NATIONAL PARK SERVICE • U.S. DEPARTMENT OF THE INTERIOR

Foundation Document

Crater Lake National Park

Oregon

August 2015

Signatures
8-7-2015


UMPQUA NATIONAL FOREST
ROGUE RIVER NATIONAL FOREST
WINEMA NATIONAL FOREST
CRATER LAKE NATIONAL PARK
SKY LAKES WILDERNESS
SUN PASS STATE FOREST
Crater Lake
Rim Village
Rim Village Café & Gift Shop
Sinnott Memorial Overlook
Rim Village Visitor Center
Crater Lake Lodge
Park HQ
Steel Visitor Center
North Entrance Station
North Junction
Cleetwood Cove Trail
Watchman Overlook
Cloudcap Overlook
Phantom Ship Overlook
Pinnacles Overlook
Vidae Falls
Duwee Falls
Annie Spring Entrance Station
Annie Creek Restaurant and Gift Shop
Mazama Village
MOUNT SCOTT
(highest point in park)
8929ft
2721m
Kerr Notch
Plaikni Falls
Lost Creek
THE PINNACLES
PUMICE DESERT
PUMICE FLAT
Oasis Butte
Red Cone
Red Cone Spring
Sphagnum Bog
Boundary Springs
Lake West
Beaver Meadows
East Fork Creek
Rogue River
Thousand Springs
Whitehorse Ponds
Annie Spring
Stuart Falls
Lightning Spring
WIZARD ISLAND
Steel Bay
Grotto Cove
Cloudcap Bay
Cascade Mountain Pass
To Medford and 5
To Bend, Eugene, and 97
To Klamath Falls and 97
To Diamond Lake, Roseburg, and
North Entrance Road
East Rim Dr
West Rim Dr.
East Rim Drive
Grayback Drive
Pinnacles Road
Annie Creek
SAND RIDGE
Pacific Crest National Scenic Trail
230
138
62

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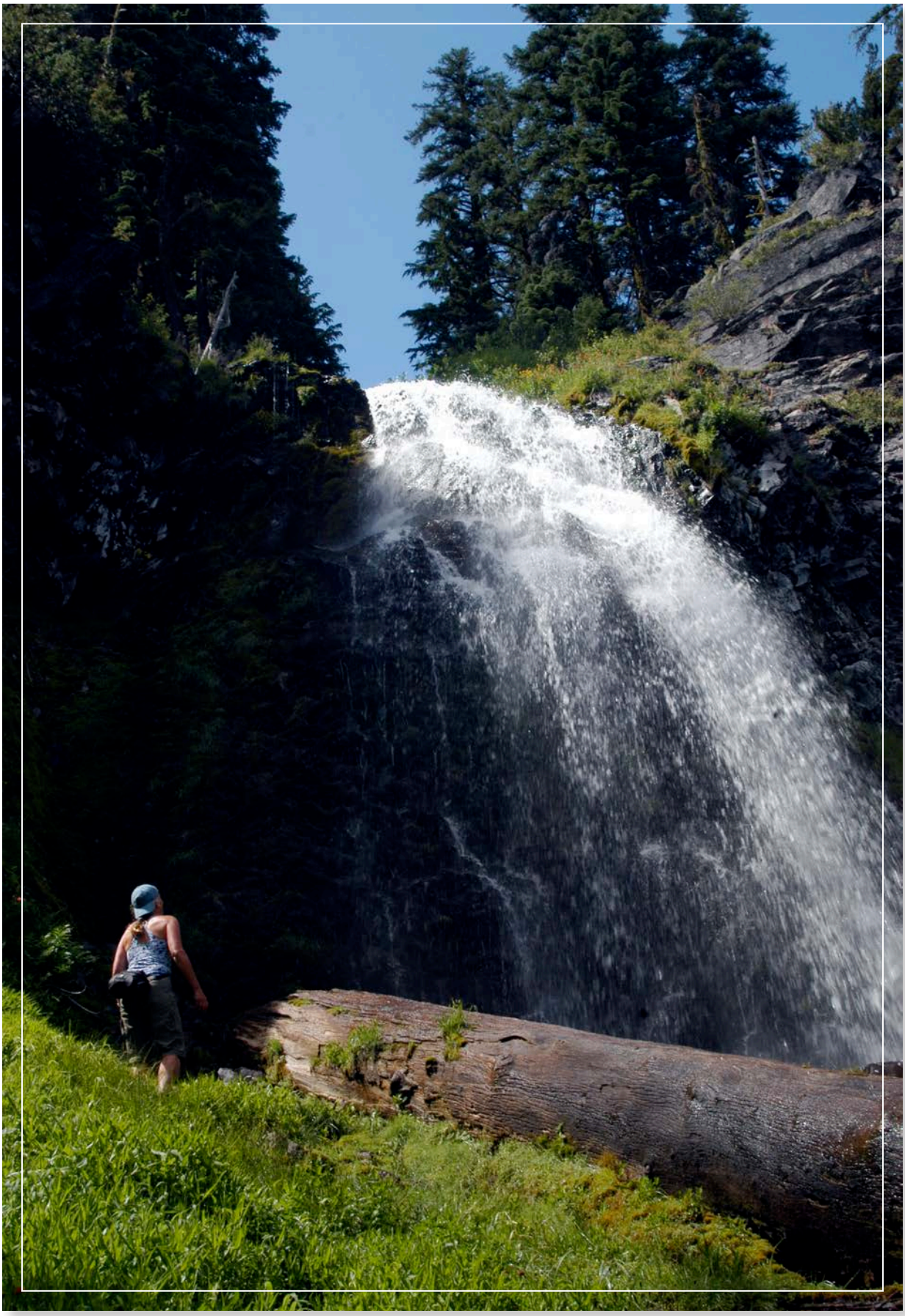


Mission of the National Park Service

The National Park Service (NPS) preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education, and inspiration of this and future generations. The National Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

The NPS core values are a framework in which the National Park Service accomplishes its mission. They express the manner in which, both individually and collectively, the National Park Service pursues its mission. The NPS core values are:

- **Shared stewardship**: We share a commitment to resource stewardship with the global preservation community.
- **Excellence**: We strive continually to learn and improve so that we may achieve the highest ideals of public service.
- **Integrity**: We deal honestly and fairly with the public and one another.
- **Tradition**: We are proud of it; we learn from it; we are not bound by it.
- **Respect**: We embrace each other's differences so that we may enrich the well-being of everyone.

The National Park Service is a bureau within the Department of the Interior. While numerous national park system units were created prior to 1916, it was not until August 25, 1916, that President Woodrow Wilson signed the National Park Service Organic Act formally establishing the National Park Service.

The national park system continues to grow and comprises more than 400 park units covering more than 84 million acres in every state, the District of Columbia, American Samoa, Guam, Puerto Rico, and the Virgin Islands. These units include, but are not limited to, national parks, monuments, battlefields, military parks, historical parks, historic sites, lakeshores, seashores, recreation areas, scenic rivers and trails, and the White House. The variety and diversity of park units throughout the nation require a strong commitment to resource stewardship and management to ensure both the protection and enjoyment of these resources for future generations.

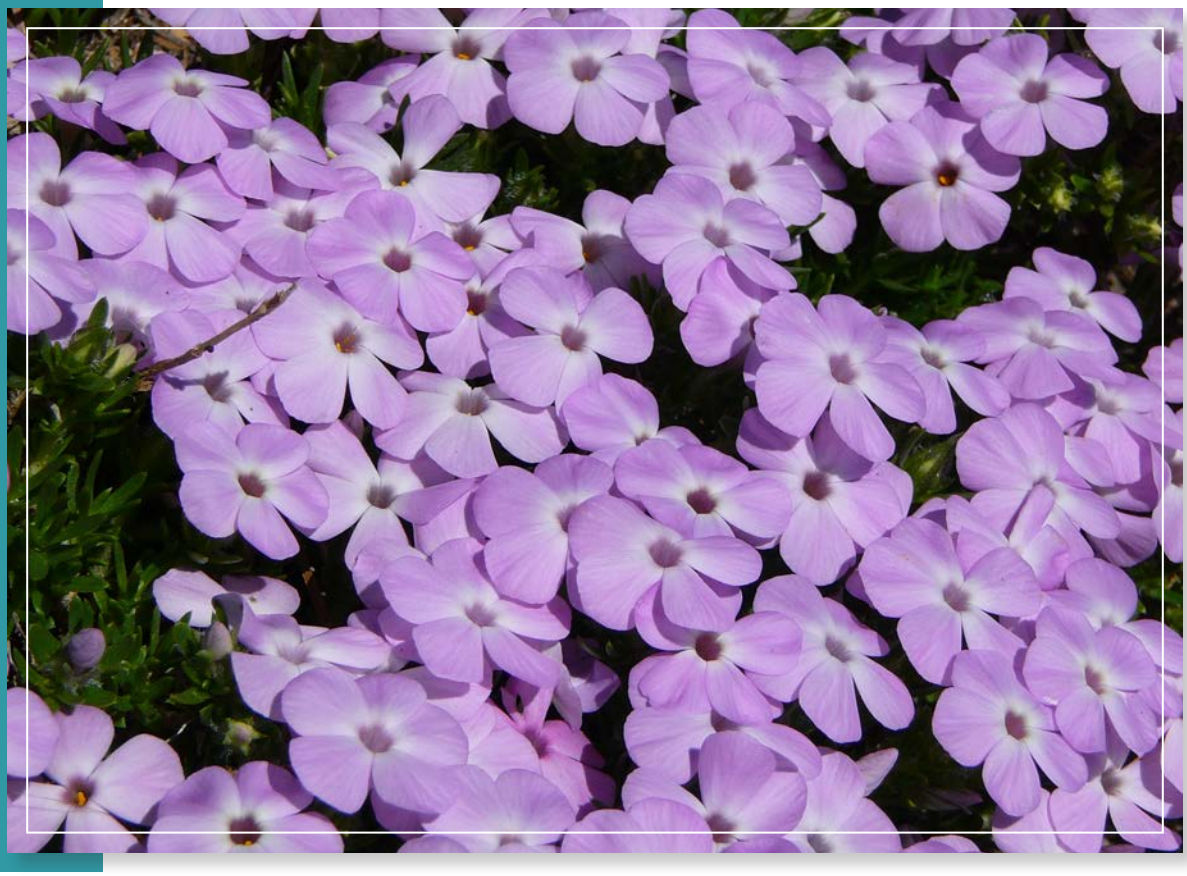
The arrowhead was authorized as the official National Park Service emblem by the Secretary of the Interior on July 20, 1951. The sequoia tree and bison represent vegetation and wildlife, the mountains and water represent scenic and recreational values, and the arrowhead represents historical and archeological values.

Introduction

Every unit of the national park system will have a foundational document to provide basic guidance for planning and management decisions—a foundation for planning and management. The core components of a foundation document include a brief description of the park as well as the park's purpose, significance, fundamental resources and values, other important resources and values, and interpretive themes. The foundation document also includes special mandates and administrative commitments, an assessment of planning and data needs that identifies planning issues, planning products to be developed, and the associated studies and data required for park planning. Along with the core components, the assessment provides a focus for park planning activities and establishes a baseline from which planning documents are developed.

A primary benefit of developing a foundation document is the opportunity to integrate and coordinate all kinds and levels of planning from a single, shared understanding of what is most important about the park. The process of developing a foundation document begins with gathering and integrating information about the park. Next, this information is refined and focused to determine what the most important attributes of the park are. The process of preparing a foundation document aids park managers, staff, and the public in identifying and clearly stating in one document the essential information that is necessary for park management to consider when determining future planning efforts, outlining key planning issues, and protecting resources and values that are integral to park purpose and identity.

While not included in this document, a park atlas is also part of a foundation project. The atlas is a series of maps compiled from available geographic information system (GIS) data on natural and cultural resources, visitor use patterns, facilities, and other topics. It serves as a GIS-based support tool for planning and park operations. The atlas is published as a (hard copy) paper product and as geospatial data for use in a web mapping environment. The park atlas for Crater Lake National Park can be accessed online at: http://insideparkatlas.nps.gov/.



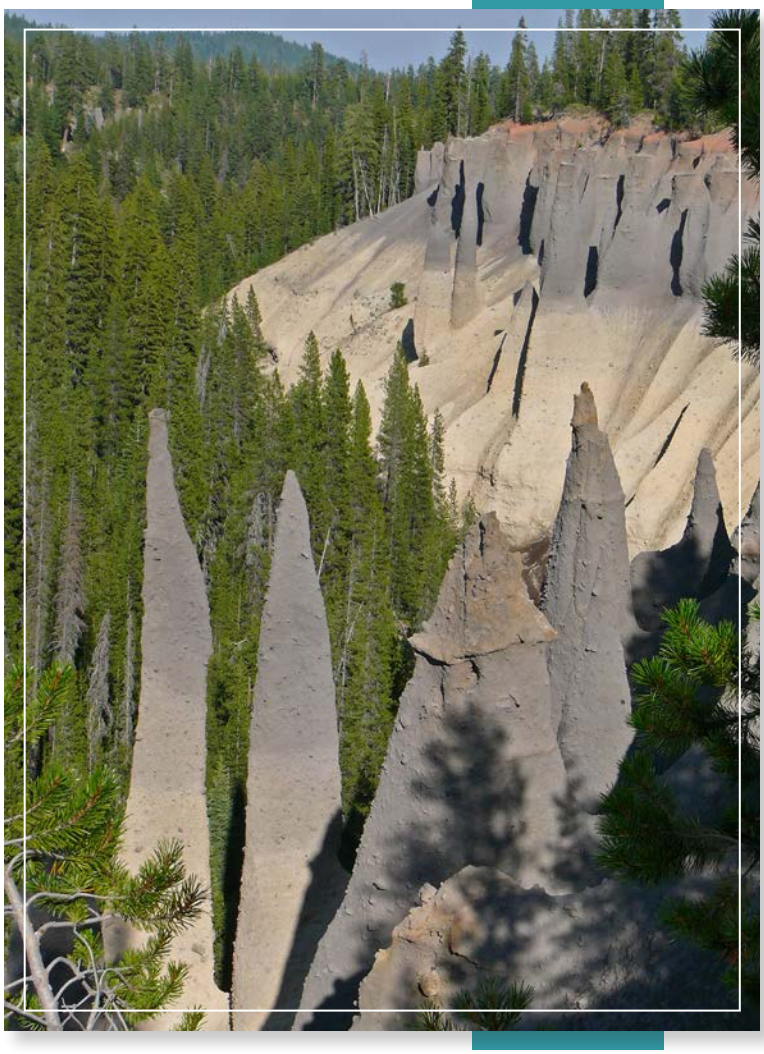
Part 1: Core Components

The core components of a foundation document include a brief description of the park, park purpose, significance statements, fundamental resources and values, other important resources and values, and interpretive themes. These components are core because they typically do not change over time. Core components are expected to be used in future planning and management efforts.

