period, the park may decide to include the previously maintained area within the 3100 Maintained Landscapes Location boundary to address future restoration.
		Summary narrative of historic character, derived from the landscape characteristic evaluations	Such narratives will allow parks to document the intended historic character of the Location. This text is entered in the Location record Long Description field.
		Documentation on areas outside of park boundaries that contribute to the historic character of the cultural landscape	Parks can enter this documentation in the Location record Long Description field. Examples include the external focal point of a vista from within the park, or a public streetscape bordering a park. If the NPS is bound through a legal agreement to maintain the external land, these areas should be captured as part of a Location record.
CLI	Inventory Unit Summary and Site Plan	CLI number for the landscape	The CLI number will identify Locations records as historic.
		CLI site plan	The site plan may serve as a basemap to graphically document Location boundaries and the interface of 3100 Maintained Landscapes with other Asset Types. There may be no one-to-one correlation between CLI boundaries and FMSS Location boundaries.
	Geographic Information	Inventory Unit Boundary Description	The Inventory Unit Boundary Description may contain data that can inform Location record boundaries for 3100 Maintained Landscapes and other Asset Types.
	Management Information	Identification of contributing adjoining lands and NPS legal interest in those lands	Parks may document this information in the Location record Long Description field. If the NPS is bound through a legal agreement to maintain the external land, these areas should be captured as part of a Location record.
	National Register Information	National Register Explanatory Narrative, Eligibility	National Register information can help parks assign the Cultural Resource Preservation value for the Asset Priority Index (API).
	Analysis and Evaluation of Integrity	See Guidance under CLR Analysis and Evaluation	
PMP	Areas and Categories of Features	Map showing the areas of the landscape	The Preservation Maintenance Plan may inform delineation of Location records of 3100 Maintained Landscapes and other Asset Types.
		Text and graphics describing the categories of features	The categories of features may help identify Asset Types in the landscape.

Sidebar 3: Cultural Landscape Data for an FMSS Asset Inventory: Asset Records

CL Data Source		CL Data for Asset Records	Guidance
CLR	Analysis and Evaluation	Landscape evaluation summary, (table identifying contributing and non-contributing features) that lists all landscape features	Parks can use this data to generate an initial Asset list for all Asset Types, and to identify Assets as historic. There will probably be no one-to-one correlation between cultural landscape features and FMSS Assets records since parks often need to group or split features based on various factors aside from cultural values. Refer to Sidebar 4 for guidance on converting landscape characteristics and features to FMSS Asset records.
		Prioritized list of landscape features that identifies those that should be included in the FMSS asset inventory as soon as possible	This data, which can be incorporated into the prior guidance, will help parks focus their efforts to ensure that the most important historic Assets are adequately addressed in FMSS work planning. For example, if a deteriorating historic wall is not captured in FMSS, it has a greater chance of not receiving required treatment, or receiving inappropriate maintenance that does not preserve or enhance its historic character.
		Concise summary of historic character for assets that have no other cultural data source	Parks can insert this data in the Asset record Long Description field to document how an historic Asset should look and how it should be maintained. A CLR is usually the primary source of cultural data on Assets that correlate to Circulation, Vegetation, and Small-Scale Features. Buildings/structures and archeological sites generally are documented in other reports. For example, a park may have plans and specifications for its exterior lighting system (Small-Scale Features), but no reports that document its historic character and significance.
		Documentation on the relationship of features associated with Spatial Organization, Land Use, Cultural Traditions, Cluster Arrangement, and Views & Vistas to maintained Assets	These landscape characteristics can be documented in the FMSS Asset records which are associated with the Location records of Maintained Landscapes and other Asset Types. Parks should describe this relationship in the corresponding Asset record Long Description field. For example, a perimeter hedge (an FMSS Asset record) that defines a garden space should note in its Long Description how it maintains the historic garden space (a Spatial Organization feature).
		Documentation on missing historic landscape features that warrant reestablishment and future inclusion as Asset records	Missing historic landscape features should not be included as part of the Asset record inventory, but rather be recorded outside of the FMSS as deficiencies. Once the park is moving forward with re-establishing the feature or has reestablished the feature, a new Asset record can be added.
CLI	Analysis and Evaluation of Integrity	Landscape characteristic narratives and list of landscape features for each characteristic	Parks can use this list to generate an initial Asset list for all Asset Types. The CLI Landscape Characteristic narrative should be consulted, and any features listed in the narrative but not in the feature fields should be added to the list of cultural landscape data. There will probably be no one-to-one correlation between cultural landscape features and FMSS Asset records since parks often need to group or split features based on various factors aside from cultural values. Refer to Sidebar 4 for guidance on converting landscape characteristics and features to FMSS Asset records. The CLI inventory will generally include most documentation from the List of Classified Structures (LCS); however, the LCS should be consulted in addition to the CLI to ensure that all previously inventoried built features are addressed in the Asset record list. See also guidance under CLR Analysis and Evaluation.
PMP	Inventory of Landscape Features	Inventory of landscape features	Parks can use this inventory to generate an initial Asset list for all Asset Types. Because this list generally includes only maintained landscape features, it may align with an FMSS asset inventory, but features may be split or grouped differently. This list may not identify historic (contributing) features.
	Feature Data	Information on location, existing conditions, and historical appearance of landscape features	This information can be used to complete data fields in FMSS Asset records.

For additional guidance, refer to the *Asset Business Practices and Asset Best Management Practices* for each Asset Type available through InsideNPS, http://inside.nps.gov/waso/waso.cfm?prg=190&lv=4

define the physical historic character of a landscape. Below-ground utilities or contemporary site furnishings such as directional signs and garbage cans are typically not inventoried in cultural landscape documents.

The actual data that can be provided will depend on the landscape. A CLR for a parkway would primarily involve the 1100 Roads Asset Type, while a CLR for a forest may contain 2100 Trails and 1100 Roads Asset Types, with much of the natural landscape outside the scope of FMSS since it does not track natural resources. Definition of Location record boundaries for 3100 Maintained Landscapes often require more analysis than other Asset Types given the often complex interface with other assets and natural resources. 3100 Maintained Landscapes Location records are mostly populated by the characteristics of Vegetation and Small-Scale Features, while Circulation, Topography, and Buildings and Structures are often categorized as other Asset Types. Small buildings and landscape structures are, however, often captured under 3100 Maintained Landscapes.[6]

Certain cultural landscape characteristics and features do not translate directly into discrete FMSS records, but can inform facility management goals for Locations and Assets (Sidebar 4: guidance on translating cultural landscape characteristics and features to an FMSS asset inventory). These include Spatial Organization, Land Use, Cultural Traditions, Cluster Arrangement, and Views and Vistas because they are composed of maintained features found under other characteristics. For example, the parade ground at Fort Baker in Golden Gate National Recreation Area, a Spatial Organization landscape feature, is maintained by the turf and perimeter trees (Vegetation), streets (Circulation), and buildings (Buildings and Structures), which are categorized under three Asset Types (1100 Roads, 3100 Maintained Landscapes, and 4100 Buildings) (fig. 15). Exclusion of cultural landscape characteristics or features

Figure 15. The parade ground, a Spatial Organization feature at Fort Baker in Golden Gate National Recreation Area, 2009. While the parade ground space is not captured in an FMSS Asset inventory, its component turf and perimeter trees can be entered as assets of a 3100 Maintained Landscapes Location. (SUNY ESF)

from an FMSS asset inventory does not diminish their historic significance or mean a feature will not be preserved. The primary purpose of delineating Location and Asset records within FMSS is to support operational needs, which ultimately support stewardship.

After an Asset inventory is generated, Facility Management and Cultural Resources staff should conduct a walk-through of the site with maps and narratives to ground truth Location record boundaries, the inventory of Asset records, and the cultural landscape data.

When parks develop an asset inventory from CLRs, CLIs, and Preservation Maintenance Plans, it is helpful to create a summary crosswalk table that correlates the relationships and discrepancies between data sets for each landscape characteristic and feature, including data from other cultural resource inventories, such as the List of Classified Structures for Buildings (sample crosswalk table in Appendix 8).

Cultural Landscape Data for FMSS Work Planning

Cultural landscape data can inform condition assessments and the development of FMSS work

Sidebar 4: Translating Cultural Landscape Characteristics to an FMSS Asset Inventory

Cultural Landscape Characteristic Feature Examples	Typical FMSS Asset Type (Location Record)	NPS Asset Classification	Guidance on Translating Characteristics and Features to Locations and Assets
Natural Systems and Features Stream, swamp, marsh, beach, dune, pond, lake, desert, natural landform, unmanaged natural vegetation (woods, grasslands, chaparral)	n/a	n/a	Natural Systems and Features are often character-defining parts of a cultural landscape, but they are typically not included in an Asset inventory. Natural features that receive periodic maintenance, such as woods that require pruning along a roadway or field, are managed as buffer areas of the related road or field, and not as maintained landscapes on their own. Natural features may define boundaries of Maintained Landscapes Location records, such as where the developed/constructed landscape ends and the natural unmaintained area begins.
Spatial Organization Corral, garden, forecourt, yard, field, pasture, plaza, quadrangle, terrace, road/trail corridor, amphitheater	0000 Site 3100 Maintained Landscapes, 3800 Boundary, 7300 Fortifications, 7100 Monuments, 7900 Amphitheaters	n/a	Spatial Organization may correlate to Location records, but generally does not translate as Asset records because spatial features are typically defined by Assets inventoried under other characteristics. For example, a formal garden space may be a 3100 Location record, but the maintained assets are the hedges, buildings, and fences that define the space (but alone are not the space), which would be inventoried in a CLR/CLI under Vegetation, Buildings and Structures, and Small-Scale Features. The relationship of these features to the landscape's Spatial Organization should be explained in their Asset record Long Description field. Spatial features/assets can also be listed in relevant Location records, including 0000 Site Locations.
Land Use Picnic area, campground, meeting place, cemetery, staff housing area, recreation area, garden, quarry	1300 Parking Area, 3100 Maintained Landscapes, 4100 Buildings, 6300 Marinas, 7100 Monuments, 7300 Fortifications, etc.	n/a	Land Use may translate to Location records, but generally not as Asset records because land-use features are typically defined by Assets inventoried under other characteristics. For example, a campground land use feature could be a 3100 Location record, but the maintained Assets are the mown turf and picnic tables that comprise the feature, which would be inventoried in a CLR/CLI under Vegetation and Small-Scale Features. The relationship of these features to the landscape's Land Use should be explained in their Asset record Long Description field.
Cultural Traditions A lake sacred to Native Americans, the use of adobe as a building material in New Mexico	3100 Maintained Landscapes, 4100 Buildings	n/a	Cultural Traditions may translate to a Maintained Landscape Location record if other Asset Types do not capture the entire feature. Generally, Cultural Traditions do not correspond to a Location or Asset records because they either are unmaintained natural features, or are inventoried only at the characteristic level as non-tangible resources, or tangible resources inventoried under other characteristics, such adobe walls that are part of Buildings and Structures.
Cluster Arrangement A farmstead, crossroads village, series of coastal defensive works	0000 Site, 3100 Maintained Landscapes, 4100 Buildings, 7300 Fortifications	n/a	Cluster Arrangement may translate as a Location record, but is often inventoried only at the characteristic level, with associated features captured under other characteristics. For example, a cluster of coastal defense batteries would be c composed of Location records inventoried in a CLR/CLI under Buildings and Structures. Cluster Arrangement should be described in the Long Description field of the associated Asset records. If a Site record exists, information about the cluster arrangement can be added to the 0000 Site record Long Description field.

