Lewis and Clark National Historical Park
Fire Management Plan
Environmental Assessment

Proposed by
National Park Service
May 2011

UNITED STATES DEPARTMENT OF INTERIOR - NATIONAL PARK SERVICE - PACIFIC WEST REGION

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CHAPTER 1: PURPOSE AND NEED

INTRODUCTION

This environmental assessment (EA) documents the potential environmental impacts of an action proposed by the National Park Service (NPS) to amend the Lewis and Clark National Historical Park Fire Management Plan (FMP).
This EA has been prepared in compliance with:

- The National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), which requires an environmental analysis for major federal actions having the potential to impact the quality of the human environment;
- Council of Environmental Quality Regulations at 40 Code of Federal Regulations (CFR) 1500-1508, which implement the requirements of NEPA;
- US Dept. of Interior Conservation Planning, Environmental Impact Analysis, and Decision Making; Director's Order #12 and Handbook.

This EA provides information to allow NPS officials to make decisions and recommendations related to the Lewis and Clark National Historical Park FMP. This decision will be made within the overall management framework already established in the Lewis and Clark National Historical Park General Management Plan (GMP). The alternative courses of action to be considered at this time are crafted to be consistent with the concepts established in the 1995 General Management Plan and NPS Director's Order #18 (DO-18).

This EA evaluates the potential impacts of the various alternatives proposed by Lewis and Clark National Historical Park (NHP) and addresses whether the proposed actions may impair resources or values that are (1) necessary to fulfill specific direction identified in the enabling legislation of the park (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park and (3) identified as a goal in the park's general management plan or other NPS planning documents.

PURPOSE AND NEED

NPS Wildland Fire Management Guidelines Director's Order 18 (DO-18) state that "all parks with vegetation that can sustain fire must have a fire management plan." The purpose of this federal action is to update the current Lewis and Clark NHP fire management plan and program that utilize the benefits of fire to achieve desired natural and cultural resource conditions while minimizing the fire danger to the public/park staff, park resources, and adjacent lands from hazardous fuel accumulations.

A Fire Management Plan is a detailed description of strategies and actions intended to provide direction for the effective management of wildland and prescribed fire on a particular area of

land. It is developed in accordance with current federal wildland fire policy as outlined in: ***Implementation of Federal Wildland Fire Management Policy*** (2009). It is important to note that the benefits of fire in achieving desired resource conditions serve a park-wide need and does not supplement or compete with forest restoration projects. The life-span of a fire management plan without a comprehensive review is five years.

National Park Service policy (Director's Order 18: January, 2008) recognizes that fire is an important ecological and evolutionary force in many terrestrial ecosystems. The policy further states that fire will be managed to fulfill the need of protecting, perpetuating, or recreating natural environments or historic scenes. Fire management strategies for individual parks must be designed based on park management objectives. The resource management objectives of the park may determine whether a prescribed fire component is needed. At Lewis and Clark National Historical Park, it is anticipated that a very minimal use of prescribed fire will be utilized to meet park objectives. As a "climate friendly" park, Lewis and Clark National Historical Park will seek alternatives to burning whenever alternative means can be used to meet management goals.

A fire management plan for Lewis and Clark National Historical Park, Fort Clatsop Unit, was approved in 2005. This plan covered the original 125 acres of Fort Clatsop National Memorial and an additional 155 adjacent acres added in 2002. This plan expired in 2010, and does not include additional units acquired since that time. The further expansion of the park and addition of new federal management sites require the park to complete a new fire management plan in accordance with pertinent National Environmental Policy Act requirements. A revised FMP and EA needs to be completed that will consider fire management activities over the next five years. This plan will assist park managers in meeting cultural and natural resource management goals while ensuring that firefighter and public safety are not compromised. If a fire management plan is not in place by the start of fire season 2011, fire management projects involving hazard fuel reduction and prescribed fire outside of the analyzed area of the 2004 Fire Management Plan will not be allowed until an approved plan is in place. The projects discussed in this report represent the full breadth of all possible fire-related projects the park *may* engage in within the next five years.