Brief Description of the Park

Crater Lake National Park—established in 1902—is in southwest Oregon in the south-central portion of the Cascade Range. The park ranges in elevation from about 3,800 feet to just over 8,900 feet at Mount Scott. Near the center of the park is one of its most spectacular features, Crater Lake. At 1,943 feet deep, it is the deepest lake in the United States. The lake is in a caldera, which was formed when the top of 12,000-foot Mount Mazama erupted and collapsed about 7,700 years ago. Over the centuries, the caldera has collected water from rain and snow to form the lake. The lake is about 5 miles in diameter and is surrounded by the jagged, steep-walled cliffs of the caldera left by the climatic eruption. The cliffs surrounding the lake rise from 500 to 2,000 feet above the lake's surface.

From the rimmed summit, the land slopes gradually downward in all directions. There are no inlets or outlets to the lake, and evaporation and seepage prevent the lake from becoming deeper. Crater Lake has no influent or effluent streams to provide continuing supplies of oxygen, nutrients, and fresh water and is considered a youthful lake with a high level of purity. The lack of dissolved minerals greatly restricts the growth of aquatic plants and the absence of sufficient carbonates inhibits the development of large-shelled animals. The result is a high level of light penetration that exceeds other alpine lakes. Crater Lake has been the object of scientific study for more than a century.



The park encompasses approximately 182,304 acres and is heavily forested, except for a number of treeless, pumice-covered flats. Streams originating on the slopes of the caldera form headwaters of the Rogue River to the west or join the Klamath Basin to the south and east. Steep-walled canyons cut through pumice and towering fossil fumaroles contribute to the ruggedness of the terrain.

The flora within the national park is typical of the vegetation found throughout the Southern Cascades and ranges from mixed conifer forest dominated by ponderosa pine in the south to high elevation mountain hemlock and whitebark pine forest at the rim. The park is regarded as a sanctuary for native forest and meadow communities.

The park lands are of continuing importance to members of American Indian tribes. Klamath Indian and Umpqua people tell stories of the eruption of Mount Mazama, and artifacts found buried under Mazama ash and pumice are evidence of the great impact the eruption had on people living in the area. Crater Lake was used as a place for vision quests and prayer, and the surrounding areas were used for resource harvesting activities and other cultural traditions. The park is part of a larger cultural landscape that extends well beyond park boundaries. Today, the park is fortunate to have the support of local and regional partners, who contribute to the protection of resources and enhance visitor experiences.

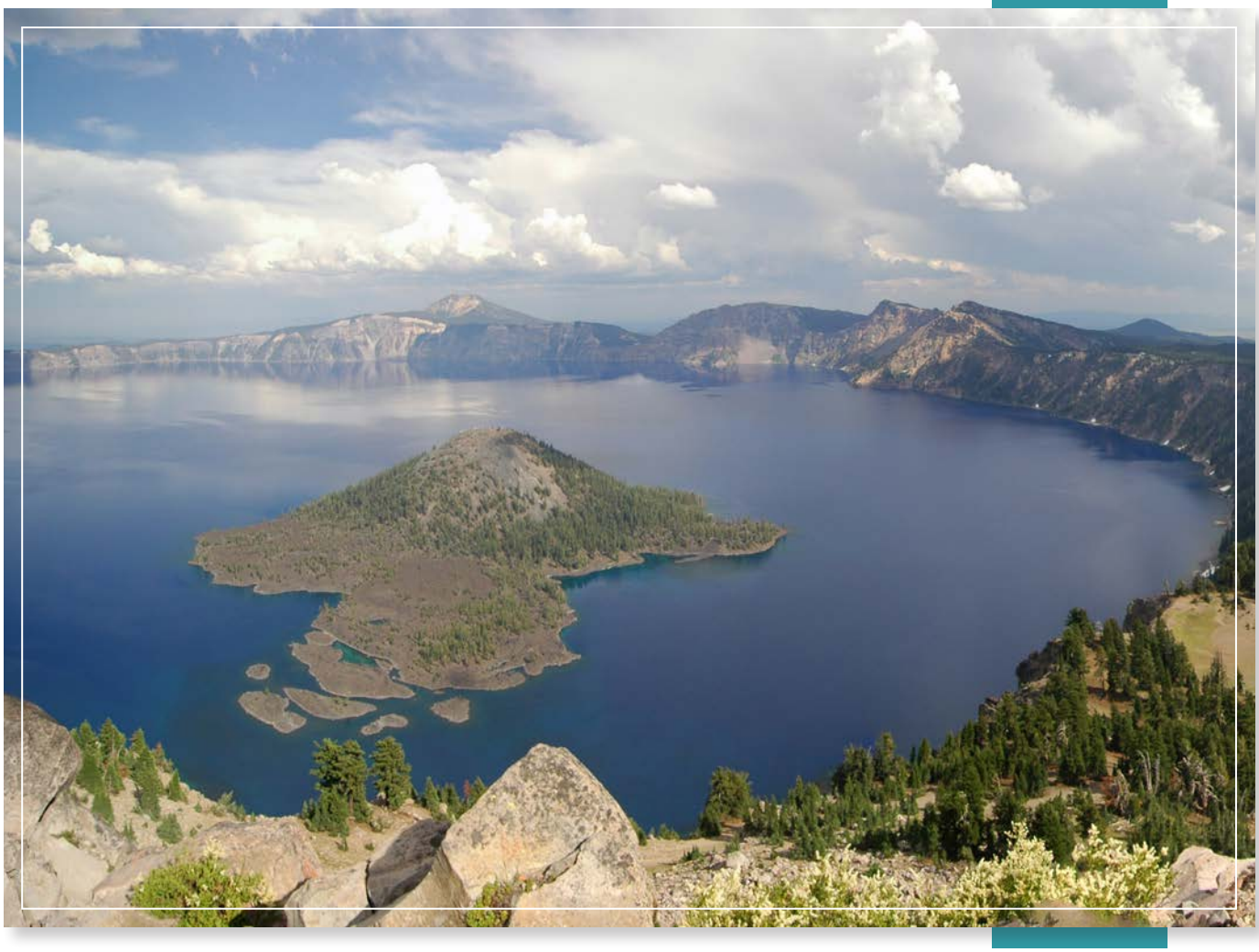
The park's southern entrance station at Mazama Village is 76 miles from Medford and 56 miles from Klamath Falls and can be reached by Oregon State Route (OR) 62. During summer the park can also be reached from the north by OR 138. Both access roads lead to Rim Drive, a 33-mile roadway that circles the caldera rim. Rim Drive and OR 209, which runs through the park, have been designated as part of the Volcanic Legacy Scenic Byway, and numerous pullouts provide scenic lake views.

The park is one of many opportunities for visitors in the area. Many people stop at the park as part of a north-south trip to various parks and scenic areas in Oregon and Northern California. In recent years park attendance has approached 600,000 and continues to grow. As a leading attraction in Southern Oregon, visitor spending contributes significantly to the regional economy.

Park Purpose

The purpose statement identifies the specific reason(s) for establishment of a particular park. The purpose statement for Crater Lake National Park was drafted through a careful analysis of its enabling legislation and the legislative history that influenced its development. The park was established when the enabling legislation adopted by Congress was signed into law on May 22, 1902 (see appendix A for enabling legislation). The purpose statement lays the foundation for understanding what is most important about the park.

Crater Lake National Park forever preserves Crater Lake, scenic landscapes, volcanic features, and unique ecological and cultural heritage, and fosters understanding and appreciation through enjoyment, education, and inspiration.



Park Significance

Significance statements express why a park's resources and values are important enough to merit designation as a unit of the national park system. These statements are linked to the purpose of Crater Lake National Park, and are supported by data, research, and consensus. Statements of significance describe the distinctive nature of the park and why an area is important within a global, national, regional, and systemwide context. They focus on the most important resources and values that will assist in park planning and management.

The following significance statements have been identified for Crater Lake National Park. (Please note that the sequence of the statements does not reflect the level of significance.)

1. The magnificence and splendor of Crater Lake are realized by the lake's geographic setting, untrammeled condition, and unique combination of biology, chemistry, and physics, including the lake's remarkable clarity, color, and depth.

2. Crater Lake National Park provides exceptional opportunities for visitors to experience spectacular mountain scenery and volcanic landscapes, dark night skies, clean air, and natural sounds and quiet. As part of the High Cascade region, the park is part of one of the snowiest landscapes in the United States and provides year-round access for recreational activities and wilderness experiences such as solitude.

3. The parklands include an assemblage of native vegetative communities that have largely escaped human alteration and remain essentially intact. The diversity and natural stability of these assemblages support a full complement of flora and fauna, contributing to the resilience and integrity of the greater Mazama ecosystem.

4. Crater Lake National Park contains archeological, architectural, historical, and material collections related to the settlement of the area and development of the park. Much of Rim Village, park headquarters, and Rim Drive are within districts listed in the National Register of Historic Places, and the park exhibits one of the best examples of blending rustic architecture and built features within a national park setting.

5. The lands within Crater Lake National Park are of enduring importance to contemporary members of American Indian tribes because of their centrality to longstanding cultural traditions and resource harvesting activities, as well as their significance as sacred sites. The park is part of a larger cultural landscape that extends well beyond park boundaries.

6. Crater Lake National Park is recognized as an outstanding laboratory for research on natural systems and processes. Crater Lake has been the object of scientific investigation since the late 1800s, making it the most studied caldera lake in the world and creating an internationally important long-term body of scientific knowledge. The park's legacy of scientific inquiry incites new research that continually informs management, enhances education, and promotes stewardship of the park's natural and cultural resources.

7. The climactic eruption and collapse of Mount Mazama more than 7,700 years ago formed an array of distinctive geologic features, such as the caldera, pumice desert, and pinnacles. These features are extraordinary in that they are geologically young, exposed, and well-preserved.

Fundamental Resources and Values

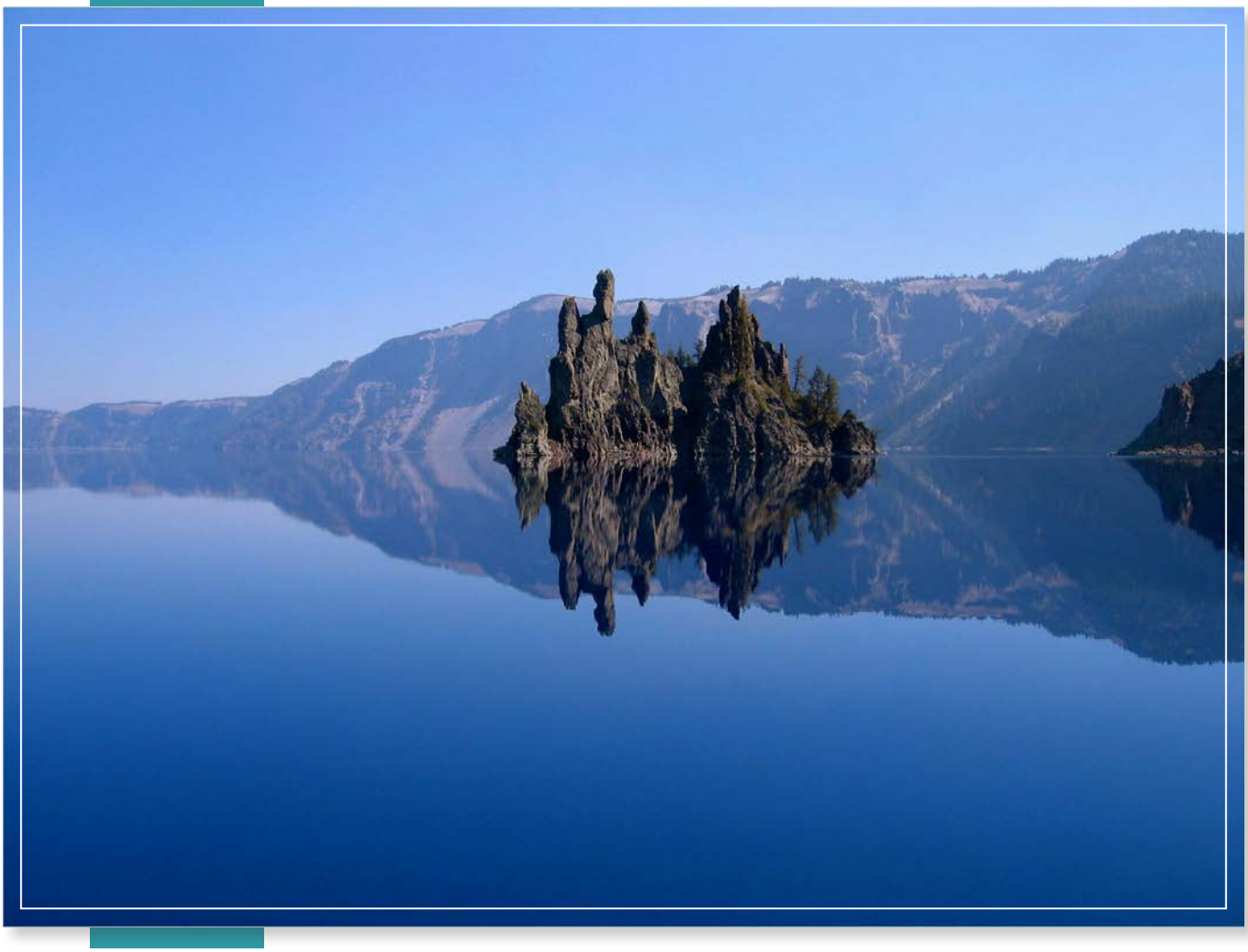
Fundamental resources and values (FRVs) are those features, systems, processes, experiences, stories, scenes, sounds, smells, or other attributes determined to warrant primary consideration during planning and management processes because they are essential to achieving the purpose of the park and maintaining its significance. Fundamental resources and values are closely related to a park's legislative purpose and are more specific than significance statements.

Fundamental resources and values help focus planning and management efforts on what is truly significant about the park. One of the most important responsibilities of NPS managers is to ensure the conservation and public enjoyment of those qualities that are essential (fundamental) to achieving the purpose of the park and maintaining its significance. If fundamental resources and values are allowed to deteriorate, the park purpose and/or significance could be jeopardized.

The following fundamental resources and values have been identified for Crater Lake National Park:

- **Crater Lake–** Crater Lake National Park's world-renowned caldera holds one of the clearest, bluest, and deepest lakes in the world. Its clarity and color is due in great part to the lack of suspended particulates and extremely low organic productivity. It contains significant and active hydrothermal features, which, among other lake qualities, have made it one of the most extensively monitored lakes of its size in the world. Its impressive scale and geographic setting within the high Cascade Mountains create lasting memories and inspire visitors.
- **Enduring Legacy of Human Relationships with the Landscape –** People have been drawn to and linked to the Crater Lake area for millennia. Its botanical resources and volcanic past have been incorporated into American Indian cultures and today retain great significance to them and to people who have more recently created ties to the landscape. The park's extensive museum and archive collections document ethnobotanical, anthropologic, and historic artifacts and stories. The park's rustic Cascadian architecture and Rim Drive demonstrate how nature has influenced the built environment and record the evolution of the National Park Service role in managing the park.
- **Distinctive Volcanism and Geology –** The cataclysmic, geologically recent eruption of volcanic Mount Mazama spewed 12 cubic miles of magma and had a significant impact on the landscapes and people of the area. The caldera continues to impress visitors and scientists with its steep, jagged walls and visible geologic record. The volcanic activity that created the caldera and built Mount Mazama over the last 400,000 years continues to influence the greater ecoregion.