Sidebar 4 (continued)

Cultural Landscape Characteristic Feature Examples	Typical FMSS Asset Type (Location Record)	NPS Asset Classification	Guidance on Translating Characteristics and Features to Locations and Assets
Circulation Road, parkway, driveway, parking lot, scenic pull-off/ overlook, sidewalk, hiking trail, steps, ski trail, railroad, runway	1100 Roads, 1300 Parking Area, 2100 Trails, 3100 Maintained Landscapes, 6400 Aviation Systems, 6500 Railroad Systems	Structure Surface	Circulation translates as Roads, Parking Areas, and Trails Location and Asset records. If they are spurs or driveways, or trails or walks contained within the landscape, they may be associated Asset records of the Maintained Landscapes Location record. Landscape features beyond the engineered cross-section of a road, for example plantings and turf along a parkway, should be Maintained Landscapes Asset records. Trails and walks that extend beyond a Maintained Landscapes Location should be part of a Trails Location record, except those that connect to another Maintained Landscapes Location record. Roads presently used as trails are 2100 Trails.
Topography Terrace, berm, shoulder, drainage ditch, earthen dam, canal prism, defensive earthwork	1100 Roads, 2100 Trails, 3100 Maintained Landscapes, 6100 Dams/ Levees, 6200 Constructed Waterways, 7300 Fortifications	Structure Surface Water Control	Topography typically translates as Assets records of Maintained Landscapes, unless they are within the engineered cross-section of a road (1100), trail (2100), or are part of a dam or levee (6100), constructed waterway (6200); or are part of a defensive earthwork (7300). Topographic features such as terraces and berms often receive no maintenance, as such they may not be documented as an Asset record. Topographic features can also help define boundaries of Maintained Landscapes Location records. For example, a steep slope that meets a flat area in the landscape and creates a clear delineation between areas may form a boundary between two Maintained Landscapes Location records. Topographical information can be added to the Long Description of a location record.
Vegetation Lawn, field crop, pasture, garden plants, foundation shrubs, hedge, vine, orchard, specimen tree, allee, windbreak, forest plantation	3100 Maintained Landscapes, 1100 Roads, 1300 Parking Areas, 2100 Trails, 6200 Constructed Waterways, 6300 Marinas, 7100 Monuments, 7300 Fortifications, etc.	Surface	Vegetation (managed vegetation as opposed to natural systems) generally translates to Asset records of Maintained Landscapes Locations. Cultural landscape data may not inventory turf, crops, or grazing pasture as individual Vegetation features. These may be referenced under other characteristics, such as Land Use or Spatial Organization. Woods, hedgerows, and field grasses that are periodically maintained are often managed as natural "buffer areas" and not as Maintained Landscapes Assets records. Vegetation managed as part of other asset types, such as Roads, Trails, Monuments, and Maintained Archeological Sites, may be captured under those Location records. Turf on a defensive earthwork, or associated camouflage plantings, should be part of 7300 Fortifications records.
Buildings and Structures House, barn, silo, shed, apartment building, barracks, pavilion, bridge, culvert, retaining wall, staircase, stone fence	1700 Road Bridges, 2200 Trail Bridges, 3100 Maintained Landscapes, 3800 Boundary, 4100 Buildings, 4300 Housing, 6300 Marinas, 7100 Monuments, 7300 Fortifications, etc.	Barriers and Fencing Communication Electrical Exhibit Furnishing Liquid & Gas Structure Water Control	Buildings and Structures may translate to Assets of a Maintained Landscapes Location record if they are minor features such as arbors, pavilions, pergolas, retaining walls, decks, or platforms. Most buildings comprise individual 4100 Location records. Structures are classified under a variety of Asset Types, with 1700, 2200, 6300, 7100, and 7300 common in cultural landscapes. Buildings and Structures that are part of functioning mechanical or utility systems, such as a free-standing chimney, should be classified with their appropriate asset type, such as 5300 Heating & Cooling Plants. Those that are no longer part of active mechanical or utility systems may be classified as assets of Maintained Landscapes Location records or 7200 Maintained Archeological Site records.

Sidebar 4 (continued)

Cultural Landscape Characteristic Feature Examples	Typical FMSS Asset Type (Location Record)	NPS Asset Classification	Guidance on Translating Characteristics and Features to Locations and Assets
Views and Vistas Overlook, panorama, prospect of a distant feature	1100 Roads, 1300 Parking Areas, 2100 Trails, 3100 Maintained Landscapes, or n/a	n/a	Views and vistas typically translate into Assets of Location records, such as a scenic overlook that is an Asset of a 1100 Roads Location record. Views and vistas, such as a system of views along a road, can also be defined as their own Maintained Landscapes Location record. Views and vistas may not translate into Asset records if they are defined by Assets inventoried in cultural landscape data under other characteristics, such as turf (Vegetation) that provides open space of a prospect toward a distant hill. Incidental views that are not specifically managed may be documented only at the characteristic level and have no associated features. The objects of the view or vista, such as a distant church spire or mountaintop, are not captured in FMSS as distinct Asset records if the NPS has no legal interest in them. The object of view should be described in the relevant Long Description field in any case.
Constructed Water Features Swimming pool, reflecting pool, fountain, canal, open reservoir	3100 Maintained Landscapes, 5100 Water Systems, 6200 Constructed Waterways, 7100 Monuments	Exhibit Liquid & Gas Structure Water Control	Constructed Water Features generally translate as Asset records of Maintained Landscape Location records. Active or watered canals are Constructed Waterways, and functioning reservoirs are Water Systems. Pools or fountains associated with a large monument or memorial can be an Asset of the respective 7100 Monument and Memorial Location. If a utilitarian water feature, such as open-water reservoir, is no longer in use but retains water, it may be a 3100 Asset or 7200 Asset.
Small-Scale Features Fence, bench, monument, sign, grave marker, flagpole, water fountain, light standard, planter, bollard, guardrail	1100 Roads, 2100 Trails, 3100 Maintained Landscapes, 3800 Boundaries, 5400 Electrical Systems, 7100 Monuments, 7500 Interpretive Media	Barriers & Fencing Electrical Exhibit Furnishing Liquid & Gas Sculpture Signage & Marking	Small-Scale Features are often Assets of a Maintained Landscape Location record, but may also translate to other Asset types. Benches are generally Maintained Landscapes (3100), while guardrails, streetlights, or traffics signs within the engineered cross-section of a road generally translate to a Roads (1100) Location record. Light standards along a walk or utility poles may be part of electrical systems (5400), while fire hydrants or drinking fountains are part of a water system (5100). Interpretive waysides and similar signs are part of interpretive media (7500). Fences or stone posts that demark boundaries may be classified as Boundaries (3800).
Archeological Sites Building foundation remnant, road trace, grave, remnant fence post, ruins	3100 Maintained Landscapes, 7200 Maintained Archeological Sites, 7300 Fortifications	Archeological	Archeological Sites as landscape features (sites with above-ground resources) may be assets of a Maintained Landscapes Location record if the feature does not receive or require management principally to protect the integrity of the feature as an archeological resource. Most maintained cemeteries and battlefields are classified as Maintained Landscapes Location records, with archeological information noted in Long Description fields. If an archeological site meets National Register Criterion D, it should be documented under Maintained Archeological Sites (7200). Buildings or structures significant primarily for their archeology, such as Native American cliff dwellings, may be classified under 7200.

orders (Sidebars 5, 6: cultural landscape data for FMSS work planning). Depending on the type of landscape, guidance will generally focus on work planning for 3100 Maintained Landscapes Location records and associated Assets, since these are most closely related to cultural landscapes, but should also extend to work orders for other Asset Types that are included in CLR treatment, CLI stabilization measures, or Preservation Maintenance Plan work specifications. These other Asset Types often include 2100 Trails, 7100 Monuments & Memorials, and 7300 Fortifications. While CLRs, CLIs, and Preservation Maintenance Plans can contain core data, they will generally not provide all information that parks need to develop work planning associated with cultural landscapes.

Although FMSS is a powerful tool for cultural landscape work planning, it cannot provide the comprehensive treatment and maintenance guidance that is in CLRs and Preservation Maintenance Plans. CLRs and Preservation Maintenance Plans provide parks with explanation of a comprehensive treatment philosophy and overall landscape treatment and maintenance goals that cannot be readily conveyed through FMSS work planning.

For condition assessments, cultural landscape data will inform facility managers about the specific management objectives for a park's cultural landscapes. Because condition assessments can address the need for both preservation maintenance and treatment, cultural landscape documents provide information necessary to identify issues pertaining to both physical condition and historical integrity (Sidebar 7: translating cultural landscape terms to FMSS work planning). Condition assessments should be undertaken through a team approach, including subject matter experts in landscape management, cultural landscape preservation, and maintenance to work alongside facilities specialists leading the inspections.

There may be disagreement between cultural landscape maintenance/treatment and facilities industry standards of maintenance that inform condition assessments. For example, building conservation standards generally recommend against growth of vines on buildings. At Fairsted, the Frederick Law Olmsted National Historic Site, the vines on the house are a character-defining feature of the cultural landscape, and are therefore not identified as a condition deficiency (fig. 16). Historic features such as worn stone steps, single-glazed windows, and lichen-covered stone walls should not be identified as deficiencies when corrective work to meet industry standards would diminish historic character. Resulting work orders should strive to retain authentic historic qualities and character to the longest extent feasible in keeping with the Secretary of the Interior's Standards for the Treatment of Historic Properties and park-specific preservation goals and objectives.

There may be no direct, one-to-one correlation between cultural landscape recommended work (CLR treatment or CLI stabilization measures) and FMSS work orders. A park may often reorganize

Figure 16. Historic vines on Fairsted, Frederick Law Olmsted National Historic Site, 1995. The vines are an example of a cultural landscape feature that does not meet current building facility condition standards, but is an important part of the landscape's historic character. The solution to this issue was to train the vines on a trellis system that keeps the vegetation off the building and allows for removal for inspection and painting. (SUNY ESF)

Sidebar 5: Cultural Landscape Data for FMSS Work Planning: Condition Assessments

CL Data Source		CL Data for Condition Assessments	Guidance on Translating CL Data to Condition Assessments
CLR	Existing Conditions	Summary of condition (physical condition) issues	Parks can use this as baseline documentation for annual and comprehensive condition assessments (CAAs, CACs).
	Analysis and Evaluation	Documentation on landscape features that have lost historic character, or have been removed (see also following Treatment category)	Parks can use this information to identify loss of historic character as a deficiency to be addressed during annual and comprehensive condition assessments (CAAs, CACs). For example, if a walk was historically gravel, its current asphalt surface could be identified as a deficiency; or if a tree was removed after the historic period and not replaced, it could be identified as a deficiency.
	Treatment	Treatment philosophy (or similar narrative) that summarizes the intended appearance of the landscape	The treatment philosophy or similar narrative can give those making condition assessments an overview of the intended condition of the landscape. For example, the treatment philosophy may note that a landscape should have a high level of maintenance, a condition that would be informative for inspectors if the existing physical condition is poor. This information should be added to the Long Description record of all related Location records (not just 3100 Maintained Landscapes).
		Secretary of the Interior's Standards for the Treatment of Historic Properties (If treatment philosophy is not available)	The Standards can give inspectors, particularly those without historic preservation experience, an understanding of how the NPS treats historic properties. For example, the Standards will convey the philosophy that historic materials should be retained where possible, and that repair is preferable over replacement. Pertinent guidance should be entered into the Long Description of the Location record (do not add generic guidance from the Standards).
		Treatment tasks that prescribe reestablishment or enhancement of landscape features	Parks can use this information to identify loss of historic character as a deficiency to be addressed during CAAs and CACs. (See examples under Analysis and Evaluation category above.)
CLI	Condition Assessment	CLI Condition Assessment Explanatory Narrative	This narrative will give an overview of physical condition issues in the landscape to be addressed during CAAs and CACs.
		Impacts to Inventory Unit table	This data will identify specific condition issues in the landscape to be addressed during CAAs and CACs.
		Stabilization Measures	Parks can use the Stabilization Measures to identify loss of historic character as a deficiency to be addressed during CAAs and CACs. (See examples under CLR Analysis and Evaluation category above.)
		Approved Landscape Treatment Explanatory Narrative	The landscape treatment narrative will provide inspectors with a brief overview of the intended appearance of the landscape, as a benchmark for assessing historic character as part of condition assessments. This should be documented in the deficiency work order Long Description field.
PMP	Field Inspection	Field inspection summary sheets	The Field Inspection section in Preservation Maintenance Plan (PMP) provides data on physical condition issues as well as integrity issues (such as missing historic trees) for all types of condition assessments. Depending on the age of the plan, the field inspection may require updating.