BACKGROUND

In May 1804, the Corps of Discovery led by Meriwether Lewis and William Clark by order of President Thomas Jefferson began their journey from Missouri to cross the American continent; creating maps, collecting specimens, and making contact with native peoples as they went. A year and a half later, their journey west would end at the mouth of the Columbia River and the Pacific Ocean. Before heading back east, they built Fort Clatsop on the Netul River, now called the Lewis and Clark River, and stayed for three months while they wrote reports, annotated maps, and processed their collections and waited for the winter to pass. They left in March of 1806 to return home. It was in appreciation of the achievements and importance of the Lewis and Clark Expedition that the Fort Clatsop site became a National Memorial in 1958.
Since the National Memorial designation was made in 1958, the park has continued to expand. In 1979 the 0.2 acre Salt Works parcel was purchased in Seaside and added to the park. The Fort Clatsop unit was expanded to about 1200 acres in 2002 under the Fort Clatsop Boundary Expansion Act. The major expansion came in 2004 with the passage of the Lewis and Clark

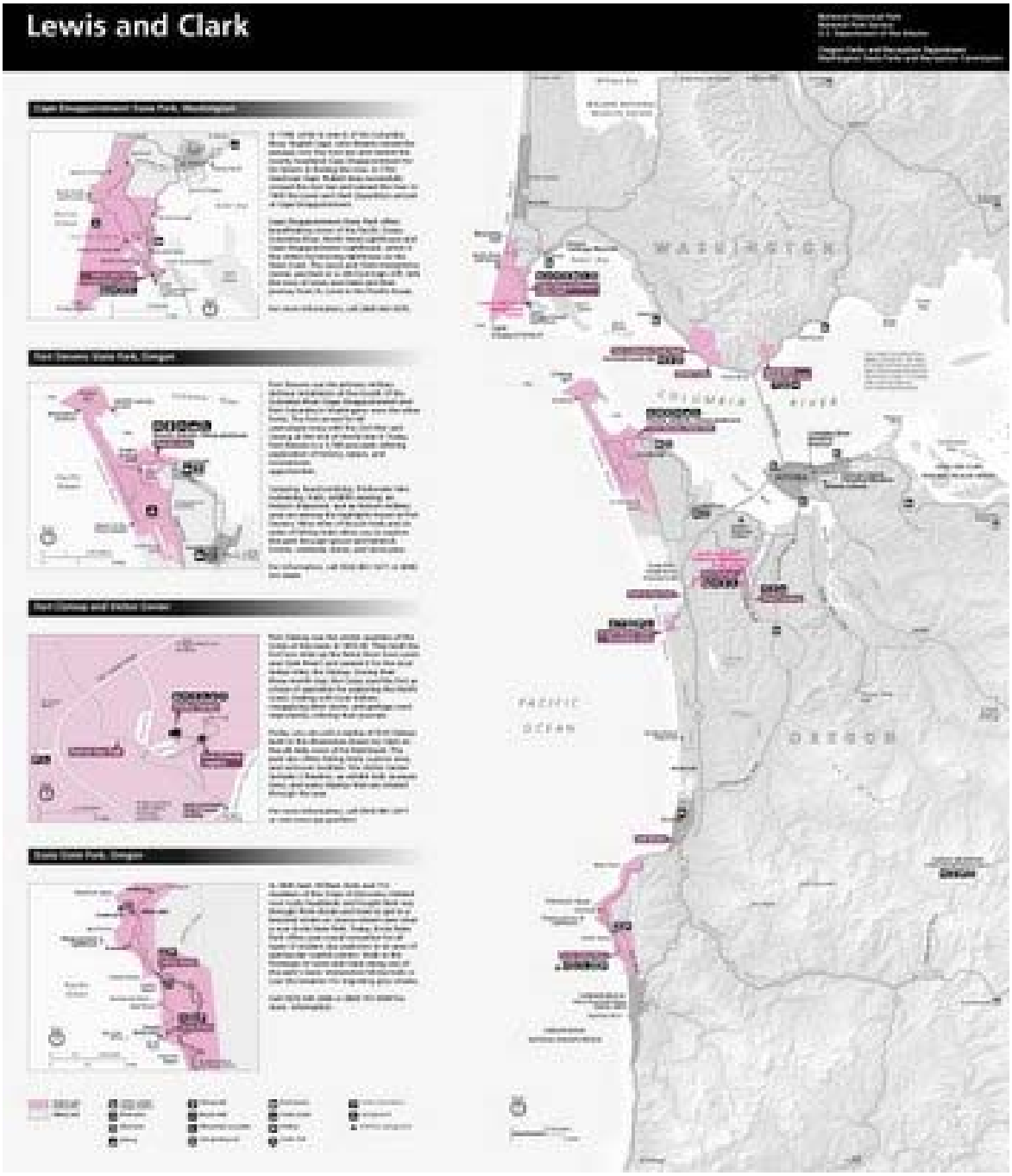
National Historical Park Designation Act, which added units in Washington and additional sites in Oregon. With the 2004 Act the park area now stands at 3,358 acres.