- **Complex and Varied Hydrological Resources and Processes –** Crater Lake has no inlet or outlet and is maintained by a balance of surface evaporation, precipitation that can exceed 500 inches per year, and intricate seepage through a thick layer of permeable glacial till. The park encompasses several perennial lakes and ponds, more than 250 wetlands, 24 year-round streams, 1 high elevation bog, and the headwaters for several major rivers.
- **Representative Cascade Mountain Ecosystems –** Much more than a lake, the park contains highly intact and heterogeneous vegetative communities essentially unaltered by humans. Its natural disturbance regime and connectivity to surrounding protected areas make it an important refuge for common and endemic terrestrial and aquatic species.
- **Awe-Inspiring Scenery–** The steep jagged walls of the caldera rim, clear blue waters of Crater Lake, and vast unaltered native vegetative communities are beloved and oft-cited scenic treasures of Crater Lake National Park. The park's clean air and minimal light pollution allow visitors to see for miles and experience dark night skies in a nearly pristine condition.



- **Vast Body of Knowledge and Opportunities for Research and Education –** The youth and integrity of Crater Lake and the volcanic caldera, as well as the remarkable quality and diversity of ecosystems in the park, make the park an invaluable natural laboratory and classroom that has inspired scientists to collect a prodigious body of knowledge since the late 1800s. This extensive data set contributes to Crater Lake National Park's usefulness as a gauge to measure and describe human impacts on the natural environment.
- **Abundant Opportunities for Visitor Connections to Nature and History–** An extensive network of recreational and educational opportunities permits a diverse set of visitors to appreciate the park from many perspectives. More than 90 miles of trail, 36 scenic overlooks along Rim Road, guided tours, charismatic architecture, minimal light and noise pollution, and numerous interpretive programs provide intimate access to the park's natural and cultural heritage in every season. Place-based, life-long learning opportunities offer visitors additional ways to study and understand park resources.

Other Important Resources and Values

Crater Lake National Park contains other resources and values that are not fundamental to the purpose of the park and may be unrelated to its significance, but are important to consider in planning processes. These are referred to as "other important resources and values" (OIRV). These resources and values have been selected because they are important in the operation and management of the park and warrant special consideration in park planning.

The following other important resources and values have been identified for Crater Lake National Park:

- **Volcanic Legacy Scenic Byway All American Road –** One of just 27 All American Roads in the United States, the Volcanic Legacy Scenic Byway connects Lassen Volcanic Park in Northern California and Crater Lake National Park in Southern Oregon. The volcanic activity of the Cascade Range has created unique geological formations and influenced the development of dense forests, broad wetlands, and clear streams that can be seen while traveling along the byway through the park.
- **Segments of the Pacific Crest Trail –** The Pacific Crest Trail spans 2,650 miles from Mexico to Canada through California, Oregon, and Washington. The trail provides commanding vistas of volcanic peaks in the Cascade Range, and 33 miles of the trail traverse the park, where a side trail leads to the rim for a spectacular view of the lake.

Interpretive Themes

Interpretive themes are often described as the key stories or concepts that visitors should understand after visiting a park—they define the most important ideas or concepts communicated to visitors about a park unit. Themes are derived from, and should reflect, park purpose, significance, resources, and values. The set of interpretive themes is complete when it provides the structure necessary for park staff to develop opportunities for visitors to explore and relate to all park significance statements and fundamental and other important resources and values.

Interpretive themes are an organizational tool that reveal and clarify meaning, concepts, contexts, and values represented by park resources. Sound themes are accurate and reflect current scholarship and science. They encourage exploration of the context in which events or natural processes occurred and the effects of those events and processes. Interpretive themes go beyond a mere description of the event or process to foster multiple opportunities to experience and consider the park and its resources. These themes help explain why a park story is relevant to people who may otherwise be unaware of connections they have to an event, time, or place associated with the park.

The following interpretive themes have been identified for Crater Lake National Park:

- **Science and the Lake –** The inventory, monitoring, observation, and research of Crater Lake over long periods of time produce robust data that scientists, educators, and decision makers use to understand, and become better stewards of, this and other caldera lakes around the world.
- **Geology and Landscape –** A nearly unfathomable force of nature in the form of a massive volcanic eruption, occurring 7,700 years ago, began a long, slow, and natural process that continues to shape the landscape in and beyond park boundaries.
- **Cascade/Mazama Ecosystem –** The establishment of Crater Lake National Park enabled the preservation of the extraordinarily rich biological diversity of the Cascade/Mazama ecosystem, which is continuously supported by ongoing research efforts and actions.
- **Cultural History –** From a sacred place of power and danger to one of the very first national parks, the Crater Lake landscape has changed and been changed by humans for thousands of years.
- **Scenery and Visitor Recreation –** Crater Lake's breathtaking beauty, seasonal weather extremes, clear skies, and distinguishing natural and cultural features, combined with a variety of recreational opportunities, provide visitors with abundant chances for discovery, reflection, and inspiration.
- **Human Environmental Impact –** The pristine nature of Crater Lake and the surrounding environment is an excellent barometer with which to measure and describe human impacts on the natural environment, ranging from invasive species and air pollution to climate change.

Part 2: Dynamic Components

The dynamic components of a foundation document include special mandates and administrative commitments and an assessment of planning and data needs. These components are dynamic because they will change over time. New special mandates can be established and new administrative commitments made. As conditions and trends of fundamental and other important resources and values change over time, the analysis of planning and data needs will need to be revisited and revised, along with key issues. Therefore, this part of the foundation document will be updated accordingly.

Special Mandates and Administrative Commitments

Many management decisions for a park unit are directed or influenced by special mandates and administrative commitments with other federal agencies, state and local governments, utility companies, partnering organizations, and other entities. Special mandates are requirements specific to a park that must be fulfilled. Mandates can be expressed in enabling legislation, in separate legislation following the establishment of the park, or through a judicial process. They may expand on park purpose or introduce elements unrelated to the purpose of the park. Administrative commitments are, in general, agreements that have been reached through formal, documented processes, often through memorandums of agreement. Examples include easements, rights-of-way, arrangements for emergency service responses, etc. Special mandates and administrative commitments can support, in many cases, a network of partnerships that help fulfill the objectives of the park and facilitate working relationships with other organizations. They are an essential component of managing and planning for Crater Lake National Park.

For more information about the existing special mandates and administrative commitments for Crater Lake National Park, please see appendix C.

Assessment of Planning and Data Needs

Once the core components of part 1 of the foundation document have been identified, it is important to gather and evaluate existing information about the park's fundamental and other important resources and values, and develop a full assessment of the park's planning and data needs. The assessment of planning and data needs section presents planning issues, the planning projects that will address these issues, and the associated information requirements for planning, such as resource inventories and data collection, including GIS data.

There are three sections in the assessment of planning and data needs:

1. analysis of fundamental and other important resources and values (see appendix B)
2. identification of key issues and associated planning and data needs
3. identification of planning and data needs (including spatial mapping activities or GIS maps)

The analysis of fundamental resources and values and identification of key issues leads up to and supports the identification of planning and data collection needs.

Analysis of Fundamental Resources and Values

The fundamental resource or value analysis table includes current conditions, potential threats and opportunities, planning and data needs, and selected laws and NPS policies related to management of the identified resource or value. Please see appendix B for the analysis of fundamental resources and values.

Identification of Key Issues and Associated Planning and Data Needs

This section considers key issues to be addressed in planning and management and therefore takes a broader view over the primary focus of part 1. A key issue focuses on a question that is important for a park. Key issues often raise questions regarding park purpose and significance and fundamental and other important resources and values. For example, a key issue may pertain to the potential for a fundamental or other important resource or value in a park to be detrimentally affected by discretionary management decisions. A key issue may also address crucial questions that are not directly related to purpose and significance, but which still affect them indirectly. Usually, a key issue is one that a future planning effort or data collection needs to address and requires a decision by NPS managers.

The following are key issues for Crater Lake National Park and the associated planning and data needs to address them:

- **Visitor Use Management and Providing Opportunities for Visitor Experiences –** Crater Lake National Park has a growing and increasingly diverse composition of visitation and has placed a high priority on addressing visitor use issues, such as crowding and user capacity, relevancy, providing desired and appropriate visitor experience, and balancing visitor use with resource protection.

    - Visitor Experience and Relevancy: Crater Lake National Park is within a one-day drive from several urban areas and airports and, as a result, hosts visitors from diverse economic, ethnic, and cultural backgrounds, as well as an increasing number of international visitors. Thus far, limited accommodation has been made for this in terms of adjusting the type and number of available facilities, providing interpretive materials in multiple languages, addressing visitor group size, or expanding the types of promotional devices used. When visitors arrive at the park, they often do not know where to go or what to do, as the park has very limited ability to provide visitor contact or orientation activities within the existing infrastructure. During the summer, visitor contact stations are overwhelmed, and during the winter, visitors who choose not to participate in outdoor activities have limited alternatives for connecting with park resources, such as through interpretive exhibits and programs. Park managers would benefit from better understanding current demographics and anticipated visitor use trends, as well as considering management actions to address the pressing visitor use issues. The park would also benefit from a primary and centralized location to provide visitor orientation and interpretation.
    - User Capacity/Crowding: The current design of the park confines visitors in a small corridor (primarily Rim Village and the Rim Road), which wears down facilities, including roads and historic buildings, and creates extensive maintenance needs. Most built resources at the park are more than 80 years old. Visitation has changed since facilities were constructed, and those in place may not meet visitor needs as well as they could.
    - Protection of Cultural and Natural Resources: Overcrowding and overuse is resulting in degradation of natural and cultural resources in certain areas of the park, including along the road prism, where people park in undesignated areas.

    Associated high-priority planning and data need: Visitor use management plan; visitor use study.

- **Human Impacts on Park Resources –** Overcrowding and overuse is resulting in degradation of natural and cultural resources in certain areas of the park, such as campgrounds, housing areas, roadways, and the Rim Village, which serve as the hub of visitor activity. There are opportunities to provide visitors education about keeping the resources safe during their stay, as well as opportunities for education on broader resource concerns related to individual actions, such as water conservation and climate change.

  - There is currently no restoration plan in place for heavily impacted resource areas, including several "orphan sites" within the boundary that have been used for various purposes in the past but not restored to natural conditions. The park also needs to better understand the impact of hydrocarbons on the lake, originating from motorboats that are used for tours, park operations, and data collection.
  - The natural and cultural resources at Crater Lake are also threatened by indirect human impacts such as air pollution and climate change. Specific resource concerns include species shifts, invasive flora and fauna, effects on endemic species populations, changes in the hydrologic cycle, and changes in fire regimes. The park has already experienced a mountain pine bark beetle infestation that has devastated the forest in the Lost Creek campground area. Crater Lake National Park is also home to the American pika, a species whose range is threatened by a warming climate.

  Associated high-priority planning need: Resource stewardship strategy.

- **Lack of Resource Information –** Crater Lake National Park is home to a broad range of natural and cultural resources, such as the endemic Mazama newt and one of the best collections of rustic architecture in the United States. Through development of the Crater Lake National Park natural resource condition assessment and the Klamath Network vital signs monitoring plan, existing natural resources data were identified, summarized, and evaluated; data gaps were articulated; and ecological indicators were identified. However, the park lacks up to date data for a number of key resources outside the scope of monitoring and data collection done by these assessments, including archeological and cultural resources, as well as some natural resources. Park resource managers have an extensive list of data collection needs. Additional data would be used as part of a comprehensive program of inventory, research, and monitoring. Providing access to collections and the existing body of scholarly research on natural and cultural resources within and relevant to the park would also be part of expanding the park's base of resource information. Bringing the resource information up to an adequate level would facilitate more effective research, education, and outreach efforts.

  Associated high-priority data need: Monitoring of key resources or ecological functions as indicators of ecosystem health.

- **Need for Science-Based and Evidence-Based Decision Making –** Crater Lake National Park is committed to using the best available environmental and social scientific research and historical evidence in its educational messaging and resource management decisions. As described above, access to this scientific information is a challenge. However, it has also been challenging to use research findings and long-term monitoring data toward implementable actions and management decisions. For example, critical maintenance functions require more information on how to implement essential work in a way to best limit impacts to resources. Tools and guidance are needed to assist parks in integrating natural resources monitoring and research data into park management and decision making.

  Associated high-priority data needs: Monitoring of key resources or ecological functions as indicators of ecosystem health; visitor use study.

- **Limited Ability to Meet Park Priorities and Concerns –** The park has a number of operational concerns that converge to make it challenging for managers to achieve park priorities. The combination of maintenance, resource, housing, information access, and staffing issues that currently face the park can also constrain its ability to meet the demands of systemwide initiatives.

  - Maintenance: The park has a limited ability to maintain facilities, including historic structures, at acceptable levels due to significant reductions in staffing and budget over the past decade.
  - Resource Conditions: The park has a limited ability to maintain cultural resources and deal with resource concerns such as invasive species and climate change. The park's ability to deal with natural resource concerns stems from the existing understanding of emerging threats and the need for appropriate funding and personnel to address issues.
  - Housing: The park's existing concessioner housing facilities are over capacity. Initial plans for three new concessioner dormitories were not realized in the last phase of development. As a result, the historic concessioner dormitory, which was intended to be shut down, is still in use. The current number of housing units is not adequate to meet the demand of commercial services staff. In addition, based on new fire code regulations, the occupancy of the buildings will need to be further reduced in the future. Park housing is also over capacity based on these new fire code standards.
  - Information Access: As described above, there is a need for improved access to collections and access to data and reports from research in order to provide for resource management and improved science-based decision-making.
  - Staff/Workload: The park has limited ability to meet departmental and service priorities due to constraints of staffing levels, budget, and workload. There is a need to facilitate better opportunities for collaboration and information sharing among divisions.

  Associated high-priority data need: Workforce management strategy.

- **Integrating Park Goals and Mission with Surrounding Communities and Land Management Agencies –** A number of issues that originate outside the park have an impact within park boundaries. Light pollution from neighboring communities, air pollution, and landscape-scale resource impacts have an effect on the park, as well as the areas surrounding the park. Because of this, the park seeks to collaborate with neighboring land management agencies on cross-boundary issues, including climate change, unlawful use of resources, fire management, wilderness management, habitat fragmentation, wildlife migrations, nonnative plant invasions and control, air quality impacts, including impacts on night sky and natural sounds, road maintenance, and geothermal development. Opportunities also exist to build and expand on partnerships for education and safety concerns. The goal would be to recognize, respect, and, where possible, complement the goals of adjacent land owners and to identify areas of collaborative land and resource stewardship.

  Associated high-priority planning needs: Climate change planning portfolio; five-year fire management plan.

Planning and Data Needs

To maintain connection to the core elements of the foundation and the importance of these core foundation elements, the planning and data needs listed here are directly related to protecting fundamental resources and values, park significance, and park purpose, as well as addressing key issues. To successfully undertake a planning effort, information from sources such as inventories, studies, research activities, and analyses may be required to provide adequate knowledge of park resources and visitor information. Such information sources have been identified as data needs. Geospatial mapping tasks and products are included in data needs.