For additional guidance, refer to the *Asset Business Practices and Asset Best Management Practices* for each Asset Type, available through http://inside.nps.gov/waso/waso.cfm?prg=190&lv=4. These documents include *Inspection Guidance* and other related documents.

Sidebar 6: Cultural Landscape Data for FMSS Work Planning: Work Orders

CL Data Source		CL Data for Work Orders	Guidance on Translating CL Data to Work Orders
CLR	Treatment	Treatment guidelines narrative (broad recommendations for landscape treatment and maintenance)	Treatment guidelines may align with FMSS work orders for Preventative Maintenance and Recurring Maintenance. For example, the guideline that a landscape be maintained with a well-tended appearance may translate into more frequent hedge shearing that occurs bimonthly (equivalent to Preventative Maintenance), rather than annually (Routine Maintenance).
		Treatment tasks (narrative and graphics)	Identify treatment tasks that align with FMSS work orders. See Appendix 7 for definition of work types. Since CLR treatment is generally developed at the conceptual level, it will likely not provide all data necessary for completion of work orders.
		Prioritized list of treatment tasks	A prioritized list of treatment tasks can help parks understand the work most critically needed to preserve and enhance the landscape's historic character, and develop FMSS work planning accordingly.
CLI	Condition Assessment	Stabilization Measures Description	CLI Stabilization Measures may be directly translated into the FMSS scope of work statement found in the Long Description field of work orders. These generally align with Deferred Maintenance.
		Stabilization Cost information	This information may inform cost estimating data in FMSS work orders. The costs identified under CLI Treatment are generally too broad for FMSS work orders.
PMP	Summary of Work Needed	Work needed information and list of features in need of work, along with field notes, and special considerations for historic appearance, design, or significance	This information can be applied to FMSS through work order creation, mostly in the categories of Facility Operations, Preventative Maintenance, and Recurring Maintenance, but often also Deferred Maintenance for reestablishing or enhancing historic features. Include data on preservation techniques, materials, replacement strategies, and cost estimating to help parks plan for and obtain funding. Depending on the park's Preservation Maintenance Plan record keeping, there may also be data on materials used, time spent, etc. that may inform FMSS work order data fields.
	Feature Data	Feature Data	The feature data can inform FMSS work orders of the relevant Asset record, type, and scope of work. It may include feature name, descriptive characteristics, historical appearance, preservation practices and work procedures, potential problems or pests, and sources of repair/ replacement parks or propagation.
	Calendar	Cyclical Maintenance Activities	The Calendar section of a PMP can be directly associated with creating FMSS work orders for Recurring Maintenance, Preventative Maintenance, and possibly Component Renewal.

For additional guidance, refer to the *Asset Business Practices and Asset Best Management Practices* for each Asset Type, available through http://inside.nps.gov/waso/waso.cfm?prg=190&lv=4. These documents include *Inspection Guidance* and other related documents.

and redefine treatment tasks to accommodate the operational constraints, materials, costs, and larger park work planning that are taken into consideration when writing a work order. General treatment guidelines, such as those that provide overall guidance on preserving and enhancing historic character, may indirectly inform development of work orders. Preservation Maintenance Plans, since they identify and describe work tasks, generally parallel FMSS work planning more so than CLRs or CLIs (see Sidebar 7). CLI stabilization measures, CLR treatment guidelines and tasks, and Preservation Maintenance Plan tasks can be written to correlate closely with the format of FMSS work orders. This is important as project funding requests for all facility projects must originate in FMSS work orders.

Work orders may be based on historic cyclical in-kind replacement that can be identified as Preventative Maintenance(PM), Recurring Maintenance (RM), or Component Renewal (CR). Examples include replacement of a wood-shingle roof, seasonal removal and replanting of flowering annuals in a garden bed, or renewal of a stone-dust surface on a garden path. Long-term cycles, such as replacement of a 150-year-old tree in advanced decline, may correlate with Deferred Maintenance (DM) or Component Renewal (CR). Such Work Orders should provide for in-kind replacement of materials that perpetuate the historic asset (landscape feature) indefinitely.

Figure 17. The Deferred Maintenance needs of an overgrown historic yew hedge are identified by a multi-disciplinary team at Antietam National Battlefield. (WASO, PHSCL)

Figure 18. The need for stabilization of a historic apple tree at Manzanar National Historic Site that has dead-wood and unbalanced limbs is identified in FMSS as a "DM" work order. (WASO, PHSCL)

Sidebar 7: Translating Cultural Landscape Terms to FMSS Work Planning

Cultural Landscape Term			FMSS Term	Guidance
CLR	**CLI**	**PMP**		
Condition Assessment (part of Existing Conditions)	Condition Assessment	Field Inspection	Condition Assessment (RA, CAA, CAC)	Condition should not be confused with "integrity" as used in a National Register or cultural landscape evaluation. A condition assessment may address integrity, such as in identifying missing historic features as deferred maintenance (DM).
n/a	n/a	n/a	Facility Operations (FO)	FO are work activities performed on a recurring basis throughout the year that intend to meet routine, daily park operational needs. Examples include weeding, watering, and lawn mowing. CLR treatment and PMPs may address FO in guidance for the level of maintenance appropriate to the landscape's historic character.
Preservation	Preservation	Routine Maintenance	Preventative Maintenance (PM)	PM involves regularly scheduled minor maintenance such as annual seasonal pruning, irrigation system winterization, and raking gravel walks. PM is typically prescribed in PMPs, not in CLRs or CLIs.
Preservation, Rehabilitation	Preservation, Rehabilitation	Cyclic Maintenance	Recurring Maintenance (RM)	RM is maintenance between 1 and 10 year cycles such as tree pruning or resurfacing stone aggregate walkways. It may be prescribed in all three CL documents, but most detail is in a PMP.
Restoration, Rehabilitation	Stabilization; Restoration, Rehabilitation	Stabilization	Deferred Maintenance (DM)	DM is maintenance that was not performed when it should have been. Continued deferred maintenance results in deficiencies. Examples of DM include replacing a dying tree, rebuilding deteriorated fencing, or repairing a collapsed stone wall. DM correlates to CLR treatment tasks, CLI stabilization, and PMP stabilization. Lost features recommended for reestablishment in a CLR, such as a tree that was removed and never replaced, are DM.
Rehabilitation, Reconstruction	n/a	n/a	Capital Improvement (CI)	CI is new construction such as reestablishing a missing orchard or road. It may be included in CLR treatment as part of a Rehabilitation or Reconstruction treatment, but not in a PMP or CLI.
Treatment Task	Stabilization Measures	Work Needed	Work Order (Parent Work Order)	FMSS Work Orders may be defined directly from CLR treatment tasks, CLI stabilization measures, and PMP "work needed." The scope of work should be captured in the Long Description field.
Treatment Task or Component	n/a	Work Needed	Work Order Task (Child Work Order)	A Work Order Task is a component of a Work Order (Parent Work Order). Work Order Tasks are typically basic steps in completing a job, such as "010 removing existing vegetation," "050 dig holes for new vegetation," etc.
Record of Treatment (CLR Part III)	n/a	Record Keeping	Work Order Tracking	Since few CLR Records of Treatment are completed, FMSS provides an opportunity for parks to consistently track implementation of landscape treatment and preservation maintenance.

3. Addressing FMSS in Cultural Landscape Reports

To facilitate stewardship, it is important for data in CLRs to be easily transferable to FMSS. Modest changes and additions to the content and format of a CLR can help to more effectively transfer cultural landscape data to FMSS Asset inventories and work planning. Development of a CLR with FMSS data requires additional content in the Existing Conditions, Analysis and Evaluation, and Treatment sections (Sidebar 8: sample CLR outline with FMSS data).

The following recommendations for addressing FMSS in a CLR serve as a supplement to *A Guide to Cultural Landscape Reports: Contents, Process, and Techniques (1998).*

Scoping FMSS Assistance in a CLR

Facility Management staff should be included on the CLR project scoping team to determine the desired level of FMSS guidance. Some parks may have little FMSS data for their cultural landscapes and therefore look to the CLR as a primary source. Other parks may ask for limited FMSS input because they already have comprehensive FMSS data, or wish to keep their FMSS database simple. All FMSS recommendations in a CLR need to be made in close consultation with facility managers because cultural landscape data is only one of several factors that parks consider when developing their FMSS Asset inventory and work planning (Sidebar 9: typical roles and responsibilities for integrating FMSS data in CLRs).

Most CLR projects can incorporate basic FMSS guidance without broadening the project scope. This may include preliminary recommendations on integrating cultural landscape data into an FMSS asset inventory and correlating CLR treatment guidelines and tasks with FMSS data. At a minimum, this may include using the Analysis and Evaluation to correlate landscape features with existing park FMSS

Sidebar 8: Sample CLR Outline with FMSS Data

CLR Existing Conditions (CLR Part 1)
Existing FMSS Overview
- Use of FMSS for cultural resource and landscape management
- Existing park FMSS data and how it relates to the cultural landscape
- Existing conditions plan with boundaries of all applicable Location Records

CLR Analysis and Evaluation (CLR Part 1)
Landscape Condition
- Condition with any pertinent Asset information
- Correlation between condition issues and FMSS work types
- Condition assessment guidance on integrating historic character with industry standards

Cultural Landscape Evaluation
- Cultural landscape data for FMSS Asset inventory
- Landscape Type recommendation for each 3100 Location record
- Recommendations for assessing the Cultural Resource Preservation value in the Asset Priority Index (API)
- Recommendations for assessing the Current Replacement Value (CRV) for Location records
- Crosswalk table between CL data and FMSS asset inventory

CLR Treatment (CLR Part 2)
Treatment Guidelines and Tasks
- Using treatment guidelines to define goals and objectives for Preventative Maintenance, Recurring Maintenance, and Deferred Maintenance
- Correlation of treatment tasks as Deferred Maintenance, or other appropriate work types
- Organization of tasks to align with FMSS Location and Asset records
- Existing Location boundaries on graphic treatment plans

Treatment Implementation
- Identification of treatment task priorities
- Identification of additional information needed for FMSS work orders
- Potential FMSS work order costing
- Summary table correlating CLR treatment and FMSS work planning
- Potential NPS funding sources for treatment
- Potential PMIS statements

CLR Record of Treatment (CLR Part 3)
FMSS "actuals" may serve as the CLR Record of Treatment

Sidebar 9: Typical Roles and Responsibilities for Integrating FMSS Data in CLRs

CLR Project Components	Project Scoping	Site History	Existing Conditions	Analysis and Evaluation	Treatment
Objective in Integrating FMSS with Each CLR Project Component	Determine the scope of FMSS recommendations in the CLR Determine what level of effort and time commitment will be needed from park facilities staff to assist with the FMSS aspect of the CLR	n/a	Document existing FMSS data related to the cultural landscape	Organize condition assessment by FMSS Locations Recommend Asset Types that characterize the cultural landscape, along with the Cultural Resource Preservation value in the API and the Current Replacement Value for Location records.	Identify the relationship of preventative maintenance (PM), recurring maintenance (RM), and deferred maintenance (DM), and other work types to landscape treatment guidelines and tasks.
CLR Author's Role and Responsibilities	Facilitate project scoping meeting Develop project scope	n/a	Facilitate discussions Develop existing conditions documentation	Facilitate FMSS hierarchy meeting Undertake condition assessment Write recommendations for addressing cultural landscape values in the FMSS Asset inventory, and assessing the Cultural Resource Preservation value for the API for each Location.	Develop a crosswalk between CLR treatment guidelines and tasks and FMSS work orders Prepare work orders for preservation actions that fall into PM, and, in particular RM and DM (to assist with funding applications for cyclic and repair rehab funding).
Park Staff Participation	Cultural resources staff Facilities staff	n/a	Facilities staff	Cultural resources staff Facilities staff	Cultural resources staff Facilities staff
Park Staff Roles and Responsibilities	Participate in project scoping meeting	n/a	Provide documentation on existing FMSS data Provide GIS-compliant spatial data for Locations and Assets	Participate in condition assessment and determining organization of FMSS, if desired. Participate in developing recommendations for FMSS Location records related to the cultural landscape, and assigning the Cultural Resource Preservation value for the API.	Review and comment on CLR-FMSS crosswalk.