Items considered of the utmost importance were identified as high priority, and other items identified, but not rising to the level of high priority, were listed as either medium- or low-priority needs. These priorities inform park management efforts to secure funding and support for planning projects.

Criteria and Considerations for Prioritization.

The following criteria were used to evaluate the priority of each planning or data need:

- Greatest utility to unit management.
- Ability to address multiple issues.
- Emergency/urgency of the issue.
- Prevention of resource degradation.
- Plans that consider protection of the fundamental resources and values.
- Result in a significant benefit for visitors.
- Feasibility of completing the plan or study and implementing its actions or recommendations.
- Opportunities, including interagency partnership or assistance.

High Priority Planning Needs

Visitor Use Management Plan.

Rationale — The park is seeing shifts in the demographics and the diversity of visitors, increases in visitation levels throughout the year, and more significant increases during shoulder seasons (spring and fall). There is a need to effectively plan to accommodate more visitors in a way that minimizes the impacts of crowding, disperses visitor use, and continues to meet visitor demand.

Scope — The visitor use management plan would incorporate data from the visitor use study to develop actions that can be taken by the park to address increasing visitor demand, changes in visitor use, commercial visitor services, and visitor demographics. It would provide guidance for issues of crowding, improving safety, accommodating various group sizes, and addressing the diverse needs of different visitor types, including international visitors.

Resource Stewardship Strategy.

Rationale — The current resource management plan is outdated. In order to ensure that current and future ecological monitoring meets specific goals and targets, a resource stewardship strategy is needed.

Scope — The resource stewardship strategy would summarize the current status of resource knowledge, select indicators to assess current and desired conditions for park resources and values, plan comprehensive strategies to ensure the protection of Crater Lake's natural and cultural resources and values, and identify key projects within the comprehensive strategies.

Climate Change Planning Portfolio.

Rationale — Climate change is a significant threat to Crater Lake National Park, and the park is already seeing the effects of changes in snow hydrology and the fire regime. Invasive species like the mountain pine bark beetle have gained ground in the park, threatening some of its native natural resources. The park is a participant in the Climate Friendly Parks program, but the 2009 climate action plan needs updating in order to assess and develop strategies for minimizing the carbon footprint of park operations and visitation. In addition, the park needs to plan for climate change by understanding and managing for further climate change-related impacts to natural and cultural resources and by working with partners to engage in climate change issues on a landscape scale.

Scope — No single planning product will address the complex climate change response needs of the park. In order to deal with the many facets of this complex issue in a way that will allow for development of targeted mitigation and adaptation strategies, effective climate change response partnerships, and a deepened understanding of climate change impacts, the park would undertake climate change mitigation and adaptation planning, which, taken together, would provide a comprehensive tool for climate change response. This climate change planning "portfolio" would include an update to the climate action plan, as well as an adaptation component, and would identify and develop strategies for adapting to climate change. Scenario planning could be employed in order to help the park understand potential climate futures as a context for management planning. In addition, the park would partner with neighboring public land managers to develop an integrative climate change vulnerability assessment that addresses climate change impacts on a landscape scale. Other park planning efforts (e.g., resource stewardship strategy, aquatic resource management plan, visitor use management plan) may also provide resource-specific climate change response actions. The climate change planning portfolio could be referenced, as needed, when considering climate change in daily decision making or in the range of other park planning and management efforts, with resource-specific climate change adaptation strategies or mitigation included in those planning products.

Crayfish Management Plan.

Rationale — Invasive crayfish species have been introduced to the park and are threatening the endemic Mazama newt. Since this species of crayfish can cause environmental damage of various kinds, it is necessary to evaluate its expected expansion into not yet infested areas. The park needs to examine ways to mitigate these impacts and identify a strategy for managing the threat and controlling crayfish populations.

Scope — The crayfish management plan would look at the effects of crayfish on the endemic Mazama newt populations in the park and would include a dynamic spatial mobility and population model of crayfish in the lake. It would identify strategies for mitigating these impacts.

Five-Year Fire Management Plan.

Rationale — The park has made regular annual updates to its short-term fire management plans but has not completed a five-year fire management plan since 2004. This plan is needed to address the full range of treatments and consider fire management on a more comprehensive scale.

Scope — The five-year fire management plan would consider fire management comprehensively and would provide a full analysis of potential treatments.

High Priority Data Needs

Visitor Use Study.

Rationale — The park needs a better understanding of the changing demographics and visitorship of the park. These data are needed to support future visitor management and visitor services planning, including commercial visitor services. The study should ideally be completed in advance of the 2015 concessioner prospectus.

Scope — The visitor use study would examine trends in visitation, types of use, and changing demographics. It would include visitor counts for the Pacific Crest Trail as well as the day-use areas of the park.

Workforce Management Strategy.

Rationale — The park has limited ability to meet departmental and service priorities due to constraints of staffing levels, budget, and workload. There is a need to facilitate better collaboration and information sharing among divisions. A workforce management strategy would assess needed employee skill sets to help guide the park in addressing this complex issue. The strategy would support a future strategic plan update.

Scope — This strategy would identify future target employee skill sets and address current changing demands on the park.

Monitoring of Key Resources or Ecological Functions as Indicators of Ecosystem Health.

Rationale — Park- and national-level management have identified science-based and evidence-based decision making as a key park issue. In order to be well informed about the state of ecological health in the park, and to record ecological responses to climate change and inform adaptation efforts, a monitoring program for ecological indicator species is needed. NPS Klamath Network staff, university cooperators, and park staff have identified a suite of ecological indicators ("Vital Signs") to track the integrity of major ecosystem domains in the park; however, resource monitoring is a dynamic and iterative process, and there is a need for additional monitoring and data collection on fine scales beyond these existing ecological indicators.

Scope — Most projects to monitor park vital signs have been implemented relatively recently (~2011–2013), and forthcoming status and trend information are needed to inform park management decisions. Also needed are tools to apply findings from research and monitoring projects toward park management. The park is interested in pursuing several other park-specific ecological indicators that were not selected for long-term monitoring across the network, as well as monitoring of keystone species, key ecological indicators of anthropogenic change, and species that may be more sensitive to climate change.

Study Impacts of Climate Change to include Paleolimnology, Lake Scenario Planning, Vegetation and Wildlife, Weather Scenarios.

Rationale — In order to inform climate change response for natural resource impacts in the park and to inform the Climate Change Planning Portfolio, data on key park resources will be needed. The background data on climate change impacts on paleolimnology, vegetation, and wildlife as well as modeling future changes in weather patterns and associated impacts on the lake, would help to inform these adaptation planning efforts, including parkwide climate change scenario planning.

Scope — This comprehensive climate change impact study would include an examination of climate change effects on paleolimnology, vegetation, and wildlife in the park. Modeling and future scenarios would be conducted, with a focus on possible future climate and weather scenarios as well as scenarios for impacts on the lake based on those potential future conditions.

Model Climate-induced Changes to the Lake Hydrology and Ecology.

Rationale — Studies (US Geological Survey models) are looking at the link between ambient air temperature and its effects on the lake ecosystem. Future research will be needed to determine the extent of those effects, and whether they will affect significant characteristics of the lake, a fundamental park resource.

Scope — A specific and focused evaluation of future climate change scenarios on the ecological function of the Crater Lake ecosystem is needed. This would focus specifically on how changes in air temperature could affect the lake ecosystem health and what types of effects could occur to the water and the life within it.

See appendix D for recently completed and ongoing planning and data collection efforts that address park issues.

Summary of High Priority Planning and Data Needs

Planning and Data Needs
Planning Need
Visitor use management plan
Resource stewardship strategy
Climate change planning portfolio
Crayfish management plan
Five-year fire management plan
Data Need
Visitor use study
Workforce management strategy
Monitoring of key resources or ecological functions as indicators of ecosystem health
Study impacts of climate change to include paleolimnology, lake scenario planning, vegetation and wildlife, weather scenarios
Model climate-induced changes to the lake hydrology and ecology

Summary of Other Planning and Data Needs

Planning or Data Need	Priority (M, L)	Notes
Natural Resources		
Planning Needs		
Aquatic resource management plan	M	Mitigation planning for the threat of invasive aquatic species and to make management decisions on permitted uses
Integrated pest management plan	M	Required One exists specifically for St John's wort, but there is not a comprehensive integrated pest management plan
Water supply contingency plan and/or long-term water supply strategy	M	Crater Lake National Park requires a long-term water supply strategy that may include legislative relief from a call, an alternate water supply from within the park, the purchase of senior water rights from outside of the park and transfer to a point of diversion within the park, or compensation to senior water right owners for out-of-priority diversions from Annie Creek
World Heritage biosphere reserve status study	L	If this resource is as unique on a global scale as we believe, there may be an opportunity to pursue this status as the most studied caldera lake in the world and a globally significant body of research
Weather data/station management plan	L	A strategy is needed to manage and collect weather data and improve the accuracy of the data collected
Bear management plan	L	Needs updating
Klamath network inventory and monitoring plan and associated protocols	L	Limited to specific resources and scope Other key resources beyond the scope of this effort need to be addressed
Wilderness management plan	L	Outdated A new one is needed
Site-specific resource restoration plans	L	Need to develop and implement restoration plans for disturbed sites "Orphan sites" exist all around the park that have been disturbed and left, but there is currently no plan for restoration Should include consideration of existing and future sites The borrow pit is one area where a restoration plan has been identified as needed
Night sky plan	L	Create this broad plan so that other plans can be tiered from it, such as a night sky action plan, etc This would deal with educational components and other implementable actions Different from the night sky monitoring plan
Cave management plan	L	Majority of caves is inaccessible
Scenery conservation plan	L	A scenery conservation plan based on the visual resource inventory would develop protection strategies for sensitive viewsheds and goals and objectives for long-term management of viewsheds to retain scenic and cultural landscape values
Total maximum daily load plan for Annie Creek	L	Ameliorate biological criteria impairments associated with Annie Creek (update or new)

Planning or Data Need	Priority (M, L)	Notes
Natural Resources		
Data Needs		
Weather data collection	M	Ground-truth the data that exist Also need additional weather monitoring sufficient to characterize microclimates and global change indices and to evaluate long-term trends Another option would be to install an automated station adjacent to the manual headquarters weather station and continue to collect data by hand in the current location, ultimately enabling the park to reduce the error in the existing data set
Effects of invasive species (fish and crayfish in the lake, vegetation along the rim and in surrounding areas)	M	Look at the impacts of invasive fish and crayfish on native biota (newts, etc)
Characterize newt life history	L	This is important to do while they are still in the lake Likely a subspecies (endemic), time sensitive, and impacted by nonnative crayfish
Integrate data (existing and new) into the Integrated Resource Management Applications data system	L	There is currently a large backlog in reports that have not been entered into the system
Research needs assessment	L	Keep a list of research needs that can be shared with researchers who may be interested in conducting the studies
Temperature trends associated with climate change at surface water features, a list of springs, streams, ponds, including ephemeral ponds	L	Need to monitor beyond Annie Creek
Examine past and current fire management impacts on species and vegetation communities	L	
Environment model to fit archeological resource into regional context	L	
Research links between biological and physical components of park ecosystems	L	Need to define links between biological and physical components of park ecosystems
Research fire, weather, and geologic events and other disturbance events	L	Data would support current management decisions regarding disturbance events
Research on the geology of the Crater Lake ecosystem	L	Needed to expand knowledge of the geology of the Crater Lake ecosystem
Erosion study	L	

Planning or Data Need	Priority (M, L)	Notes
Natural Resources		
Data Needs		
Update of 1990s study regarding impacts of boat hydrocarbons	L	New information is needed to detect change since original study
Survey the remainder of the lake bottom	L	Ninety-eight percent still needs to be surveyed
Inventory of disturbed "orphan sites"	L	Would support restoration of disturbed sites "Orphan sites" exist all around the park There is a list, but it is incomplete There is no official process for tracking This might be a good GIS project
Visual resource inventory	L	The visual resource inventory would identify visual and NPS/visitor values for scenic views The current inventory system developed inventories scenic resources within and beyond park boundaries to inform management and collaboration efforts in protection of scenic views
Night sky monitoring	L	Night sky monitoring plan has been completed Park wants to be certified as a Night Sky park Equipment has been ordered This will be starting soon
Air quality data – continued monitoring, statistical analysis of the data	L	Need to look more at the details of the data that comes out of the monitoring In addition to visibility, monitor for ozone and wet deposition, as well as special studies to examine dose-response relationships in sensitive park ecosystems, to better understand resource threats and assess the resilience of native ecosystems in the face of external perturbations Study the air pollution dose-response relationships in the lake
Acoustic monitoring	L	Vehicle sound monitoring is needed in particular Overflights are an issue, and loud motorcycles and vehicle stereos have a major noise impact
Need to better understand diseases and pests present in the park	L	Issues for both plants and animals Diseases affecting vegetation, also the endemic newts Pine bark beetle infestations are a major issue for the whitebark pine
Analysis of topographic / light detection and ranging (LiDAR) data	L	Would require some outside assistance
Trends concerning the number and area of wetlands, ponds, and lakes within the park, including their quality	L	
Measure and study the impacts of contaminants, atmospheric deposition of nitrogen and sulfur, other water quality variables, groundwater levels, and other indicators of wetland and other surface water conditions	L	

Planning or Data Need	Priority (M, L)	Notes
Natural Resources		
Data Needs		
Monitor hydrothermal features on the lake floor	L	Data needs for monitoring hydrothermal vents at the bottom of the lake
Wet and dry atmospheric deposition monitoring data	L	
Monitor discharge in another watershed besides the Klamath Basin	L	Stream discharge There is no monitoring done currently in the Rogue and Umpqua Basins
Determine and monitor the return rate from man-made ponds / sewer lagoons and groundwater, maintenance and support facilities included	L	Would give credit for return water to the system
Discharge measurements on Sun Creek – continuous discharge recording	L	
Study modification of wildlife behavior from human interaction	L	
Inventory and monitor invasive plants and animals on existing ecosystems in the park	L	
Inventory of vegetation structure	L	
Analysis of shifting species distribution as it relates to climate change	L	
Determine the extent of bat use of caves in the park	L	
Determine groundwater flow characteristics	L	Including where seepage from Crater Lake ends up Possibility to use isotope tracers
Cultural Resources		
Planning Needs		
Curatorial collection transition plan	L	Analyze how to transition location of collection and how best to protect the collection Provide recommendation
Data Needs		
Comprehensive archeological survey	M	The park has carried out a number of archeological surveys in the past, but often they have been in reaction to development/maintenance needs A comprehensive survey program could help inform long-term planning in the park

Planning or Data Need	Priority (M, L)	Notes
Cultural Resources		
Data Needs		
National register nomination forms – Wagon Road, Old Rim Road, Mount Scott lookout, Mazama amphitheater	L	All areas are eligible for the national register but forms have not yet been submitted
Ritual feature inventory	L	
Historic furnishing study of the Superintendent's Residence	L	This structure is a national historic landmark (House 19) Furniture is associated with the structure
Traditional cultural properties nominations	L	Need a high level interest from the tribes
Updated historic resource study	L	Get an idea of what may be eligible for the national register (current is 30 years old)
Updated administrative history	L	
Develop monitoring protocols for archeological sites and features	L	
Updated archeological overview	L	
Historic structure reports	L	
Special history study	L	To put Civilian Conservation Corps-built structures or transportation-related structures in context outside the National Park Service and explore opportunities for quiet paving
Interpretation and Education		
Planning Needs		
Interpretive media plan	M	A plan is needed to address existing needs for interpretive media and to plan for interpretive materials in other languages
Long-range interpretive plan update	L	As the park moves toward more solid plans for a year-round visitor center, an updated long-range interpretive plan becomes more important The plan would incorporate updated interpretive themes and address use of new media in educating visitors and the public Include provisions for developing interpretive media in multiple languages (particularly Spanish, Mandarin, and German) If the long-range interpretive plan update includes an interpretive media plan, the long-range interpretive plan would become a medium priority plan
Public outreach strategy / communication plan	L	Understand the role of the park in increasing public awareness and knowledge of land and environmental stewardship Develop means and methods to engage students and the general public in educational experiences

Planning or Data Need	Priority (M, L)	Notes
Park Operations		
Planning Needs		
Continuity of operation plan	M	This is a requirement for all parks, and the park does not currently have one
Strategic plan update	M	Current strategic plan needs updating This is needed in order to set priorities for park management and to realign funding toward the most critical operations Address staffing needs Staffing assessment would provide information for this
General management plan	L	The 2005 general management plan is a little outdated but generally usable; however, there are instances where the current general management plan is not supported by defensible data (e g , visitor perception of the number of boats on the lake)
Partner action strategy (possibly in coordination with regional land-use planning)	L	Address partnership opportunities for resource protection and management, education, safety, and land management
Management plan for science learning center	L	Reconsider how it is currently set up Look at changes in partnerships with researchers and academic institutions
Data Needs		
Economic and environmental benefits analysis	L	Understand patterns and trends of population growth, economic development, and land ownership and use in the surrounding region that may impact the natural systems of the park Understand the effects of the park management on patterns and trends of population growth, economic development, and land ownership and use
Visitor Experience		
Data Needs		
Study to understand impacts of crowding (user capacity)	L	The park experiences heavy visitation in certain concentrated areas and needs to better understand the impacts due to current and projected crowding Areas of particular concern include Rim Village, boat access on Wizard Island, and backcountry areas
Facilities		
Planning Needs		
Site planning (including development concept plan for Rim Village circulation and others)	M	Would include site planning / development concept plan development for Rim Village, North Junction, Pinnacles Area, East Entrance, Lost Creek, South Entrance, Rim Access areas to address parking, crowding, circulation, safety, and facility needs
Accessibility transition plan	M	Inventory and address accessibility features

Planning or Data Need	Priority (M, L)	Notes
Facilities		
Planning Needs		
Transportation plan	L	Park needs to look at transportation design modes There is interest in offering a shuttle, issues with some current circulation, and also some current road safety issues The plan could look at sources of vehicle noise and emissions and ways to mitigate those impacts
Housing management plan update	L	There is a need for park housing and, in particular, for additional concessioner housing The Unit C concessioner dorm (Mazama dorm complex) that was originally planned for has never been built Based on a recent fire code assessment, the current occupancy of the buildings is over capacity Bringing the residency levels to code would require approximately 30 additional units of concessioner housing
Alternative boat fuels plan	L	To address potential hydrocarbon issues / carbon footprint
Campground management plan	L	Managing for hazards and for visitor impacts, noise, and artificial light
Data Needs		
Transportation study	M	To support transportation plan and quantify areas of congestion and overcrowding
Accessibility inventory	M	To support accessibility transition plan
Commercial Services		
Planning Needs		
Commercial services strategy	L	This plan would replace outdated 1999 visitor services plan It would provide a10-year outlook on commercial services Would not be able to complete before the new contract prospectus has been prepared
Safety		
Planning Needs		
Physical security plan and assessment	L	All parks should have one It is a safety need according to region, though not necessarily of the highest priority
Hazard spill contingency plan	L	Needs updating and implementation
Develop and implement plans and protocols to mitigate adverse visitor/ resource conflicts (e g , human/bear interaction plan, hazard tree management plan)	L	Safety Related to natural resource data need for information on effects to wildlife from human interaction

Part 3: Contributors

Crater Lake National Park

Craig Ackerman, Superintendent
Mac Brock, Chief, Resource Preservation and Research
Mark Buktenica, Aquatic Ecologist
Scott Burch, Management Assistant
Steve Clark, Administrative Officer
Brian Coulter, Building and Utilities Supervisor
Curt Dimmick, Chief Ranger
Jennifer Gifford, Trails Supervisor
Steve Mark, Historian
Marsha McCabe, Chief of Interpretation and Cultural Resources
Mary Merryman, Curator, Museum and Archive Collections
Sean Mohren, Terrestrial Ecologist
Raymond Moore, Chief of Maintenance

NPS Pacific West Regional Office

Mary Lou Herlihy, Interpretive Media Specialist
Brad Phillips, Planner
Amanda Schramm, Planner

NPS Denver Service Center, Planning Division

Sarah Bodo, Project Manager
Tabitha Carver-Roberts, Editor
Rebecca Corning, Foundations Contract Librarian
Kelly Donahue, Landscape Architect
John Paul Jones, Visual Information Specialist
Greg Jarvis, Project Manager
Melanie Myers, GIS Specialist
Alex Williams, Natural Resource Specialist

Stakeholders

George Buckingham, President, Friends of Crater Lake National Park
Carolyn Hill, CEO, Crater Lake National Park Trust and Travel Southern Oregon
Mike Keller, General Manager, Xanterra
Kevin Talbert, Vice Chair, Crater Lake Natural History Association
Bill Thorndike, Chair, Crater Lake National Park Trust

Appendixes

Appendix A: Enabling Legislation for Crater Lake National Park

FIFTY-SEVENTH CONGRESS, SESS. I. CHS. 818–820. 1902.

CHAP. 820.—An Act Reserving from the public lands in the State of Oregon, as a public park for the benefit of the people of the United States, and for the protection and preservation of the game, fish, timber, and all other natural objects therein, a tract of land herein described, and so forth.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the tract of land bounded north by the parallel forty-three degrees four minutes north latitude, south by forty-two degrees forty-eight minutes north latitude, east by the meridian one hundred and twenty-two degrees west longitude, and west by the meridian one hundred and twenty-two degrees sixteen minutes west longitude, having an area of two hundred and forty-nine square miles, in the State of Oregon, and including Crater Lake, is hereby reserved and withdrawn from settlement, occupancy, or sale under the laws of the United States, and dedicated and set apart forever as a public park or pleasure ground for the benefit of the people of the United States, to be known as Crater Lake National Park.

SEC. 2. That the reservation established by this Act shall be under the control and custody of the Secretary of the Interior, whose duty it shall be to establish rules and regulations and cause adequate measures to be taken for the preservation of the natural objects within said park, and also for the protection of the timber from wanton depredation, the preservation of all kinds of game and fish, the punishment of trespassers, the removal of unlawful occupants and intruders, and the prevention and extinguishment of forest fires.

SEC. 3. That it shall be unlawful for any person to establish any settlement or residence within said reserve, or to engage in any lumbering, or other enterprise or business occupation therein, or to enter therein for any speculative purpose whatever, and any person violating the provisions of this Act, or the rules and regulations established thereunder, shall be punished by a fine of not more than five hundred dollars, or by imprisonment for not more than one year, and shall further be liable for all destruction of timber or other property of the United States in consequence of any such unlawful act: *Provided*, That said reservation shall be open, under such regulations as the Secretary of the Interior may prescribe, to all scientists, excursionists, and pleasure seekers and to the location of mining claims and the working of the same: *And provided further*, That restaurant and hotel keepers, upon application to the Secretary of the Interior, may be permitted by him to establish places of entertainment within the Crater Lake National Park for the accommodation of visitors, at places and under regulations fixed by the Secretary of the Interior, and not otherwise.

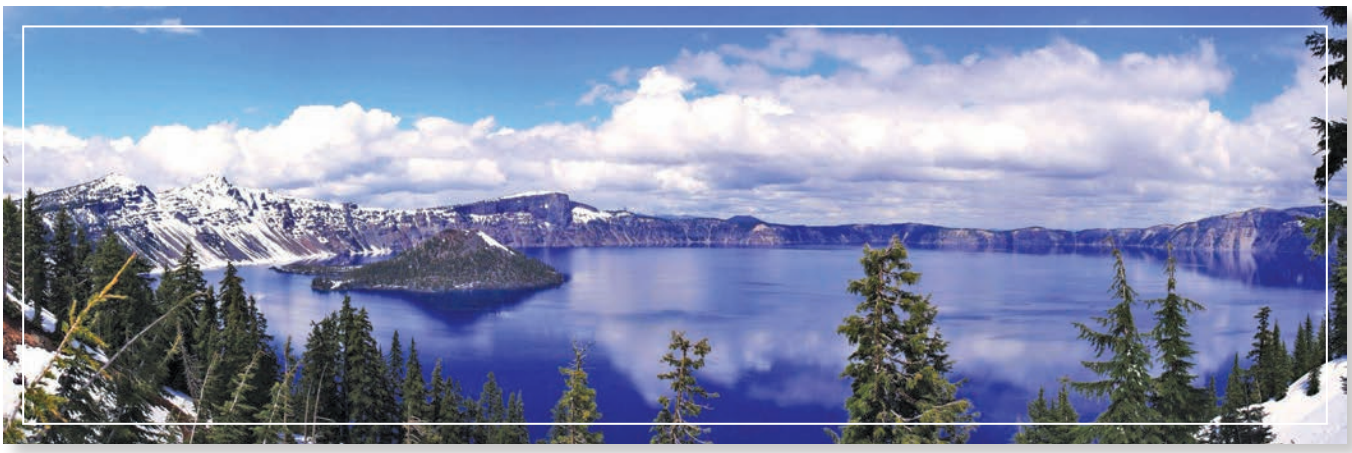
Approved, May 22, 1902.

Appendix B: Analysis of Fundamental Resources and Values and Other Important Resources and Values

Analysis of Fundamental Resources and Values

Fundamental Resource or Value	Crater Lake
Related Significance Statements	Related to all significance statements
Current Conditions and Trends	**Conditions** • Except for the atmospheric changes and the introduction of fish and crayfish, the lake is relatively untouched and in a natural state • Crater Lake is the deepest lake in the United States, the second deepest lake in the Western Hemisphere, and within the top 10 deepest lakes in the world • Crater Lake is one of the most extensively monitored and studied lakes of its size in the world • Crater Lake's levels vary in response to the changing balance between precipitation amount, evaporation, and seepage rate, and the lake's water budget is controlled mostly by precipitation • Lake evaporation is about 76 cm/year and seepage is about 127 cm/year • The residence time of water in Crater Lake is about 225 years • At its lowest, the lake was 12 feet below the current levels Current lake levels are close to historic median lake levels • The lake is in a state of dynamic stability with natural changes (e g , lake level) occurring over time **Trends** • Water transparency increased from 1978–2008 • From 1966–2008, the annual onset of thermal stratification occurred an average of 7 days earlier per decade (29 days earlier since 1966) • The depth of the lake's thermocline (rapid temperature transition layer) has risen at an average rate of 1 8 m per decade since 1983
Threats and Opportunities	**Threats** • Atmospheric impacts, including pollution and the effects of climate change, lake color, transparency, and the unique geochemical and biological environment, are influenced by climate factors • Nitrogen enrichment from airborne pollutants may increase lake productivity and reduce lake clarity • Nonnative species are affecting native flora and fauna (e g , distribution, population), natural runoff regimes, and lake chemistry **Opportunities** • Use the lake as a gauge for the impacts of climate change and invasive species and to conduct comparative research with other areas • Expand recreational opportunities such as boat tours, hiking and solitude on Wizard Island, fishing, and swimming

Fundamental Resource or Value	Crater Lake
Existing Data and Plans Related to the FRV	• Long-term lake monitoring data • Limnological studies final report • Studies of hydrothermal processes in Crater Lake • Evaluation of the sensitivity of Klamath Network parks to acidification effects from atmospheric sulfur and nitrogen deposition • A selected bibliography of water-related research in the Upper Klamath Basin, Oregon • Weather and climate inventory for the Klamath Network parks • Natural resource condition assessment • Studies of air pollution, vegetation, and fish
Data and/or GIS Needs	• Determine effects of invasive species (fish and crayfish in the lake, vegetation along the rim and in surrounding areas) • Study modification of wildlife behavior from human interaction • Update the 1990s study on the impacts of boat hydrocarbons • Survey the remainder of the lake bottom (98% still needs to be surveyed) • Monitor hydrothermal features on the lake floor • Inventory of vegetation structure • Studies of air pollution, vegetation, and fish
Planning Needs	• Visitor use management plan (update) • Alternative boat fuels plan • Aquatic resource management plan • Resource stewardship strategy • Climate change planning portfolio • Crayfish management plan
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Endangered Species Act of 1973, as amended • Clean Water Act of 1972 • Clean Air Act of 1977 (42 U S C 7401 et seq) • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • NPS *Natural Resource Management Reference Manual 77*