Location and Asset records, and using treatment to identify Deferred Maintenance work needed to preserve and enhance the cultural landscape. CLRs can also readily inform Preventative Maintenance and Recurring Maintenance in treatment guidelines, and provide documentation of historic significance that will influence the rating of the Cultural Resource Preservation criteria of the API and Resource Risk Assessment Code (R-RAC) scoring on work orders.

Advanced FMSS guidance may require additional CLR project funding and coordination with park regional and facilities staff. The additional guidance may include correlating all landscape features with existing or potential Location and Asset records, providing guidance on condition assessments, and translating treatment guidelines and tasks into actual work orders. Advanced guidance may also include helping parks determine particular cost driving aspects for preservation that could be used for adjusting the CRV.

The following recommendations represent advanced FMSS guidance in a CLR, but may be selectively applied to provide baseline recommendations. These are presented for combined CLR Parts 1 and 2 (Site History through Treatment). If a CLR is a stand-alone Part 2 (Treatment), then it should also address the recommendations for Part 1. There is typically little need for FMSS data in a Site History, although including documentation on historic maintenance practices can inform contemporary facilities work.

FMSS in CLR Existing Conditions

Existing Conditions provides an opportunity to document a park's existing FMSS data that is relevant to management of the cultural landscape.

Existing Park FMSS Overview

The following information may be captured in a section devoted to FMSS within a larger discussion of current landscape management:

- Explain how the park uses FMSS to manage the cultural landscape.
- Summarize the park's existing FMSS Asset inventory relevant to the cultural landscape: identify Asset Types that characterize the cultural landscape and existing Location records in the park FMSS data to determine gaps in the Asset list.
- Identify the Landscape Type, complexity, and acreage for existing and proposed 3100 Location records and other Asset Types for use in the Current Replacement Value (CRV) calculator. The CRV is part of the equation that determines the Facility Condition Index (FCI) which assists with work planning in FMSS.

In addition, indicate the boundaries of existing Location records that correlate to the cultural landscape on the CLR existing conditions graphic plan. Verify and revise GIS-compliant spatial data for the Location record boundaries based on mapping of existing features. The plan should be annotated to describe location boundaries where they are not clearly defined or where they correlate to visible delineations (walls, fences, curbing, forest edge, etc.). These boundaries should not graphically obscure the primary purpose of the plan to document the physical character of the landscape.

FMSS in CLR Analysis and Evaluation

A CLR Analysis and Evaluation can provide parks with information on condition of Locations and Assets, including physical condition and deficiencies in historic character, and how cultural landscape characteristics and features inform an FMSS Asset inventory. Because parks must consider multiple factors in developing an Asset inventory (such as classification, age, and construction), a CLR should only make recommendations on how cultural landscape values should be considered in defining Location and Asset records.

Analysis and Evaluation data may be summarized in a cultural landscape evaluation table that correlates landscape features to FMSS data, and includes a summary of historic character and identification of condition deficiencies for use in condition assessments and record Long Descriptions (Sidebar 10: sample crosswalk table).

Landscape Condition Assessment

The following information may be captured in a section of the Analysis and Evaluation that provides an assessment of the physical condition (not historic integrity) of the cultural landscape:

- Organize documentation on the existing physical condition of the cultural landscape according to existing or potential Location records. For example, make separate condition assessments for a 3100 Maintained Landscapes and a 1100 Roads Location record. Locations that only partially comprise the cultural landscape, such as historic light standards (5100 Electrical Systems), should still be documented in the CLR.

- For each Location record, correlate the condition standards in the NPS Cultural Resource Management Guideline (Good-Fair-Poor-Unknown) to deficiencies and identify the FMSS work types (Deferred Maintenance, Recurring Maintenance, etc.) that would be needed to bring the landscape up to good condition.

- Provide direction to Facility Management staff or contractors on taking historic character into account when making condition assessments. This should include a synopsis of the landscape's historic character by Location and Asset records, and identification of any particular conditions that may not meet contemporary facilities industry standards, but which contribute to the historic character of the landscape, such as vines on a building. Explain that a full evaluation of the landscape's historic character is found in the evaluation of cultural landscape characteristics and features.

Cultural Landscape Inventory and Evaluation

The following information may be provided as part of the evaluated inventory of cultural landscape characteristics and features, or in a subsection that follows.

- Correlate cultural landscape characteristics and features to Asset Types and existing Location records (such as Spatial Organization to 3100 Maintained Landscapes), and Asset records (such as Circulation features to 1100 Roads). If identified in the CLR project scope, make recommendations for missing Location and Asset records.

- Where possible, document existing and/or historic details for each landscape feature, such as dimensions, materials, color, species, etc., that can be used to inform specification templates and work orders.

- Recommend an API Cultural Resource Preservation value for existing or proposed Location records that characterize the cultural landscape, such as 1100 Roads, 3100 Maintained Landscapes, and 7100 Monuments. The reasons for the recommended value should be explained based on the definitions in the "API Definitions and Examples" available through the NPS Park Facilities Management Division.

- Provide recommendations for assessing the Current Replacement Value for cultural landscape Location records. The recommendations may not include an actual value, but should identify possible additional costs for preservation work, such as in-kind replacement of unique building mafeeterials or heritage plants, as well as the complexity of the landscape.

Sidebar 10: Sample CLR-FMSS Crosswalk Table for CLR Analysis and Evaluation

CLR Feature Name	FMSS Asset Type	FMSS Location Record	FMSS Asset Record	CLI No.	LCS No.	ASMIS No.	Cultural Landscape Evaluation	Historic Character	Deficiency (Historic)	Additional Guidance
Spatial Organization										
Formal Garden Space	Not applicable	Not applicable	Not applicable	124761	n/a	n/a	Contributing	Square open space enclosed by 8 foot high sheared hedge	Yes	Not a maintained asset; address in Formal Garden Location record Long Description
Circulation										
Main Entrance Drive	Roads (1100)	Estate Roads (13450)	Main Entrance Road surface (28456)	124561	601120	n/a	Contributing	Well-groomed, weed-free gravel drive edged by stone gutters	Yes	Includes loop through porte-cochere
Formal Garden Walks	Maintained Landscapes (3100)	Formal Garden (13456)	Asset record needed	124567	601122	n/a	Contributing	Well-groomed pea-gravel walks with crisp border along lawn and bed edging	No	Facilities staff recommends grouping with C-3, access walk from main house
Vegetation										
Specimen Trees	Maintained Landscapes (3100)	House Grounds (13452)	Asset record needed	124789	n/a	n/a	Contributing	10 deciduous trees (oak, maple), high canopy, and two conifers (Norway spruce) with canopy to ground	Yes	Facilities staff recommends splitting into deciduous and conifer assets
Formal Garden perimeter hedges	Maintained Landscapes (3100)	Formal Garden (13453)	Formal Garden Plantings (28345)	124787	n/a	n/a	Contributing	8 foot high hemlock hedge, canopy to ground, sheared with straight sides, beveled top	Yes	Hedge defines Formal Garden Space
Buildings and Structures										
Main House	Buildings (4100)	Main House (13478)	Outside scope of CLR	n/a	601130	n/a	Contributing	Federal-period house with Colonial Revival modifications	Undet.	
Kitchen Garden Shed	Buildings (4100)	Kitchen Garden (13457)	Potential future asset	n/a	n/a	n/a	n/a	Board and batten shed built in ca.1900, removed in 1972	Yes	CLR Treatment: Reconstruction
Views and Vistas										
River View	Not applicable	Not applicable	Not applicable	124389	n/a	n/a	Contributing	South view of river from formal garden 25' opening framed by specimen trees on east and west sides	Yes	Not a maintained asset; address in formal garden Location record Long Description
Small-Scale Features										
Formal Garden light standards	Electrical Systems (5400)	Location record needed	Asset record needed	124391	n/a	n/a	Non-contributing	Modern park light standards; detract from historic character of the landscape	Yes	
Archeological Sites										
A-1. Historic Dump	Maintained Archeological Sites (7200)	Location record needed	Asset record needed	n/a	n/a	23445	Unevaluated	Mostly subsurface remains of domestic refuse area	Undet.	
Note: Data is fictional										

FMSS in CLR Treatment

CLR Treatment serves as an important source of information for FMSS work planning related to the cultural landscape. Treatment guidelines and tasks can define work orders for Deferred Maintenance (DM) to enhance historic character, as well as Preventative Maintenance (PM) and Recurring Maintenance (RM) to preserve the cultural landscape. While CLR Treatment is often developed at the conceptual level, with some additional information it can help parks further detail FMSS work planning.

The following recommendations are for Treatment that follows CLR Part 1. If Treatment is a stand-alone Part 2, it should include the existing FMSS summary and conditions assessment recommended for CLR Part 1. An alternative organization of the information as listed below is to combine all FMSS guidance in its own section or as an appendix to the report.

Treatment Guidelines and Tasks

The following information should be incorporated into landscape treatment guidelines and tasks narrative (Sidebar 11: example of a landscape treatment task narrative with FMSS Work Order information).

- Develop treatment guidelines that identify routine maintenance to sustain historic dimensions, form, character, size, color, etc., such as through hedge clipping, mulching, road grading, etc., to inform creation of Facility Operations (FO), Preventative Maintenance (PM) and Recurring Maintenance (RM) work orders in FMSS.

- Consider grouping treatment tasks into project components that correlate to FMSS Parent Work Orders and FMSS Child Work Orders. For example, a treatment project "Restore Formal Garden" would be an FMSS

Sidebar 11: Sample Landscape Treatment Task with FMSS Work Order Information

Treatment Task (FMSS Parent Work Order): Rehabilitate Views to and from East Black Point

Historic Background: East Black Point historically featured screened views through gardens and trees planted in the 1920s on the terreplein and escarpment of the fortifications. Filtered, tree-framed vistas remained through the end of World War II, but abandonment of the gardens and growth of volunteer trees obscured the views in subsequent decades as maintenance of the slope was curtailed.

> *Facility Work Type/Subtype:* Facility Maintenance/ Deferred Maintenance
>
> *CLR Treatment Priority:* 3 (out of 25 tasks)
>
> *FMSS Location:* Black Point Slope Landscaped Area (85972).
>
> *FMSS Assets:* No Asset records have been established for this area.

This treatment task is composed of the following components (FMSS Child Work Orders):

1. Remove invasive trees, including blackwood acacia and rock elm. This will require removing approximately 24 trees and 5,000 SF of saplings, including root grinding of mature trees.

2. Remove invasive shrubs and groundcover, including poison hemlock, cotoneaster, English ivy, blackberry, and poison oak. This will require removing approximately 52,000 square feet of shrubs and groundcover.

3. Undertake slope stabilization planting. This will require approximately 52,000 square feet of shrubs, groundcover, and mulch. Species to be determined. Use a dark natural mulch. Ensure light watering daily until plantings are established.

Recurring Maintenance Needed: Yes. Reapply mulch every 2 to 3 years to suppress weeds. Volunteer woody vegetation should be removed from the slope stabilization plantings on a biannual basis to maintain the views.