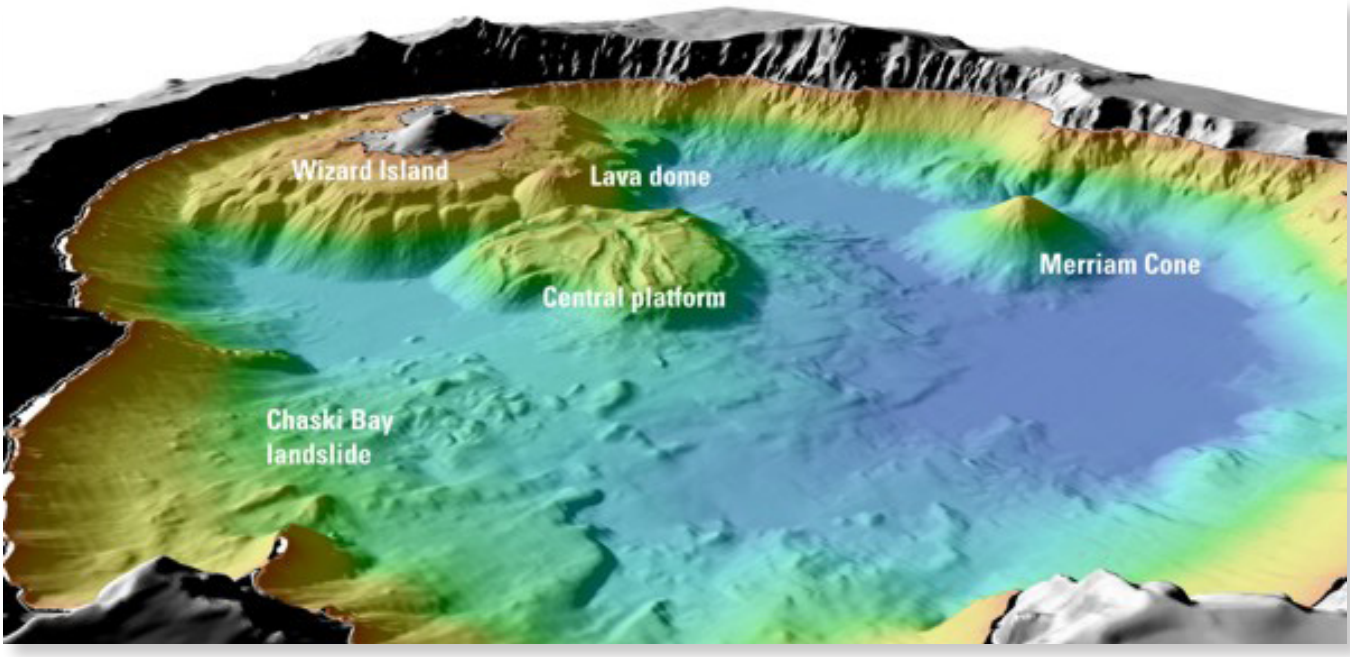


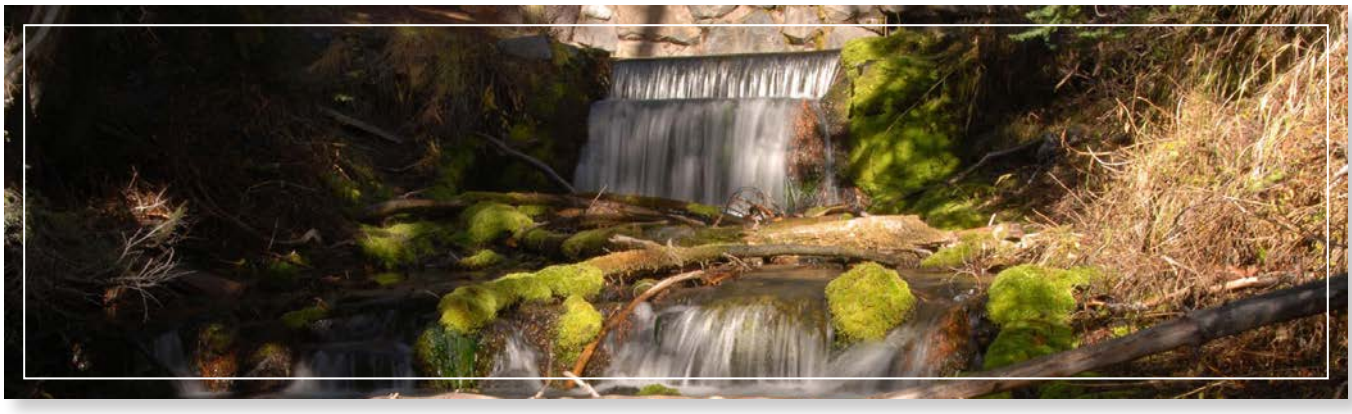
Fundamental Resource or Value	Enduring Legacy of Human Relationships with the Landscape
Related Significance Statements	Related to significance statements 2, 4, 5, and 6
Current Conditions and Trends	**Conditions** • Park museum collection consists of nearly 240,000 items, including natural science specimens, works of art, historic objects, and archival materials • Crater Lake National Park has approximately 9 entries in archeological sites management system and more than 50 in the state historic preservation office database Cultural landscapes that have been inventoried are in relatively good condition • The park archives collection has a large backlog The current storage meets 60% of the Department of the Interior standards • There are 43 contributing resources on the national register • There are 46 structures on the park's List of Classified Structures • Watchman fire lookout restoration work is accomplished intermittently by volunteers and is incomplete; high dollar work is not addressed • Approximately 5% of the park has been surveyed for archeological resources Sometimes fire surveys include larger areas **Trends** • Reduced regional and park support staff for cultural resources • Collections are managed at the department level as per the Department of the Interior policy • Cultural anthropology work, including communication with the tribes, fluctuates and depends on cooperative ecosystem studies units project funding
Threats and Opportunities	**Threats** • There is no monitoring of cultural resources other than museum collections • Storage conditions do not meet standards • The park does not possess appropriate museum environments, and collections are adversely impacted by dust, dirt, rodents, and insect pests • Obtaining oral histories is time sensitive • Climate change impacts, such as water inundation due to changes in snowpack, threaten historic structures • There is a backlog of around 100 sites that need to be properly recorded in the state historic preservation office's database **Opportunities** • Increase interpretive programming related to cultural resources • Hartell internship program now has enough funding to proceed on an annual basis • Transfer the collections to a housing unit that is more accessible for interpretation and research • National register nominations for four Mission 66 properties, a traditional cultural property, and four trails
Existing Data and Plans Related to the FRV	• Cultural landscape report for Rim Drive • Cultural landscape inventory for Castle Crest Wildflower Trail, Superintendent's Residence, Rim Drive Historic District, Watchman Observation Station, and Watchman Trail • Historic structures report • Historic resource study • Site record for the Wagon Road

Fundamental Resource or Value	Enduring Legacy of Human Relationships with the Landscape
Existing Data and Plans Related to the FRV (continued)	• Interior collections management system contains all data related to collections • Storage conditions assessment • Cultural resource survey of Rim Village and related areas • Rustic landscapes of Rim Village • Cultural landscape recommendations for park headquarters at Munson Valley • Report on archeological reconnaissance • Study of stonework in the park • Report on archeological survey of proposed OR 62 improvements • Historic paint finishes and plaster analysis study of Superintendent's Residence • Museum management plan • Collection storage alternatives report of findings
Data and/or GIS Needs	• Comprehensive archeological survey • Historic furnishing study of the Superintendent's Residence • Ritual feature inventory • Traditional cultural properties nominations • Complete national register nomination forms for Fort Klamath Rogue River Wagon Road and the Old Rim Road • Special history study • Updated historic resource study
Planning Needs	• Curatorial collection transition plan • Resource stewardship strategy
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Antiquities Act of 1906 • Historic Sites Act of 1935 • National Historic Preservation Act of 1966, as amended (16 USC 470) • Archeological and Historic Preservation Act of 1974 • American Indian Religious Freedom Act of 1978 (PL 95-341) • Archaeological Resources Protection Act of 1979 • Native American Graves Protection and Repatriation Act of 1990 • Management of Museum Properties Act of 1955 (PL 84-127) (16 USC 18f through 18f-3) • Executive Order 11593, "Protection and Enhancement of the Cultural Environment" • Executive Order 13007, "Indian Sacred Sites" • "Curation of Federally-Owned and Administered Archaeological Collections" (36 CFR 79) • "Protection of Historic Properties" (36 CFR 800) • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 24: *NPS Museum Collections Management* • Director's Order 28: *Cultural Resource Management* • Director's Order 28A: *Archeology* • NPS *Museum Handbook*, parts I, II, and III • *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation*

Fundamental Resource or Value	Distinctive Volcanism and Geology
Related Significance Statements	Related to all significance statements
Current Conditions and Trends	**Conditions** • Mount Mazama consisted of a succession of overlapping shield and stratovolcanoes built upon lava flows more than 400,000 years old • The climactic eruption of Mount Mazama took place in a single-vent phase that produced a towering column of pumice and ash, and a ring-vent phase that started as the volcano began to collapse in on itself The eruption ejected 12 cubic miles of magma • During the eruption of Mount Mazama, ash rose into the air and settled over an area of 656,000 square miles The ash today is a valuable stratigraphic marker and important time horizon across many depositional environments • Lacustrine (lake) sedimentary processes continue today • The park contains features such as ice-bounded lava flows, lava-formed table mountains, till and moraines, polish and striations, U-shaped values and notches, cirques, and horns • Crater Lake is a significant thermal feature according to the Geothermal Steam Act of 1970 • Wizard Island is the only post caldera volcano to break the surface of Crater Lake • There are about 40 known caves in the park Cave resources are thought to be stable, although no current information exists **Trends** • Some soils in the park are highly prone to erosion and erosion has been accelerated locally within a few heavily traveled areas of the park due to compaction, vegetation damage, and changed runoff patterns
Threats and Opportunities	**Threats** • Earthquake hazards in the greater Crater Lake area are similar to those in other earthquake-prone areas, namely damage to structures, utilities, etc • Landslides/debris-avalanches and volcano hazards are minimal but on going threats to park resources, park operations, and visitor safety • Cave exploration can be difficult and dangerous as there is a potential for rockfall in and around cave entrances • Rock scaling to remove loose surface material presents rockfall hazards • Erosion may be undermining the geology of roads and trails **Opportunities** • There is the potential for cave exploration, mapping, documentation, and study

Fundamental Resource or Value	Distinctive Volcanism and Geology
Existing Data and Plans Related to the FRV	• Topographic and LiDAR data • US Department of Agriculture, Natural Resources Conservation Service soil survey • Geologic resources inventory report • Studies of hydrothermal processes in Crater Lake • Geologic evaluation of Crater Lake Lodge rehabilitation • Slope stability report • Rapid visual screening of buildings at the park for potential seismic hazards • Geotechnical investigation for the remodel of Rim Village • Natural resource condition assessment
Data and/or GIS Needs	• Extent of bat use of caves in the park • Erosion study • Research of the geology of Crater Lake ecosystem • Analysis of topographic and LiDAR data
Planning Needs	• Site specific restoration plans (borrow pit restoration plan) • Cave management plan • Resource stewardship strategy
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Paleontological Resources Preservation Act of 2009 • Clean Water Act of 1972 • Federal Cave Resources Protection Act of 1988 • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 18: *Wildland Fire Management* • NPS *Natural Resource Management Reference Manual 77*





Fundamental Resource or Value	Complex and Varied Hydrological Resources and Processes
Related Significance Statements	Related to significance statements 1, 2, 3, 6, and 7
Current Conditions and Trends	**Conditions** • As much as 60%–80% of the summer flows in the Rogue, Umpqua, and Klamath Rivers originate in the groundwater-dominated upper parts of their watersheds located in or near the park • Most of the park's perennial and intermittent streams are groundwater-dominated • There are at least 24 streams that flow year-round, and 49 seeps and springs within the caldera • The park contains 6–10 perennial lakes and ponds, 1 high elevation bog, and at least 250 wetlands and nonperennial ponds Nearly all wetlands are in good condition • The park has water rights through the State of Oregon that provide for an exemption of up to 15,000 gallons per day for residential use and 5,000 gallons per day for commercial use per operating system Average annual snowfall at the park is 524 inches, with a maximum recorded snowfall of 836 inches and a minimum of 243 inches • Above an elevation 5,500 feet, the northern part of the park has no springs or streams with perennial flow **Trends** • Annie Creek was added to Oregon's 303(d) impairment list by the US Environmental Protection Agency in 2012, as it is above state standards concerning sedimentation levels • The park is seeing changes in precipitation, snowpack, and water availability • Changes are occurring in the chemistry, transparency, and the biologic communities (e g , crayfish) of Crater Lake itself, as well as other surface water bodies (although for the most part these changes are natural) • Snowfall rates have decreased from more than 600 inches per year in the 1930s to around 500 inches per year in the 2000s • Higher average temperatures are changing evaporation and snowmelt runoff regimes
Threats and Opportunities	**Threats** • Annie Creek is the sole source of water for administrative and domestic uses at Crater Lake National Park The exception is Lost Creek, the source of water for the 17-unit Lost Creek Campground Crater Lake holds a water right for Annie Creek with a priority date of May 22, 1902 With a 1902 priority date, the risk of the park's water supply being curtailed when there is insufficient water in Annie Creek to satisfy the rights of senior (priority dates earlier than May 22, 1902) water right owners is high In times of water shortage in Annie Creek, the state could serve a call on the park's Annie Creek water right, and the park could be required by state law to cease its diversion of Annie Creek water, potentially closing the park to overnight use

Fundamental Resource or Value	Complex and Varied Hydrological Resources and Processes
Threats and Opportunities	**Threats (continued)** • In 14 of the past 22 years (every 2 out of 3 years) the state has made a declaration of drought in Klamath County, Oregon (OWRD 2015) Drought declarations were made for Klamath County, and calls were placed on Wood River and Annie Creek water rights during the irrigation seasons of 2013 and 2014 As of March 2015, drought conditions persist, and in the absence of sufficient snowfall, a drought declaration for Klamath County is forthcoming and the likelihood of a call during the 2015 irrigation season is high If a call is made for Annie Creek water rights with priority dates earlier than 1905, Crystal Lake National Park could be affected • Uncertainty with regard to climate change and long-term impacts to water resources in the Klamath Basin add to the threat to the park's Annie Creek water right and long-term water supply • Headwater streams at the park are sensitive to acid deposition, which can affect reproduction and survival of fish, amphibians, and aquatic insects Acid rain is not a big concern to Crater Lake itself • Changes in temperature, precipitation, snowpack, and the timing of snowmelt runoff and water availability due to climate change • Development of geothermal resources near the park may impact groundwater levels within the park, including hydrothermal features and vents • Soil erosion from heavily traveled areas of the park due to compaction, vegetation damage, and changed runoff patterns may abnormally increase sediment loads in water bodies • Low-flying military and civilian aircraft pose a threat to water resources from the potential to introduce hazardous materials **Opportunities** • Transition from surface water to groundwater sources for park uses • Expand interpretation of hydrological resources and climate change
Related Resources and Values	• Klamath River Basin water rights adjudication
Existing Data and Plans Related to the FRV	• There are five weather monitoring stations (although not all are active) • Extensive survey and flow measurements of 46 park streams and 21 springs • The park monitors snowfall, snow depth, and snow cores for water content • Groundwater monitoring data associated with sewage contaminants • Water lake level data from a gauge monitored by the US Geological Survey • Discharge gauge at the headwaters of Annie Creek and Sun Creek • The park monitors water quality characteristics in the lake • Temperature monitoring is conducted in several streams and Crater Lake • The State of Oregon monitors a new well in park • Study of hydrothermal processes of Crater Lake • A selected bibliography of water-related research in the Upper Klamath Basin, Oregon • Weather and climate inventory for the Klamath Network parks • Report on the water resources and requirements of the Upper Klamath Basin • Wind tunnel study of snow conditions at Rim Village • Limnological studies final report • Wetland delineation report • Assessment of the ecological condition of wetlands • Natural resource condition assessment • Seepage investigations and water rights assessment of Annie Creek

Fundamental Resource or Value	Complex and Varied Hydrological Resources and Processes
Data and/or GIS Needs	• Trends concerning the number and area of wetlands, ponds, and lakes within the park, including their quality • Measure and study the impacts of contaminants, atmospheric deposition of nitrogen and sulfur, other water quality variables, groundwater levels, and other indicators of wetland and other surface water conditions • Monitor hydrothermal features on the lake floor • Air quality data – continued monitoring, statistical analysis of the data • Model climate induced changes to the lake hydrology and ecology • Wet and dry atmospheric deposition monitoring data • Monitor discharge in another watershed besides the Klamath Basin (none currently in the Rogue and Umpqua Basins) • Temperature trends associated with climate change at surface water features, including springs, streams, ponds (and ephemeral ponds) • Determine and monitor the return rate from man-made ponds / sewer lagoons and groundwater, including maintenance and support facilities • Discharge measurements on Sun Creek – continuous discharge recording • Determine groundwater flow characteristics, including where seepage from Crater Lake ends up
Planning Needs	• Total maximum daily load plan to ameliorate biological criteria impairments associated with Annie Creek (update or new) • Water supply contingency plan and/or long-term water supply strategy • Climate action plan • Weather data/station management plan • Design concept plan for Lost Creek
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Clean Water Act of 1972 • Water rights adjudication and law • Executive Order 11514, "Protection and Enhancement of Environmental Quality" • Executive Order 11988, "Floodplain Management" • Executive Order 12088, "Federal Compliance with Pollution Control Standards" • National Flood Insurance Program • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • NPS *Natural Resource Management Reference Manual 77* • NPS Reference Manual 18: *Wildland Fire Management* • Director's Order 77-2: *Floodplain Management*

Fundamental Resource or Value	Representative Cascade Mountain Ecosystems
Related Significance Statements	Related to all significance statements
Current Conditions and Trends	**Conditions** • The park contains numerous vegetation types: lodgepole pine-hemlock, pine-fir belt, fir belt, ponderosa pine belt, herb-grass and semi-barren herb-grass, chaparral, Douglas-fir belt, wetlands including at least one large undisturbed peatland, and various other significant ecosystems • Nearly all park wetlands are in good condition as defined by their plant communities • Sphagnum Bog, Llao Rock, Desert Creek, and Pumice Desert have been recognized by the Oregon Natural Heritage Program as research natural areas • The park's terrestrial vegetation is a relatively pristine example of the regional vegetation on young pumice and other volcanic substrata in the central Cascades • The park supports an assemblage of extensive mosses growing at extreme lake depths, unusual microbes associated with hydrothermal vents, and a healthy bull trout population • Certain species of interest are not currently inventoried in the park • The park's large areas of herb-grass vegetation on pumice are regionally unique • The park currently has three threatened species: the northern spotted owl, wolf, and bull trout The Pacific fisher will likely be listed as threatened soon **Trends** • Numbers of some species, such as the newt and spotted owl, are declining • Lodgepole pine stands have been dramatically reduced since originally surveyed in 1936 • Fire suppression has greatly reduced fire size and number of acres burned by fire • The fire regime is likely to change, but there is debate on what changes will occur
Threats	• Species of interest, water resources, and ecological processes are currently being impacted by climate change, external anthropogenic influences, and diseases • Nonnative invasive species are a significant threat to native plant communities and could result in the replacement of native vegetation, the loss of rare species, changes in ecosystem structure, alteration of nutrient cycles and soil chemistry, shifts in community productivity, changes in water availability, and alteration of disturbance regimes • A nonnative species and plant pathogen of high concern is the blister rust fungus • There are concerns that the probability of high severity fire has increased (due to fire suppression) where low-severity fire regimes occurred historically • Several impacted areas lack needed rehabilitation measures • Nitrogen deposition may exceed ecosystem health thresholds known to affect the diversity of aquatic and terrestrial plants and lichens • Sulfur deposition is a significant concern at the park based on the NPS Air Resources Division benchmark conditions as ecosystems at the park may be highly sensitive to acidification effects (relative to all inventory and monitoring program parks) • Plant and animal poaching is a moderate concern • Many ecosystems are at risk from point source contamination (boats, oil spills, sewage, etc) • Increased nitrogen and sulfur from air pollution may affect the productivity of the water and water quality characteristics, and at extreme levels lead to eutrophication • Mercury and persistent pesticides are a potential concern, as contaminants have been documented in park biota such as vegetation and fish Park plants are at moderate risk of foliar ozone injury Ozone-sensitive species include *Apocynum androsaemifolium* (spreading dogbane), *Pinus ponderosa* (ponderosa pine), and *Populus tremuloides* (quaking aspen)

Fundamental Resource or Value	Representative Cascade Mountain Ecosystems
Opportunities	• Partnerships with outside agencies • Partner with adjacent forest land managers to develop climate change adaptation strategies • Understand the resources in the park well enough to make certain that the park would recognize potential hazards • Use the best available science to inform the decision-making process to make certain park management does not impair the park resources • Partner with individuals/groups that are specialists in a specific area to help inform management decision making • Training to make sure the current staff does not fall behind in knowledge about the fields of study relevant to the park
Existing Data and Plans Related to the FRV	• Natural resource condition assessment • Thorough vegetation survey and detailed information/maps about vegetation types • Status of whitebark pine along the Pacific Crest National Scenic Trail • Klamath Network initial surveys for amphibians and reptiles • Ecological effects of fire suppression, fuels treatment, and wildlife through bird monitoring in the Klamath ecoregion • Klamath Network landbird monitoring annual reports • Mixed severity fire regimes and forest structure • Technical report on estimating bird density and detection probability • Fire management plan • Fire ecology and seedling establishment in Shasta red fir forests • Fishes and stream habitat in tributaries of the Klamath River, with special reference to the Sun Creek bull trout population • Vegetation and special-status plant species report • Wetland delineation report • Wildland fire management plan • Studies of air pollution, vegetation, and fish
Data and/or GIS Needs	• Analysis of shifting species distribution as it relates to climate change • Need to better understand diseases and pests present in the park • Inventory and monitor invasive plants and animals on existing ecosystems in the park • Research links between biological and physical components of park ecosystems • Research fire, weather, geologic, air pollution, and other disturbance events • Characterize newt life history
Planning Needs	• Visitor use management plan (update) • Climate action plan • Resource stewardship strategy • Five-year fire management plan • Bear management plan (update) • Transportation plan • Integrated pest management plan • Wilderness management plan

Fundamental Resource or Value	Representative Cascade Mountain Ecosystems
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Endangered Species Act of 1973, as amended • National Invasive Species Act of 1996 • Migratory Bird Treaty Act of 1918 (16 U S C 703–712) • Clean Water Act of 1972 • Clean Air Act of 1977 (42 U S C 7401 et seq) • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 18: *Wildland Fire Management* • NPS *Natural Resource Management Reference Manual 77* • NPS Reference Manual 18: *Wildland Fire Management*

Fundamental Resource or Value	Awe-Inspiring Scenery
Related Significance Statements	Related to significance statements 1, 2, 3, 5, 6, and 7
Current Conditions and Trends	**Conditions** • The park is designated as Class I under the Clean Air Act Park lands are contingent to the largest dark area in the lower 48 states • Ground-based observations at the park found an anthropogenic light ratio of 0 06, indicating that the park is only 6% brighter than in entirely natural conditions • The Milky Way is often visible from horizon to horizon and may show great detail • Park visibility does not meet the NPS Air Resources Division benchmark for good condition; rather it falls within the moderate concern category **Trends** • Regional populations have grown in recent decades • During the last decade, visibility improved on the 20% clearest days and remained relatively unchanged on the 20% haziest days, resulting in an overall unchanged visibility trend
Threats and Opportunities	**Threats** • Vistas in the park are sometimes obscured by pollution-caused haze • Nitrogen enrichment could alter lake diversity and result in decreased lake transparency • Native species of plants and animals may be displaced by nonnatives, reducing the scenic quality of the landscape • Growing regional populations may impact night skies, soundscapes, and air quality • Wildfires impact many park resources, including air quality and visibility • The lights required on communication towers may disqualify the park from night sky certification • At night, pollution can make stargazing more difficult because it scatters artificial light and increases the impact of light pollution, resulting in an overall unchanged visibility trend • Increased visitation results in increased anthropogenic noise pollution • Logging in adjacent areas impacts the viewshed from the park • Impacts on water resources and native flora and fauna due to a changing climate **Opportunities** • Partner with communities and adjacent land managers to protect resources (night skies, air quality, etc) • Expand interpretive and educational tools to communicate the connections between night sky, air quality/pollution, Crater Lake, natural and cultural resource protection, climate change, human health, and other associated resources • Participate in federal, regional, and local air control plans • Address the aim of the Clean Air Act to eliminate all human-caused visibility impairments in Class I areas by the year 2064
Existing Data and Plans Related to the FRV	• Scenic values study • Natural resources condition assessment • Acoustic environment and soundscape analysis • Air emissions inventory • Weather and climate inventory • Fire management plan • Airborne contaminants in western parks • There is an on-site visibility monitor at the park

Fundamental Resource or Value	Awe-Inspiring Scenery
Data and/or GIS Needs	• Visual resource inventory • Night sky monitoring • Air quality data – continued monitoring and statistical analysis of the data • Acoustic monitoring for vehicle noise (overflights, loud motorcycle traffic, etc)
Planning Needs	• Night sky plan • Scenery conservation plan
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Organic Act of 1916 • Clean Air Act of 1977 (42 U S C 7401 et seq) • National Parks Air Tour Management Act • National Parks Overflight Act of 1987 (Public Law 100-91) • "Audio disturbances" (36 CFR 2 12) • "What is the maximum noise level for the operation of a vessel?" (36 CFR 3 15) • Clean Water Act of 1972 • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 47: *Soundscape Preservation and Noise Management* • NPS *Natural Resource Management Reference Manual 77*

Fundamental Resource or Value	Vast Body of Knowledge and Opportunities for Research and Education
Related Significance Statements	Related to all significance statements
Current Conditions and Trends	**Conditions** • Scientific studies began at Crater Lake in the early 1800s, and today it has an extraordinary amount of associated information • Highly pristine ecosystems and exposed geologic resources allow for valuable scientific access and study • Extensive museum and archive collections document all aspects of the park and are available for research and education • The Crater Lake Science and Learning Center was established to enhance scientific research and education programs dedicated to understanding, preserving, and interpreting the natural and cultural resources of the park The center helps guide management decisions and enhances interpretive and educational programs • There are 33 active research permits in the park as of November 2014 • The park averages 7–8 research applications per year • Recently competed research includes studies of the black-backed woodpecker, a forest inventory and analysis, and a study of the effect of ice extent on Mount Mazama eruptions • The current Classroom at Crater Lake education program takes place for 7–8 weeks each spring and fall The programs focus on topics related to snow science, winter survival, technology, geology, forest ecology, water quality, wildlife monitoring, interdependence and adaptations, and art • Other education programs include teacher development workshops, Teacher at the Lake, field courses, citizen science projects, and casual conversations **Trends** • Increased interest in the ongoing monitoring of the lake and associated scientific research • The Classroom at Crater Lake education program has grown from serving mostly upper elementary students to include middle and high school students • The average number of research permits granted by the park has increased significantly since the establishment of the Crater Lake Science and Learning Center
Threats and Opportunities	**Threats** • Competition for research funding from other high priority parkwide efforts • The park is not always successful at putting studies to use in practical management applications • Research conducted by outside entities is not always submitted to the park **Opportunities** • Partnerships with nonprofit organizations, other agencies, and the academic community to further research initiatives • Collect on-the-ground data to verify existing data sets • Develop the next generation of park employees and park stewards • Ensure the long-term stability of the Crater Lake Science and Learning Center through stronger academic partnerships • Pursue opportunities for citizen science
Existing Data and Plans Related to the FRV	• Research library

Fundamental Resource or Value	Vast Body of Knowledge and Opportunities for Research and Education
Data and/or GIS Needs	• Integrate data (existing and new) into the Integrated Resource Management Applications data system • Research needs assessment • World Heritage biosphere reserve status study
Planning Needs	• Klamath Network inventory and monitoring program plan and associated protocols • Long-range interpretive plan update • Management plan for the Crater Lake Science and Learning Center
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • National Historic Preservation Act of 1966, as amended (16 USC 470) • Antiquities Act of 1906 • Archeological and Historic Preservation Act of 1974 • Archaeological Resources Protection Act of 1979 • American Indian Religious Freedom Act of 1978 (PL 95-341) • Historic Sites Act of 1935 • Management of Museum Properties Act of 1955 (PL 84-127), as amended • Paleontological Resources Protection Act of 2009 • Federal Cave Resources Protection Act of 1988 • Federal Noxious Weed Act of 1974, as amended • "Curation of Federally-Owned and Administered Archaeological Collections" (36 CFR 79) • "Protection of Historic Properties" (36 CFR 800) **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 6: *Interpretation and Education* • Director's Order 24: *NPS Museum Collections Management* • Director's Order 28: *Cultural Resource Management* • Director's Order 28A: *Archeology*, section 4A(3), "Native American Graves Protection and Repatriation Act" • Director's Order 77-2: *Floodplain Management* • NPS *Museum Handbook*, parts I, II, and III • *NPS-75 Natural Resources Inventory and Monitoring Guideline* • NPS *Natural Resource Management Reference Manual 77*

Fundamental Resource or Value	Abundant Opportunities for Visitor Connections to Nature and History
Related Significance Statements	Related to all significance statements
Current Conditions and Trends	**Conditions** • There is a diversity of programs and recreational opportunities to engage visitors at the park, including hiking trails, interpretive boat tours, trolley tours, multiple interpretive programs at Sinnott Memorial, the Lodge, and the Mazama Amphitheatre, snowshoeing, and other important recreational opportunities • The park has a new and updated film, waysides, and trailheads • Franchise fee funding provides for two-thirds of the park staff requirements • Several facilities are newly renovated, such as the Annie Creek restaurant, the Lodge, and the Rim Café and Gifts • There is no visitor center; the existing facilities are visitor contact stations that focus mostly on souvenirs and educational materials • The Sinnott Memorial has exhibits, but it is only accessible for four to five months of the year and has limited accessibility to people in wheelchairs • Trolleys provide an alternative to going on boat tours **Trends** • The park has seen decreased funding and numbers of interpretive staff • Increased work with partners to provide recreational and interpretive opportunities • There have been changes in visitation patterns, although the changes have not been quantified

Fundamental Resource or Value	Abundant Opportunities for Visitor Connections to Nature and History
Threats and Opportunities	**Threats** • Lack of a visitor center and inadequate staffing • There may be lower quality visitor experiences if there are not opportunities to interact with rangers • Climate change is impacting resources and thus the visitor experience of the park • Negative impacts on air quality inhibit the visitor's experience of scenic resources and the quality of recreation **Opportunities** • Use partners for expanded interaction with visitors and increase visitor contact with park rangers • Identify additional long-term funding for education program (e g , license plate funding and grants) • Interpretation/education of the influences from climate change on park resources • Additional partnerships with the US Forest Service to improve boundary access roads • Exhibits at the Watchman fire lookout – the waysides are updated but the museum is not available to visitors • A year-round visitor center would enhance the visitor experience, especially in winter • Audio descriptions to accompany the waysides • Shuttle services would provide an opportunity to reduce congestion at key parking lots (e g , Rim Village, Cleetwood Cove) • Begin winter lodging at Mazama Village • Increase the length of visitor stays at the park • Expand chances to explore more of the park • Attract new and diverse audiences • Improve wayfinding and develop easily accessibly pre-visit information on the internet • Increase visitor awareness of winter and shoulder season opportunities to experience the park • Continue to improve park sustainability and communicate with stakeholders and public about the park's environmental leadership through the Climate Friendly Parks Action Plan park Environmental Management System (Director's Order 13A)
Existing Data and Plans Related to the FRV	• Trails management plan (in progress) • Long-range interpretive plan • Interpretive prospectus • Annual visitor satisfaction survey • Visitor services plan environmental impact statement • Scenic values study • Vehicle and visitor use study technical memorandum • Superintendent's compendium • Winter use study • Museum management plan
Data and/or GIS Needs	• Visitor use study • Accessibility inventory • Transportation study to support transportation plan and quantify areas of congestion and overcrowding