Parent Work Order, and individual treatment tasks such as replacing the perimeter hedge and replanting the herbaceous borders may comprise constituent FMSS Child Work Orders.

- Prioritize treatment tasks based on physical condition and historic character.

- Identify Location and Asset records involved with each treatment task/work order.

- Identify the type of work associated with the treatment task. Describe treatment tasks that reestablish historic character and missing historic features as Deferred Maintenance (DM). See Appendix 7 for other work types.

- Identify the Recurring Maintenance (RM) and Preventative Maintenance (PM) that will be required upon completion of the work order. This will assure that the asset will be maintained in the future.

- Provide information on materials/units and units of measure to assist with cost estimating. Also consider other FMSS work order data fields, such as Labor (expertise) and Tools, in consultation with facilities staff.

- Indicate the boundaries of existing FMSS Location records in the cultural landscape on the CLR treatment plan.

- Provide a treatment task summary table that correlates treatment tasks with FMSS work order information (Sidebar 12: sample treatment task summary table).

Treatment Implementation

Include a section in the CLR that provides guidance to parks on implementing treatment through FMSS work planning.

- Describe implementation priorities to assist parks in FMSS work planning. This should summarize the priorities identified under individual treatment tasks based on the goal of retaining contributing features and enhancing historic character, based on consultation with park staff.

- Identify additional information needed to complete FMSS work orders related to cultural landscape preservation.

- Identify potential NPS funding sources for treatment tasks (work orders), such as Cyclic Maintenance, Rec Fee, and Repair/Rehab.

- Identify possible PMIS statements based on treatment tasks/work orders.

FMSS in CLR Record of Treatment

The Record of Treatment (CLR Part 3) provides an accurate account of the implemented treatment for the historical record. The intent is to document treatment actions, not preservation maintenance. In the past, parks have seldom undertaken formal CLR Records of Treatment, although Facility Management records usually contain the necessary documentation.

FMSS has the potential, with future updates, to allow images, such as site plans or photographs of assets, to be incorporated into a Record of Treatment. These could also include files exported from FMSS to document condition assessments, work orders, construction drawings, contracts, completion reports, and actual costs. The files should be organized according to the CLR treatment tasks, and be maintained as an appendix to CLR Treatment (Part 2). Recommendations for completing a Record of Treatment should be addressed in a CLR project scope.

Sidebar 12: Sample CLR-FMSS Crosswalk Table for CLR Treatment

CLR Treatment Task / FMSS Parent Work Order	Priority	CLR Treatment Task Component / FMSS Child work order	FMSS Asset Type	FMSS Location Record	FMSS Asset Record	FMSS Work Type / Sub-type	Maintenance Needed (PM or RM)	Units	Unit of Measure
Task 1. Replace Formal Garden Hedges and Install Deer Fence	2/6	1. Remove hedge	Maintained Landscapes (3100)	Formal Garden (13456)	Formal Garden Plantings (28345)	Facility Maintenance / Deferred Maintenance, Preventative Maintenance	Yes (twice-yearly hedge shearing)	120 hemlock, b&b, 6' stock	EA
		2. Plant new hedge						300 (8' high deer fence)	LF
		3. Install deer fence							
Task 2. Replant Missing Specimen Trees on House Grounds	1/6	1. Plant white oak SE of house	Maintained Landscapes (3100)	House Grounds (13452)	House Grounds Specimen Trees Asset record needed	Facility Maintenance / Deferred Maintenance	Not determined	2 (4" caliper trees)	EA
		2. Plant sugar maple N of house							
Task 3. Rehabilitate Main Entrance Drive	4/6	1. Remove weeds and top 4" of road material.	Roads (1100)	Estate Roads (13450)	Main Entrance Road pavement (28456) Main Entrance Road stone gutters (28457)	Facility Maintenance / Deferred Maintenance	Yes (annual grading to maintain even weed-free surface)	1500 (fabric)	SF
		2. Install geotextile fabric and 4" gravel top, grade to even surface						500 (gravel)	CY
		3. Repoint stone gutters							
Task 4. Reestablish River View	3/6	Remove obstructing limbs from adjoining House Grounds grove	Maintained Landscapes (3100)	House Grounds (13452)	House Grounds grove Asset record needed	Facility Maintenance / Deferred Maintenance	Yes (prune trees biannually to maintain view)	2 (trees)	EA
Task 5. Reconstruct Kitchen Garden Shed	5/6	1. Reconstruct building	Buildings (4100)	Location record needed (future)	Asset record needed (future)	Capital Improvement / New Construction	Not determined	60 (building)	SF
		2. Grade and install site drainage				Facility Maintenance / Preventative Maintenance		80 (French drain)	LF
Task 6. Install interpretive signage at Historic Dump	6/6	1. Improve trail to dump	Maintained Landscapes (3100)	Kitchen Garden (12357)	Trail to Dump (C-15) Asset record needed	Facility Maintenance / Deferred Maintenance	Not determined	125 (trail)	LF
		2. Install wayside at dump	Maintained Archeological Sites (7200)	Location record needed	Historic Dump (A-1) Asset record needed	Not determined	Not determined	1 (sign)	EA

Note: Data is fictional

4. Addressing FMSS in Cultural Landscape Inventories

Since the Cultural Landscape Inventory (CLI) is a set database, authors and parks have limited flexibility on adapting the data to FMSS.

FMSS can be addressed in a CLI in the following manner:

- By ensuring contributing and non-contributing features of landscape characteristics are clearly identified and described in the Analysis and Evaluation;
- By providing sufficient information in stabilization measures to allow for their translation into work orders by Facilities Management staff;
- By completing the FMSS table in the CLI database with Location and Asset record numbers for the cultural landscape; and
- By adding Location and Asset record numbers to GIS-compliant spatial data.

More specific information can be found in the *CLI Professional Procedures Guide*.

5. Addressing FMSS In Preservation Maintenance Plans

Preservation Maintenance Plans provide the greatest opportunity for aligning content and format with FMSS.The reports could be structured to follow the FMSS Location/Asset hierarchy, and the work needed can be aligned with FMSS categories of Deferred Maintenance, Preventative Maintenance, and Recurring Maintenance. Work planning could be presented to align with data fields in FMSS work orders. Such changes to Preservation Maintenance Plans will be addressed in future revisions to the *Guide to Preparing a Preservation Maintenance Plan for a Historic Landscape* (1998).

Conclusion

FMSS can be a powerful tool for enhancing stewardship of cultural landscapes and advancing the NPS Call to Action to preserve America's special places. Because FMSS has the ability to integrate cultural landscape data into facilities work planning, it provides an important opportunity to facilitate communication between the Park Cultural Landscapes Program and Facilities Management, and thereby achieve seamless landscape stewardship from planning through implementation.

Cultural landscape data can help parks develop FMSS in a way that advances their cultural resource preservation mission. Without good cultural landscape data, FMSS may not capture all assets, may not assign the correct Cultural Resource Preservation value to the Asset Priority Index (API), or may assign an inaccurate Current Replacement Value (CRV) due to higher preservation costs. These situations could lead to absence of needed work orders, or creation of work orders that do not adequately preserve and enhance historic assets, or that compete poorly for funding.

Park Cultural Landscapes Program staff can use the information in this technical brief to gain an overview of the concepts behind Facilities Management and FMSS, and to adapt CLRs to facilitate integration of data into FMSS. Detailed information on evolving FMSS business practices, best management practices, inspection guidance, and other technical facilities information is available through the NPS Park Facility Management Division.

For Additional Guidance

The Park Facility Management Division of the National Park Service is responsible for developing Asset Tools for each Asset Type in FMSS, available through the Asset Management Toolbox, http://inside.nps.gov/waso/waso.cfm?prg=190&lv=4. These tools contain detailed guidance on entering data in FMSS, making condition assessments, and other technical information formerly in "Business Practices and Inspection Guidance" documents.

Park Facility Management Program Help Desk, fmp_help_desk@nps.gov or (303) 969-2609

Operations and Maintenance: Facility Management Software System (FMSS) Student Manual (2011). http://eppley.org/resources

Endnotes

1. National Park Service, *A Call to Action* (2012).

2. International Facility Management Association, "FM Knowledge Base," http://www.ifma.org/know-base/fm-knowledge-base (accessed February 19, 2014); NPS Director's Order #80 (2006); NPS 28, Cultural Resource Management Guideline (1998).

3. NPS Director's Order #80 (2006).

4. The FMSS hierarchy is defined by geography and not asset type groupings, such as "Roads."

5. Cultural landscape treatment and maintenance may also address another work type, Facilities Operations-Grounds Care. This involves activities that occur on a more frequent basis, such as weekly or monthly, and may include lawn mowing, litter pick-up, and weeding.

6. Refer to 3100 Best Management Practices (Park Facility Management Division) for additional guidance on determining 3100 Maintained Landscapes boundaries and interface with other Asset Types.

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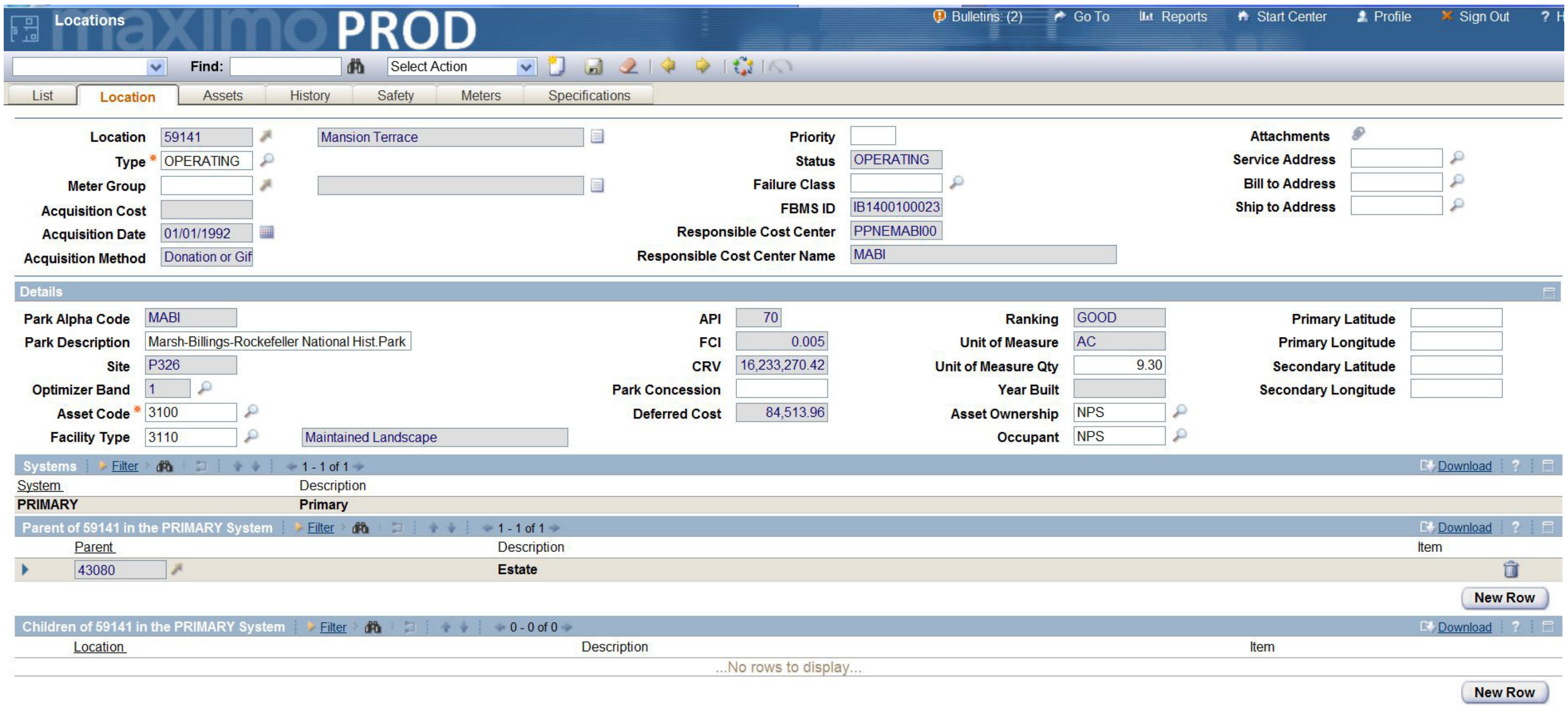
Appendix 1. Common Facilities Management Terms Related to Cultural Landscapes

Source: Operations and Maintenance: FMSS Student Manual (Eppley, 2011) and Olmsted Center for Landscape Preservation

Term	Acronym	Definition
Asset	n/a	A distinct element or separately identifiable part of a Location on which work is performed. Example: A hedge around a formal garden 3100 Maintained Landscapes Location.
Asset Type	n/a	A category used to group like Assets that define a Location; currently 32 Asset Types organized into 8 groups; each defined by a four-digit code. Example: 3100 Maintained Landscapes.
Asset Priority Index	API	An evaluation process that quantifies the value of an Asset in relation to the mission of the park. Performed at the Location level only.
Condition Assessment, Annual	CAA	Inspection of an Asset identifying apparent deficiencies and documenting the condition as measured against the applicable maintenance or condition standards. Basis for annual work plans and budgets.
Condition Assessment, Comprehensive	CAC	Review and validation of the inventory; inspection of an Asset identifying in-depth deficiencies, and documenting the condition as measured against the applicable maintenance or condition standards. Determines DM and FCI. Performed on an Asset every 5 years.
Capital Improvement	CI	Construction that adds to the existing footprint of an Asset, or creates a new asset; or alterations. Example: expansion of a parking lot.
Corrective Maintenance	CM	Unscheduled reactive repairs that are not estimated or planned. Example: replacement of a fence damaged by a falling tree.
Component Classification System	CompClass	An NPS system for classifying Assets according to set types.
Current Replacement Value	CRV	Standard industry costs and engineering estimates of materials, supplies, and labor required to replace a facility at existing size and functional capability. Can be adjusted to address known local costs or historic preservation costs if needed.
Deferred Maintenance	DM	Maintenance that was not performed as it should have been. Example: in-kind replanting of a historic tree that was removed 10 years ago.
Facility	n/a	A term used to encompass land, buildings, other structures, and other real property improvements, including utilities; another term for Location.
Facility Type	n/a	A category used to delineate the class of a facility. Example: Agricultural Field under 3100 Maintained Landscapes.
Facility Condition Index	FCI	A measure of a facility's relative condition at a particular point in time to other similar facilities. FCI is a ratio of the cost of repair of asset deficiencies divided by the current replacement value (CRV). Performed at the Location level only.
Facility Management	FM	The planning, prioritizing, organizing, controlling, reporting, evaluation, and adjusting of facility use to support NPS activities based upon facility needs and NPS mission requirements.
Facility Management Software System	FMSS	An asset-based work identification, management, and analysis program, based on IBM Maximo® platform.
Facility Operations	FO	Work activities performed on a recurring basis throughout the year which intend to meet routine, daily park operational needs.
Location	n/a	Property that the NPS desires to track and manage as a distinct identifiable entity, based on set Asset Types, that require recurring maintenance and/or corrective actions to sustain or return it to an 'industry standard' level of acceptable condition; another term for "facility." Example: A hedge-enclosed flower garden within a residential landscape.
Maintained Landscapes	ML	The Asset Type (3100) comprised of exterior park areas exclusive of other Asset Types. Asset Type most closely aligned with cultural landscapes.
Preventative Maintenance	PM	Regularly scheduled periodic maintenance activities (within a year) on select Assets. Example: annual grading of a gravel road.
Routine Assessment	RA	Identification of minor deficiencies to support recurring maintenance and set short-term work plans.
Recurring Maintenance	RM	Work activities that recur based on normal wear patterns on a periodic cycle of greater than 1 year and less than 10 years. Example: resetting of a bluestone walk.
Work Order	n/a	Process for documenting work needs and collecting information to aid the work scheduling and assignment process.

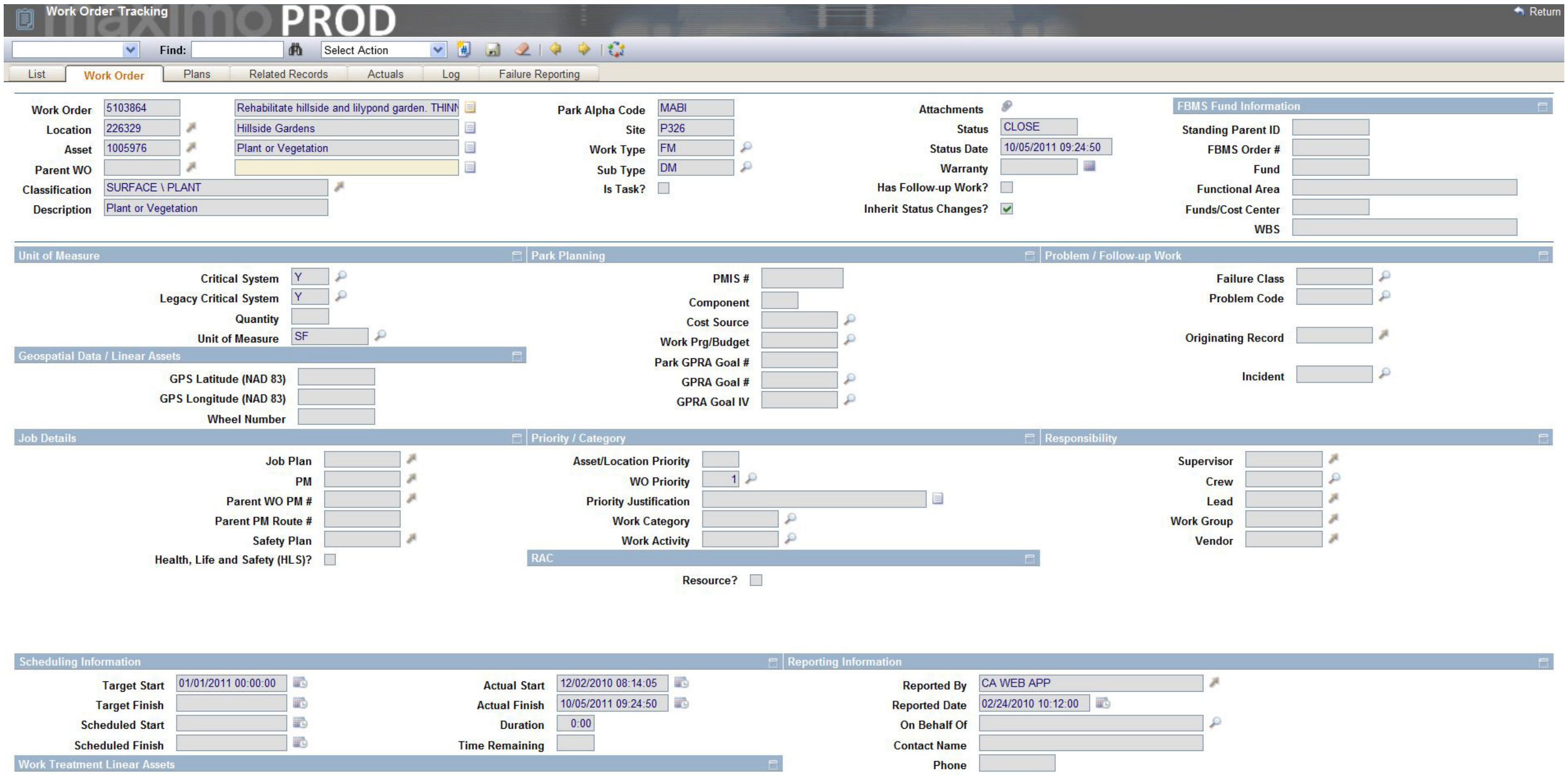
Appendix 2A. FMSS Sample Screen (FMSS version 6.2)

SAMPLE LOCATION RECORD SCREEN



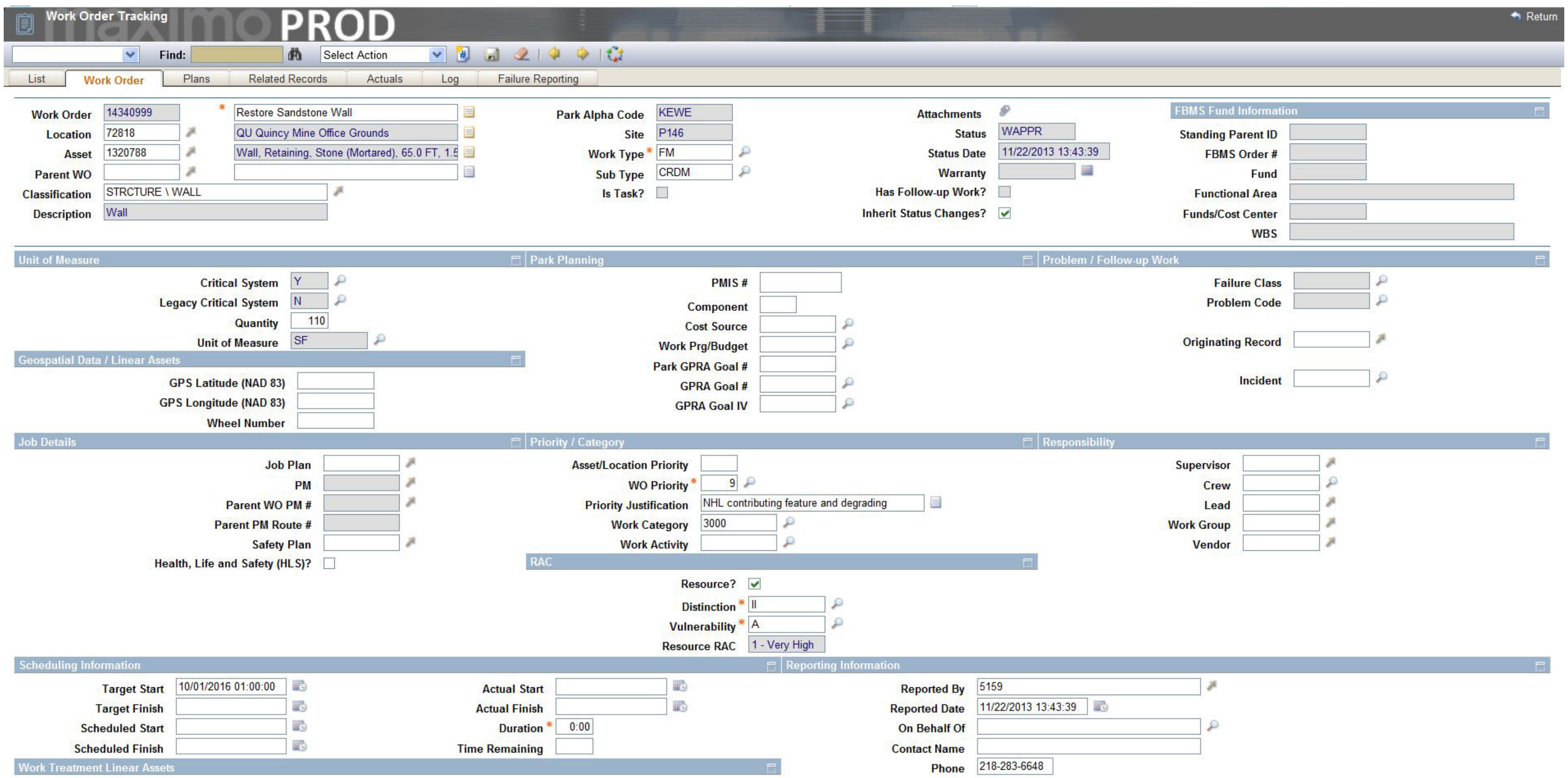
Appendix 2B. FMSS Sample Screen (FMSS version 6.2)