Fundamental Resource or Value	Abundant Opportunities for Visitor Connections to Nature and History
Planning Needs	• Visitor use management plan update • Accessibility transition plan • Interpretive media plan • Long-range interpretive plan update • Campground management plan
Laws, Executive Orders, and Regulations That Apply to the FRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the FRV** • Clean Water Act of 1972 • Clean Air Act of 1977 (42 U S C 7401 et seq) • Americans with Disabilities Act (PL 101-336) • Architectural Barriers Act • "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act Accessibility Guidelines" (36 CFR 1191) • Rehabilitation Act of 1973 • National Park Service Concessions Management Improvement Act • "Concession Contracts" (36 CFR 51) • Secretarial Order 3289, "Addressing the Impacts of Climate Change on America's Water, Land, and Other Natural and Cultural Resources" **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • Director's Order 6: *Interpretation and Education* • Director's Order 42: *Accessibility for Visitors with Disabilities in National Park Service Programs and Services* • Director's Order 48A: *Concession Management* • Director's Order 48B: *Commercial Use Authorizations* • NPS *Transportation Planning Guidebook*

Analysis of Other Important Resources and Values

Other Important Resource or Value	Volcanic Legacy Scenic Byway All American Road
Current Conditions and Trends	**Conditions** • The National Scenic Byways Program is part of the US Department of Transportation, Federal Highway Administration • Rim Drive is in need of repair • North Junction is in need of an upgrade • There is a good website and informational material about the byway • Volcanic Legacy Scenic Byway map, tour guide, and interpretive guide are available • Newly installed wayside and trailhead exhibits **Trends** • The byway is being revitalized after a period of minimal activity
Threats and Opportunities	**Threats** • No funding available yet to rehabilitate East Rim Drive **Opportunities** • Grants could fund improvements to pull outs, picnic areas, and trailheads along the byway, such as paving, signs, restrooms, kiosks, etc They might be a source to fund improvements for North Junction or the Corrals (Watchman Trailhead) or other locations • Grant funds could assist with some aspects of a year-round visitor center • Partnerships with other federal agencies and local tourism groups • Funding available to rehabilitate West Rim Drive and Cleetwood parking starting in 2015
Existing Data and Plans Related to the FRV	• Volcanic Legacy Scenic Byway corridor management plan • Volcanic Legacy Scenic Byway strategic plan • Volcanic Legacy Scenic Byway interpretive plan
Data and/or GIS Needs	• None identified
Planning Needs	• Site planning (including development concept plan for Rim Village circulation, North Junction, and others)
Laws, Executive Orders, and Regulations That Apply to the OIRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the OIRV** • Intermodal Surface Transportation Efficiency Act of 1991 • Transportation Equity Act for the 21st Century 1998 • Clean Air Act of 1977 (42 U S C 7401 et seq) • Historic Sites Act of 1935 • "Audio disturbances" (36 CFR 2 12) **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • NPS *Natural Resource Management Reference Manual 77* • NPS *Transportation Planning Guidebook* • Director's Order 47: *Soundscape Preservation and Noise Management*

Other Important Resource or Value	Segments of the Pacific Crest Trail
Current Conditions and Trends	**Conditions** • The segment of the Pacific Crest Trail within Crater Lake National Park is in good condition • Part of the trail is composed of old fire roads • There is no water available to hikers on the northern portion of the trail • There is an alternate route along the rim of the lake that makes use of the Old Rim Road • Stock and dogs are allowed on the trail • The Pacific Crest Trail is the trail coordinator and the land owning agencies manage individual trail segments • Trail work is conducted by Northwest Youth Corps, Pacific Crest Trail volunteers, Student Conservation Association volunteer groups, etc • The backcountry trails in the park receive limited use compared with the rest of the park **Trends** • The Pacific Crest Trail is increasing in popularity, in part because of Cheryl Strayed's book Wild • Having fewer backcountry rangers has led to reduced information about use and impacts on park resources and makes it more difficult to regulate visitors in backcountry areas
Threats and Opportunities	**Threats** • Stock animals and dogs may pose threats to wildlife and may introduce nonnatives • Some native plants can be overgrazed by stock animals, further increasing opportunities for invasive species to thrive **Opportunities** • Expand collaboration with volunteer groups such as the Northwest Youth Corps, Pacific Crest Trail volunteers, Student Conservation Association volunteer groups, and others • Share information with Pacific Crest Trail hikers about wilderness ethics, leave no trace, etc
Existing Data and Plans Related to the OIRV	• Trails management plan (in progress) • Pacific Crest Trail hiker logs
Data and/or GIS Needs	• None identified
Planning Needs	• None identified
Laws, Executive Orders, and Regulations That Apply to the OIRV, and NPS Policy-level Guidance	**Laws, Executive Orders, and Regulations That Apply to the OIRV** • Federal Noxious Weed Act of 1974, as amended • Clean Water Act of 1972 • Executive Order 13112, "Invasive Species" • National Trails System Act of 1968 **NPS Policy-level Guidance (NPS *Management Policies 2006* and Director's Orders)** • NPS *Natural Resource Management Reference Manual 77*

Appendix C: Inventory of Special Mandates and Administrative Commitments

Special Mandates

Long-Term Limnological Monitoring Program

The Crater Lake Long-Term Limnological Monitoring Program began with a congressionally mandated (Public Law 97-250) 10-year study (1982–1992). The 10-year program was established to determine whether the lake was undergoing what appeared to be a long-term decline in water clarity. The National Park Service did not have an adequate limnological database to interpret the apparent changes in clarity for managing this nationally and internationally treasured resource. During the 10-year program, scientists and park managers built a high quality limnology program. The program documented that the lake clarity was within normal interannual variation. It also provided valuable data and recommendations on a number of other management issues.

In 1994 the National Park Service received Congressional funding to continue a long-term monitoring program as part of park base operations. The purpose of the long-term program is to develop a limnological database to evaluate long-term trends, to develop an understanding of the interrelationships among ecosystem components to evaluate change, and to contribute to the preservation and management of Crater Lake, and other international aquatic resources, through publication of peer-reviewed program results.

Klamath Basin General Stream Adjudication

The State of Oregon, Klamath Basin General Stream Adjudication, is currently active and includes Crater Lake National Park. The adjudication is a legal process that will determine the quantities and relative priorities associated with the park's use of water from Crater Lake and the streams flowing within the park. The National Park Service has filed 21 federal reserved water rights claims (Claim Nos. 591–611) on behalf of Crater Lake National Park for instream, lake level, and out-of-stream uses.

The first phase of the adjudication was the review and determination of the claims. With Oregon's Water Resources Department's issuance of the Adjudicator's Findings of Fact and Final Order of Determination on March 7, 2013, this phase of the process is now complete.

The second phase of the adjudication process is occurring. This is the review of the Final Order of Determination by the courts. Adjudication claimants or contestants who dispute the department's determination of their claims or contests will have an opportunity to file exceptions with the Klamath County Circuit Court. The court will then review these exceptions and will ultimately issue a water rights decree affirming or modifying the Final Order of Determination. The department can issue water right certificates in accordance with the decree once it is issued by the court.

Acquisition of the federal reserved water rights would not eliminate the risk of Crater Lake's administrative uses being called out by downstream senior water rights holders during dry years. The National Park Service is negotiating with local water users for senior water rights that would augment the park's federal reserved water rights during dry years.

The park has developed an alternative ground water source that could meet all present and foreseeable needs. The National Park Service is working with the State of Oregon, Water Resources Division on how this source may be developed and used under existing regulation and law. The park is represented on the Upper Klamath Basin Watershed Rules Advisory Committee.

Requirements for Inventory of Geothermal Resources under the Geothermal Steam Act of 1970, Amended (P.L. 100-443)

The act requires the National Park Service to maintain a list of significant thermal features within the park and to maintain a monitoring program for significant thermal features. The act also requires the National Park Service and US Forest Service to assess impacts on the significant thermal features within the park before granting leases for geothermal exploration or development.

Designation of Crater Lake National Park as a Class I Area

Crater Lake National Park has been designated as a Class I area under the Clean Air Act. Class I areas are national parks larger than 6,000 acres and national wilderness areas larger than 5,000 acres that were in existence on August 7, 1977. As a Class I area, only the smallest increment of criteria pollutants can be added to the air by a proposed source. Also, the federal land manager has an "affirmative responsibility to protect air quality related values (including visibility)" in Class I areas.

Authority to Prohibit Commercial Air Tours Over the Park under the FAA Modernization and Reform Act of 2012 (PL 112-95)

The act allows the director of the National Park Service to deny commercial air tour operations without the establishment of an air tour management plan if the director determines that such operations would adversely affect park resources or visitor experiences.

Wilderness Recommendation for Crater Lake National Park (1974)

The 1974 National Park Service wilderness proposal recommended wilderness designation for approximately 122,400 acres of lands within the park. This recommendation was transmitted to Congress by the president. The legislative process has not been completed for the Crater Lake National Park Wilderness Designation proposal. However, it is the policy of the National Park Service (NPS Management Policies 2006, chapter 6, "Wilderness Preservation and Management") to "take no action that would diminish the wilderness eligibility of an area possessing wilderness characteristics until the legislative process of wilderness designation has been completed. Until that time, management decisions will be made in expectation of eventual wilderness designation. This policy also applies to potential wilderness, requiring it to be managed as wilderness."

Administrative Commitments

Agreement Name	Type of Agreement	Start Date	Expiration Date	Stakeholders	Purpose
Southern Oregon University and Oregon Institute of Technology	Cooperative agreement	1/1/12	12/31/16	Southern Oregon University and Oregon Institute of Technology	Operation of the Crater Lake Science and Learning Center
Cooperative Ecosystems Studies Unit agreement with Oregon State University	Cooperative Ecosystems Studies Units task agreement	9/8/14	8/31/16	Oregon State University	Lepidopteran survey
Cooperative Ecosystems Studies Unit agreement with University of Washington	Cooperative Ecosystems Studies Units task agreement	9/1/11	12/1/15	University of Washington	Using LiDAR to evaluate fire history and severity
Cooperative Ecosystems Studies Unit agreement with University of Washington	Cooperative Ecosystems Studies Units task agreement	9/1/14	12/31/16	University of Washington	Using LiDAR to assist in forest restoration
Oregon Institute of Technology	State grant collaboration	2008	2010	Oregon Institute of Technology	To create the Crater Lake Digital Research Collection at Oregon Institute of Technology
Research Natural Areas (4)	Designated by the National Park Service as part of a national network	N/A	N/A	Research community	Identify examples of natural ecosystems for the purposes of scientific study and education and for maintenance of biological diversity
Ten-year plan for long-term monitoring of the park (from 1983/1984)	Public Law 97-250	1982	1992	Crater Lake National Park	To determine if Crater Lake was undergoing what appeared to be a long-term decline in water clarity
Draft commitment with Klamath tribal government		TBD			Create government-to-government agreement determining rights and responsibilities for both parties concerning tribal use of heritage lands within Crater Lake National Park

Agreement Name	Type of Agreement	Start Date	Expiration Date	Stakeholders	Purpose
Agreement between the United States Department of the Interior, National Park Service – Crater Lake National Park and the Crater Lake National Park Trust (agreement number G-9320-10-001)	Memorandum of understanding	2/9/10	Five years after the start date	Crater Lake National Park Trust	To raise funds to support park project and program needs; to promote the protection, understanding and appreciation of Crater Lake; and to support projects and programs that will enhance the visitor experience or improve and protect natural and cultural resources at Crater Lake National Park
Crater Lake National Park Science and Learning Center Endowment Fund Agreement and Judgment Modifying Fund Restrictions (case number 120790977, circuit court of the State of Oregon, Multnomah County)	Fund agreement and general judgment modifying fund restrictions	Agreement dated: 05/31/07; Judgment dated: 07/12/12	None	The Oregon Community Foundation	To assure long-term financial support for the operation and maintenance of the Crater Lake Science and Learning Center; funds come from the sale of Crater Lake license plates
Xanterra Parks and Resorts, Inc	Concession contract	2002	2017		Provide food service, lodging, gift and merchandise sales, and boat tours
Crater Lake Trolley	Concession contract	2013	2023		Provide interpretive tours of Rim Drive
Greg Hartell Historic Preservation Student Internship Endowment Fund agreement	Fund agreement	12/2007	None	University of Oregon Foundation	To provide limited stipend to University of Oregon students selected as Hartell interns each summer
Greg Hartell Fund for Historic Preservation	Fund agreement	10/26/ 12	No expiration date, remains active as long as the fund exists	The Oregon Community Foundation, University of Oregon Foundation	To establish a charitable fund for the purposes of supporting the advancement of historic preservation and protection of cultural resources at the Crater Lake National Park, Oregon Caves National Monument, or other units of the National Park Service; provide a limited stipend to University of Oregon students selected as Hartell interns

Agreement Name	Type of Agreement	Start Date	Expiration Date	Stakeholders	Purpose
Klamath County Fire Defense Board Countywide mutual aid agreement	Countywide mutual aid agreement	2013	No expiration	All structural fire departments in the county	Countywide mutual aid agreement for structural fire; all the structural fire departments in the county are partners and agree to support each other with equipment and personnel as needed for emergencies
Klamath County Ambulance Advisory Committee	Charter		No expiration		Mutual aid emergency medical services among the ambulance service areas within the county; the park is considered its own service area; members agree to assist each other as needed in emergencies as to emergency medical services equipment and personnel
NPS-US Forest Service Regional Mutual Aid Law Enforcement	Memorandum of understanding		No expiration	NPS Pacific West Region and the US Forest Service Pacific Northwest Region	Mutual aid law enforcement; the agencies agree to provide support to each other as requested for law enforcement incidents occurring on lands administered by either agency
National Department of the Interior law enforcement mutual aid agreement	Memorandum of understanding		2017	NPS, Bureau of Land Management, US Fish and Wildlife Service, Bureau of Indian Affairs	Assist each other with law enforcement incidents on any of the agency's administered lands as needed

Appendix D: Ongoing High Priority Plans

The following high priority plans are either currently funded or underway. They are highlighted here to emphasize that they remain high priority needs for park management.

Planning Document	Status
Ethnohistory	Funded
Invasive vegetation management plan	Underway
Data infrastructure and recabling plan	Underway

Pacific West Region Foundation Document Recommendation
Crater Lake National Park

August 2015

This Foundation Document has been prepared as a collaborative effort between park and regional staff and is recommended for approval by the Pacific West Regional Director

RECOMMENDED
Craig Ackerman, Superintendent, Crater Lake National Park **Date**

APPROVED
Patricia L Neubacher, Acting Regional Director, Pacific West Region **Date**

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historic places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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