SAMPLE ASSET RECORD SCREEN



Appendix 2C. FMSS Sample Screen (FMSS VERSION 6.2)

SAMPLE WORK RECORD SCREEN



Appendix 3. Asset Codes and Categories for FMSS Location Records

Select List of Codes Common to Cultural Landscapes

Source: FMSS Desk Reference (2013)

SITE/AREA		UTILITY, continued
0000 – Site/Area		5500 – Communication Systems
ROAD		5700 – Fuel Systems
1100 – Roads		5800 – Solid Waste/Recycling Systems
1300 – Parking Areas		MARINE/WATERWAY/WATERFRONT
1700 – Road Bridges		6100 – Dams/Levees/Dikes
1800 – Road Tunnels		6200 – Constructed Waterways
TRAIL		6300 – Marina/Waterfront Systems
2100 – Trails		AVIATION/RAILROAD
2200 – Trail Bridges		6400 – Aviation Systems
2300 – Trail Tunnels		6500 – Railroad Systems
GROUNDS		6600 – Ship
3100 – Maintained Landscapes		UNIQUE ASSET
3800 – Boundaries		7100 – Outdoor Sculptures/Monuments
BUILDING		7200 – Maintained Archeological Sites
4100 – Buildings		7300 – Fortifications
UTILITY		7400 – Towers/Missile Silos
5100 – Water Systems		7500 – Interpretive Media
5200 – Waste Water Systems		7900 – Amphitheaters
5300 – Heating & Cooling Plants		
5400 – Electrical Systems		

Appendix 4. NPS Component Classification Hierarchy (for all Asset Types)

Select List of Components Common to Cultural Landscapes

Source: FMSS Desk Reference (2013)

Parent Classification	Classification Description	Full Classification (Including Sub-Parent Class)
Archeological		
ARCHLOGY	Archeology	ARCHLGCL/ARCHLOGY
Barrier & Fencing		
BARRIER	Fence/Gate	BARRIER/FENCGATE
BARRIER	Railing	BARRIER/RAILING
Communication		
COMMNCTN	Antenna/Trans Tower	COMMNCTN/ANTENNA
Electrical		
ELECTRCL	Lighting	ELECTRCL/LILGHT
ELECTRCL	Substation	ELECTRCL/SUBSTATS
Exhibit		
EXHIBIT	Interpretive Exhibit: Fixed Artillery	EXHIBIT/INTRPRTV/ARTILERY
EXHIBIT	Sculpture: Fountain/Pool	EXHIBIT/SCLPTURE/FNTNPOOL
Furnishing		
FURNISH	Exterior Furnishing	FURNISH/EXTFURN
HVAC		
HVAC	Cooling Tower	HVAC/COOLTOWR
Life Safety & Facility Protection		
SAFETY	Suppression: Fire Hydrant	SAFETY/SUPPRSSN/HYDRANT
Liquid & Gas		
LIQDNGAS	Plumbing: Irrigation Sys	LIQDNGAS/PLUMBING/IRRIGTN
LIQDNGAS	Plumbing: Valve	LIQDNGAS/PLUMBING/VALVE
Signage & Marking		
MARKING	Sign	MARKING/SIGN
MARKING	Traffic Light	MARKING/TRAFLGHT
Structure		
STRCTURE	Abutment	STRCTURE/ABUTMENT
STRCTURE	Wall	STRCTURE/WALL
STRCTURE	Access: Stairs	STRCTURE/ACCESS/STAIRS
Surface		
SURFACE	Land Surface	SURFACE/LANDSURF
SURFACE	Plant or Vegetation	SURFACE/PLANT
SURFACE	Trailer Pad	SURFACE/TRALRPAD
SURFACE	Turfgrass/Pasture Crop	SURFACE/TURFCROP
Water Control		
WTRCNTRL	Constructed Channel	WTRCNTRL/CONSCHAN
WTRCNTRL	Culvert	WTRCNTRL/CULVERT
WTRCNTRL	Drain	WTRCNTRL/DRAIN
WTRCNTRL	Outlet Work	WTRCNTRL/OUTLETWK

Appendix 5. Asset Priority Index (API) Values for Cultural Resource Preservation	
Source: NPS Asset Priority Index Criteria (2012)	
Value	**Definition**
High	The asset meets at least one of the following criteria: • The asset's preservation is specifically legislated • The asset is key to the park's legislated cultural significance • The asset meets the National Register criteria at the national level of significance • The asset is a National Historic Landmark • The asset is a contributing resource to a National Historic Landmark district or a nationally significant National Register property • The asset is a fundamental resource specified in the park's foundation document or park plans • The asset is a prehistoric asset • The asset directly protects a cultural resource • The asset meets FRP Historic Factor 1
Medium	The asset meets all of the following criteria: • The asset is of state or local significance and meets the National Register criteria individually or as a contributing resource of a property or district • The asset is compatible with the park's legislated significance, and • The asset has a continuing or potential use based on its design and location OR The asset meets at least one of the following criteria: • The asset limits the impacts of visitor use on a cultural resource, where impacts could cause major degradation • FRP Historic Factor 2 or 3
Low	The asset meets at least one of the following criteria: • The asset does not meet the National Register criteria, but a decision has been reached through a park planning process to manage the asset as a cultural resource • The asset meets the National Register criteria at the state or local level of significance, but is incompatible with the park's legislated significance or with the park's management objectives for fundamental resources • The asset meets the National Register criteria at the state or local level of significance, but has no continuing use or potential use, based on its design or location • The asset limits the impacts of visitor use on a cultural resource where impacts could cause limited degradation • FRP Historic Factor 4 or 5
None	Asset has no relationship to cultural resource preservation and meets FRP Historic Factor 6.
Federal Real Property (FRP) Historic Factors: 1. National Historic Landmark 2. National Register Listed 3. National Register Eligible 4. Non-contributing resource of National Historic Landmark or National Register district 5. Not evaluated 6. Evaluated, not historic	

Appendix 6A. Sample CRV Calculator Screen (FMSS version 6.2)

SAMPLE CRV CALCULATOR FOR A 3100 MAINTAINED LANDSCAPES LOCATION

Web CRV Calculator
National Park Service

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Guidance

- If after entering the quantities listed, the estimator feels the CRV is not reasonable, they should utilize the Historic/Other Costs section of the Calculator to complete the estimate.

- For items added to the Historic/Other Costs section, all costs will be multiplied in the worksheet by the Park Location Factor and Service Costs, so only bare national average costs should be entered.

Calculator

2100	Trail		History: Approved: 03/27/2014		Update CRV
Location Num	Location Description	FMSS Status	FMSS Location Quantity		CRV
81089	SEASIDE PATH (77)	OPERATING	3403 LF	Current CRV in FMSS:	$560,525.80
	Located at ACAD			Last Calculated Year:	2014
Comments: *(Max 100 characters)*				Direct Cost CRV based on national average:	$291,996.00
				Park Location Factor:	1.08
				Direct Cost CRV with Park Location Factor:	$315,355.68
				Net Construction Markup 77.7440%	$245,170.11
				Total CRV:	$560,525.79

Asset/Feature/Type Description		Quantity	UOM	Unit Price	Fixed Price	Cost
Tread	Asphalt	0	SF	$10.00	$0.00	$0.00
	Concrete	0	SF	$10.60	$0.00	$0.00
	Gravel (crushed stone aggregate)	0	SF	$3.11	$0.00	$0.00
	Native	0	SF	$2.70	$0.00	$0.00
	Paver block	150	SF	$13.40	$0.00	$2,010.00
	Rip Rap	0	SF	$60.60	$0.00	$0.00
	Wood chips	0	SF	$1.63	$0.00	$0.00
Raised Trail Structures	Boardwalk	0	SF	$17.00	$0.00	$0.00
	Gadbury	0	SF	$44.60	$0.00	$0.00
	Puncheon	0	SF	$35.90	$0.00	$0.00
	Turnpike/Causeway	3900	SF	$10.50	$0.00	$40,950.00
Other Features	Stairs, stone	0	EA	$350.00	$0.00	$0.00
	Number of Waterbars and Checks	0	EA	$173.00	$0.00	$0.00
	Retaining Wall	60	SF	$60.60	$0.00	$3,636.00
Historic / Other Costs	Ditching	240	SF	300	$0.00	$72,000.00
	Closed Stone Culvert	2	EA	3400	$0.00	$6,800.00
	Coping Wall	100	SF	85	$0.00	$8,500.00

Appendix 6B. Sample CRV Calculator Screen (FMSS version 6.2)

SAMPLE CRV CALCULATOR FOR A 3100 MAINTAINED LANDSCAPES LOCATION

Web CRV Calculator
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Guidance

- If after entering the quantities listed, the estimator feels the CRV is not reasonable, they should utilize the Historic/Other Costs section of the Calculator to complete the estimate.

- For items added to the Historic/Other Costs section, all costs will be multiplied in the worksheet by the Park Location Factor and Service Costs, so only bare national average costs should be entered.

Calculator

7100 Outdoor Sculptures/Monu/Interp — History: Approved: 04/29/2014 — Update CRV

Location Num	Location Description	FMSS Status	FMSS Location Quantity		CRV
62481	SC29 Scottys Castle Scott s Grave	OPERATING	1 EA	Current CRV in FMSS:	$67,530
	Located at DEVA			Last Calculated Year:	20

Comments: *(Max 100 characters)*

Direct Cost CRV based on national average:	$28,143
Park Location Factor:	1
Direct Cost CRV with Park Location Factor:	$37,993
Net Construction Markup 77.7440%	$29,537
Total CRV:	$67,530

Asset/Feature/Type Description		Quantity	UOM	Unit Price	Fixed Price	Cost
Sculptures	Stone Statuary: Average	0	CF	$655.00	$0.00	$0.00
	Stone Statuary: Ornate	0	CF	$1,080.00	$0.00	$0.00
	Stone Statuary: Very Ornate	0	CF	$1,510.00	$0.00	$0.00
	Life Size - Bronze Statuary	0	EA	$183,000.0	$0.00	$0.00
	2-1/2 Life Size - Bronze Statuary	0	EA	$458,000.0	$0.00	$0.00
Monuments	Stone Monuments: Average	64	CF	$342.00	$0.00	$21,888.00
	Stone Monuments: Ornate	0	CF	$422.00	$0.00	$0.00
	Stone Monuments: Very Ornate (Detailed cornices)	0	CF	$503.00	$0.00	$0.00
Plaques	20" x 30", up to 450 Letters, Cast Bronze	0	EA	$1,450.00	$0.00	$0.00
	30" x 36", up to 900 Letters, Cast Bronze	0	EA	$2,740.00	$0.00	$0.00
	36" x 48", up to 1300 Letters, Cast Bronze	1.50	EA	$4,170.00	$0.00	$6,255.00
Historic / Other Costs		0		0	$0.00	$0.00
		0		0	$0.00	$0.00
		0		0	$0.00	$0.00
		0		0	$0.00	$0.00

Appendix 6C. Sample CRV Calculator Screen (FMSS version 6.2)

SAMPLE CRV CALCULATOR FOR A 3100 MAINTAINED LANDSCAPES LOCATION

Web CRV Calculator
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Guidance

- The unit of measure RT MI is equivalent to the length (in miles) of a two-lane road. For example, a two-lane, ten-mile road would be 10 RT MI. In contrast, a one-lane, ten-mile road would be 5 RT MI and a four-lane, ten-mile road 20 RT MI.

- Square-Footage (SF) quantities are calculated by multiplying the length of the road in miles by the number of feet in a mile (5,280) and the width of the road. For example: 3.5 miles x 5,280 LF/mile x 11 LF = 203,280 SF

- If after entering the quantities listed, the estimator feels the CRV is not reasonable, they should utilize the Historic/Other Costs section of the Calculator to complete the estimate.

- For items added to the Historic/Other Costs section, all costs will be multiplied in the worksheet by the Park Location Factor and Service Costs, so only bare national average costs should be entered.

Calculator

1100	Roads			History: Approved: 01/24/2014	
Location Num	Location Description	FMSS Status	FMSS Location Quantity		CRV
104483	SB Wash Blvd RAMP to SB GWMP (RT-0508G)	OPERATING	0.68 MI	Current CRV in FMSS:	$6,926,100.68
	Located at GWMP			Last Calculated Year:	2014
Comments: *(Max 100 characters)*				Direct Cost CRV based on national average:	$3,746,800.00
				Park Location Factor:	1.04
				Direct Cost CRV with Park Location Factor:	$3,896,672.00
				Net Construction Markup 77.7440%:	$3,029,428.67
				Total CRV:	$6,926,100.67

Asset/Feature/Type Description		Quantity	UOM	Unit Price	Fixed Price	Cost
Paved Roads - by Terrain Type	Flat Terrain - Pavement and Related Components (paved)	0	Route M	$1,060,000	$0.00	$0.00
	Rolling Terrain - Pavement and Related Components (paved)	0	Route M	$1,060,000	$0.00	$0.00
	Mountainous Terrain - Pavement and Related Components (paved)	0	Route M	$2,620,000	$0.00	$0.00
	Urban Terrain - Pavement and Related Components (paved)	0.68	Route M	$5,510,000	$0.00	$3,746,800.00
Unpaved Roads with Native Soil - by Terrain Type	Flat Terrain - Road Bed and Related Components (native)	0	SF	$0.65	$0.00	$0.00
	Rolling Terrain - Road Bed and Related Components (native)	0	SF	$0.65	$0.00	$0.00
	Mountainous Terrain - Road Bed and Related Components (native)	0	SF	$1.04	$0.00	$0.00
	Urban Terrain - Road Bed and Related Components (native)	0	SF	$2.21	$0.00	$0.00
Unpaved Roads with Pit Run Gravel - by Terrain Type	Flat Terrain - Road Bed and Related Components (pit run gravel)	0	SF	$1.54	$0.00	$0.00
	Rolling Terrain - Road Bed and Related Components (pit run gravel)	0	SF	$1.54	$0.00	$0.00
	Mountainous Terrain - Road Bed and Related Components (pit run gravel)	0	SF	$2.47	$0.00	$0.00
	Urban Terrain - Road Bed and Related Components (pit run gravel)	0	SF	$5.25	$0.00	$0.00

Appendix 6D. Sample CRV Calculator Screen (FMSS version 6.2)

SAMPLE CRV CALCULATOR FOR A 3100 MAINTAINED LANDSCAPES LOCATION

Web CRV Calculator
National Park Service

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Guidance

- If after entering the quantities listed, the estimator feels the CRV is not reasonable, they should utilize the Historic/Other Costs section of the Calculator to complete the estimate.

- For items added to the Historic/Other Costs section, all costs will be multiplied in the worksheet by the Park Location Factor and Service Costs, so only bare national average costs should be entered.

Calculator

3100 — Maintained Landscapes | History: Approved: 06/26/2014 | Update CRV

Location Num	Location Description	FMSS Status	FMSS Location Quantity		CRV
69780	Nashville Pike Cultural Landscape	OPERATING	435.23 AC	Current CRV in FMSS:	$11,509,119.52
	Located at STRI			Last Calculated Year:	2014
Comments: *(Max 100 characters)*				Direct Cost CRV based on national average:	$6,411,000.00
				Park Location Factor:	1.01
				Direct Cost CRV with Park Location Factor:	$6,475,110.00
				Net Construction Markup 77.7440%	$5,034,009.51
				Total CRV:	$11,509,119.51

	Asset/Feature/Type Description	Quantity	UOM	Unit Price	Fixed Price	Cost
Agricultural Landscape	Agricultural Landscape - Simple	230	ACRE	$12,900.00	$0.00	$2,967,000.00
	Agricultural Landscape - Moderate	0	ACRE	$50,900.00	$0.00	$0.00
	Agricultural Landscape - Complex	0	ACRE	$106,000.0	$0.00	$0.00
Battlefield	Battlefield - Simple	205	ACRE	$16,800.00	$0.00	$3,444,000.00
	Battlefield - Moderate	0	ACRE	$55,900.00	$0.00	$0.00
	Battlefield - Complex	0	ACRE	$126,000.0	$0.00	$0.00
Structure Building Landscape	Structure Building Landscape - Simple	0	ACRE	$86,300.00	$0.00	$0.00
	Structure Building Landscape - Moderate	0	ACRE	$180,000.0	$0.00	$0.00
	Structure Building Landscape - Complex	0	ACRE	$302,000.0	$0.00	$0.00
Burial Landscape	Burial Landscape - Simple	0	ACRE	$38,000.00	$0.00	$0.00
	Burial Landscape - Moderate	0	ACRE	$149,000.0	$0.00	$0.00
	Burial Landscape - Complex	0	ACRE	$472,000.0	$0.00	$0.00
Campground	Campground - Simple	0	ACRE	$14,600.00	$0.00	$0.00
	Campground - Moderate	0	ACRE	$49,100.00	$0.00	$0.00
	Campground - Complex	0	ACRE	$142,000.0	$0.00	$0.00

Appendix 7. FMSS Work Types and Sub-types Related to Cultural Landscapes

Sources: FMSS Desk Reference (2013); FMSS Student Manual (2013)

Work Type / Sub-Type		Definition
FM	Facility Maintenance	The day-to-day activities as well as the planned work required to preserve facilities (buildings, structures, grounds, and utility systems) in such a condition that they may be used for their designated purpose over an intended service life. Facility maintenance includes all activities not included in Facility Operations and Capital Improvements.
CR	Component Renewal (Recapitalization)	The planned replacement of a component or system that will reach the end of its useful life based on condition and life cycle analysis within the facility's lifetime. Examples include roof replacement, utility upgrades, and repaving.
CM	Corrective Maintenance	Unscheduled reactive repairs that would not be estimated and planned, but are accomplished by local staff or existing service contractors, such as fixing a light standard damaged in an automobile accident.
DM	Deferred Maintenance	Maintenance that was not performed when it should have been, or was scheduled and was put off or delayed. Continued deferment of maintenance will result in deficiencies. Examples include repair of a stone wall that collapsed due to lack of maintenance to the associated drainage system.
DEM	Demolition	Removal of an asset that has been determined to be unsafe or no longer meets mission goals. Removal of an asset is determined by management in conjunction with NPS planning procedures.
EM	Emergency Maintenance	A maintenance task carried out to avert an immediate hazard, or to correct an unexpected failure, such as responding to a rockslide.
LMAC	Legis. Mandate Accessibility	Accessibility, EPA, lead-based paint, etc., deficiencies that must be corrected in response to regulatory requirements. These activities include retrofitting for code compliance and accessibility and removing hazardous materials.
PM	Preventative Maintenance	Regularly scheduled periodic maintenance activities (within 1 year) on selected assets. Examples include lubrication, minor adjustments, and seasonal pruning.
RM	Recurring Maintenance	Work activities that recur based on normal wear patterns on a periodic cycle of greater than 1 year and less than 10 years. Examples include painting, caulking, and replacement of a gravel surface on a walk.
FO	Facility Operations	Work activities performed on a recurring basis throughout the year that are intended to meet routine, daily park operational needs.
GC	Grounds Care	The methods, materials, equipment, and techniques used on a regular basis to sustain an improved landscape and associated features. Lawn mowing and trimming, weed control, pruning trees and shrubs, fertilizing plants, minor grading and mulching, raking leaves or sand, litter and debris pickup, adjusting irrigation systems, etc.
PC	Pest Control	Periodic actions that eliminate or protect facilities from pests which encompasses insects, rodents, nematodes, fungi, weeds, and other forms of terrestrial or aquatic plant or animal life or virus, bacteria, or other form of micro-organism.
SN	Snow/Sand/Debris	Activities performed to ensure safety from unanticipated hazards or obstructions; removal or precautions applied to roads, parking, trails, benches, waterways, and sidewalks.
CI	Capital Improvements	Changes to the interior arrangements or other physical characteristics of an existing facility or installed equipment so that it can be used more effectively for its currently designated purpose or adapted to a new use. Alterations may include work referred to as improvement, conversion, remodeling, and modernization. Such alterations are not maintenance.
LMAC	Legis. Mandate Accessibility	Accessibility, EPA, lead-based paint, etc., deficiencies that must be corrected in response to regulatory requirements. These activities include retrofitting for code compliance and accessibility and removing hazardous materials.
NC	New Construction	Construction that adds to the existing footprint of an asset, or creates a new asset. Examples include expanding a parking lot and replacing portable restrooms with a permanent facility in a frequently visited area.

Appendix 8. Sample FMSS Summary Data Crosswalk Table

Representative Entries from Marsh-Billings-Rockefeller National Historical Park, FMSS Site: Estate

FMSS Location Record	NPS Classification	FMSS Asset Record	CLI #	CLI Feature Name	CLR #	CLR Feature Name	LCS #	Park Structure Name/Number	Evaluation
1100 Roads									
88797 Estate Main Entrance Road	BARRIER/ TRAFFBAR	199506 Traffic Barrier, Steel	131438	Main Entrance Drive	C-1 C-7	Main Entrance Drive Mansion Parking Area	40510	HR-01	Historic
	SURFACE/ TRAFSURF	396786 Traffic Surface, Gravel							Wall, Retaining part of BS-9: Perimeter Stone Wall, BS-9 HLF-05, LCS 40517 (Historic)
	STRCTURE/WALL	483552 Wall, Retaining, Masonry/Stone							Steel traffic barrier not inventoried in CLR; not historic
3100 Maintained Landscapes									
226032 Hill	LIQDNGAS/WELL	188293 Well, Reservoir	111388	Reservoir	BS-25	Reservoir	40529	HS-11 Reservoir	Historic
	FURNISH/ GENFURN	188401 Upper Meadow Corral Horse Trough	131750	Upper Meadow Corral Horse Trough	SSF-31	Upper Meadow Corral Horse Trough	n/a	n/a	Historic
	SURFACE/ TRAFSURF	188298 Traffic Surface (Hill Trails & Paths)	111422	Hill Trails	C-30	Upper Hillside Path	n/a	n/a	Historic
				C-31	Arboretum Path	n/a	n/a	n/a	
				C-33	Woodland Garden Path	n/a	n/a	n/a	
59141 Mansion Terrace	BARRIER/ FENCGATE	188279 Upper Summerhouse iron fence	11646	Upper Summerhouse Iron Fence	SSF-2	Upper Summerhouse Iron Fence	n/a	n/a	Historic
	SURFACE/PLANT	188615 Plant or Vegetation, 6.5 FT, 619 FT, 8 FT	131302	Perimeter Hemlock Hedge	V-24	Perimeter Hemlock Hedge	n/a	n/a	Historic
	SURFACE/ TRALRPAD	188350 Summerhouses Path	131454	Summerhouses Path	C-9	Summerhouses Path	n/a	n/a	Historic
4100 Buildings									
43137 Lower Summerhouse	SURFACE/FINISH/ EXTFNSH	359222, Exterior Finish, No Finish	131552	Lower Summerhouse	BS-5	Lower Summerhouse	40526	HS-08	Historic
	SURFACE/ ROOFSURF	355548 Roof Surface, Copper							
87838 Forest Center	Multiple	Multiple	n/a	n/a	n/a	n/a	n/a	n/a	Non-historic; not inventoried in CLR
5400 Electrical Systems									
88164 Electrical Distribution System	ELECTRCL/LIGHT	28343	131658	Lampposts (Rockefeller-installed)	SSF-6	Lampposts	40516	HLF-04	Asset includes both historic and non-historic components

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Cultural Resources

Park Historic Structures & Cultural Landscapes