LOCATION AND ACCESS

Lewis and Clark National Historical Park is located on the Pacific coast in Clatsop County, Oregon and Pacific County, Washington (Figure 1). There are six main Park Service units: Cape Disappointment, Middle Village/Station Camp, Dismal Nitch, Sunset Beach, Yeon, and Fort Clatsop. There is also a seventh small Park Service property, the Salt Works, which is a treed city lot with an interpretive panel and reproduction of a salt cairn similar to that described in the Lewis and Clark journals as having been used by expedition members. The lot is inland from the beach due to the fact that several hundred feet of shoreline have accreted over the last 200+ years. In addition to their historical significance, the Lewis and Clark NHP lands preserve declining coastal habitats and provide important resources for wildlife.
Three of the units are located in Washington State. The largest is Cape Disappointment State Park, an entirely coastal park located on the peninsula at the extreme south-western tip of Washington. It includes headlands, forests, wetlands, dunes and several miles of beach line. While this unit continues to be managed by Washington State Parks, it is within the legislative boundaries of Lewis and Clark NHP as defined in the 2004 Lewis and Clark NHP designation act. The other two Washington units are located upstream along the Columbia River. They are Middle Village/Station Camp, a pre- and post-contact site of international significance located west of the Astoria Bridge, and Clark's Dismal Nitch, a smaller unit located just east of the Astoria-Megler Bridge; both sites are largely composed of forests on the bluffs overlooking the Columbia River. Main highway access to all sites is off Highway 101. A vicinity map is shown in Figure 1

The original national historical monument, Fort Clatsop, is located on the Lewis and Clark River south-east of the city of Astoria, Oregon. Aside from the wetlands and riparian habitats along the river, this 1,200 acre unit is a mostly forested area which now includes the Fort to Sea trail east of Highway 101, connecting the fort to the ocean. The Fort to Sea trail terminates at Sunset Beach State Recreation Area, which is owned by Oregon State Parks but is within the legislative boundaries of Lewis and Clark NHP, and is cooperatively managed between the two agencies. Directly south of Sunset Beach is the recently acquired Yeon property.

Figure 1 Vicinity Map



FIRE HISTORY

There is limited evidence available with which to reconstruct a "natural" fire history at Fort Clatsop. The presence of buried charcoal at Fort Clatsop suggests that fire did occur there at one time. Unlike drier interior forests throughout much of the western U.S., natural fires in coastal Sitka spruce rainforests are very infrequent; Fahnestock and Agee (1983) calculated a fire return interval for the Sitka spruce type in western Washington at over 1,100 years. Wind replaces fire as the dominant ecological disturbance and evolutionary force in this forest type. When fire does occur in the "Sitka Spruce Zone", it burns under unusually dry weather conditions and has generally severe effects on the stand.

Evidence suggests that there has been one stand-replacement fire at Fort Clatsop, occurring approximately several to many hundred years ago. The fire most likely covered an area much larger than Fort Clatsop. Observations by Lewis and Clark of many large trees further support the hypothesis that the fire occurred many centuries prior to their visit.

Northwest coastal tribes used fire as a management tool to maintain forest openings to improve hunting opportunities and increase berry production (Derr 2003, Deur 2005).

Modern fire history shows most wildfires are human-caused and occur in areas of human use. Prescribed fire activities in the park have been limited to pile burning to dispose of materials generated from hazardous fuel reduction activities and/or maintenance activities.

Hazard fuel reduction projects have been completed at the park annually since 2006. These projects have entailed thinning dense stands of mixed conifer and reducing dead and down surface fuel loading in order to provide adequate defensible space around developed areas, such as the Visitor Center and Yeon House. Approximately 10-15 acres have been treated each year.

VEGETATION RESTORATION PROJECTS

Use of wildland fire (prescribed fire only) can be an important step in eradication of invasive plant species, such as reed canary grass (*Phalaris arundinacea*) and Scotch broom (Cytisus scoparius). The park may wish to engage in some small, controlled, research burns in combination with mechanical and chemical treatments of these and other invasive species. These possible projects and project areas are described on the following maps. (Figures 2-4)
The park is currently developing a forest restoration plan as directed in the General Management Plan (1995). The purpose of the Forest Restoration Plan is to restore and rehabilitate recently purchased industrial forest lands at Lewis and Clark National Historical Park. The park aims to convert 963 acres of land managed for industrial hemlock and Douglas fir production to forests that more closely approximate the structure, ecology, and appearance of forests in 1805-1806. This will be achieved primarily by thinning out dense stands and creating gaps. The use of wildland fire (prescribed fire only) in conjunction with other treatments to achieve both the ecological goals outlined in the Forest Restoration Plan (2011) and create fuel breaks is possible. In this case "prescribed fire" would be limited to pile burning; no broadcast or understory burning would take place in the forest. The vegetation goals described in the Forest Restoration Plan will serve as the vegetation goals for forested portion of the Fort Clatsop unit under this fire

plan. Potential fire management project locations are shown in figures 2-4 (Proposed 5 –year plan project areas).

Figure 2 Yeon Property Project Area Summary

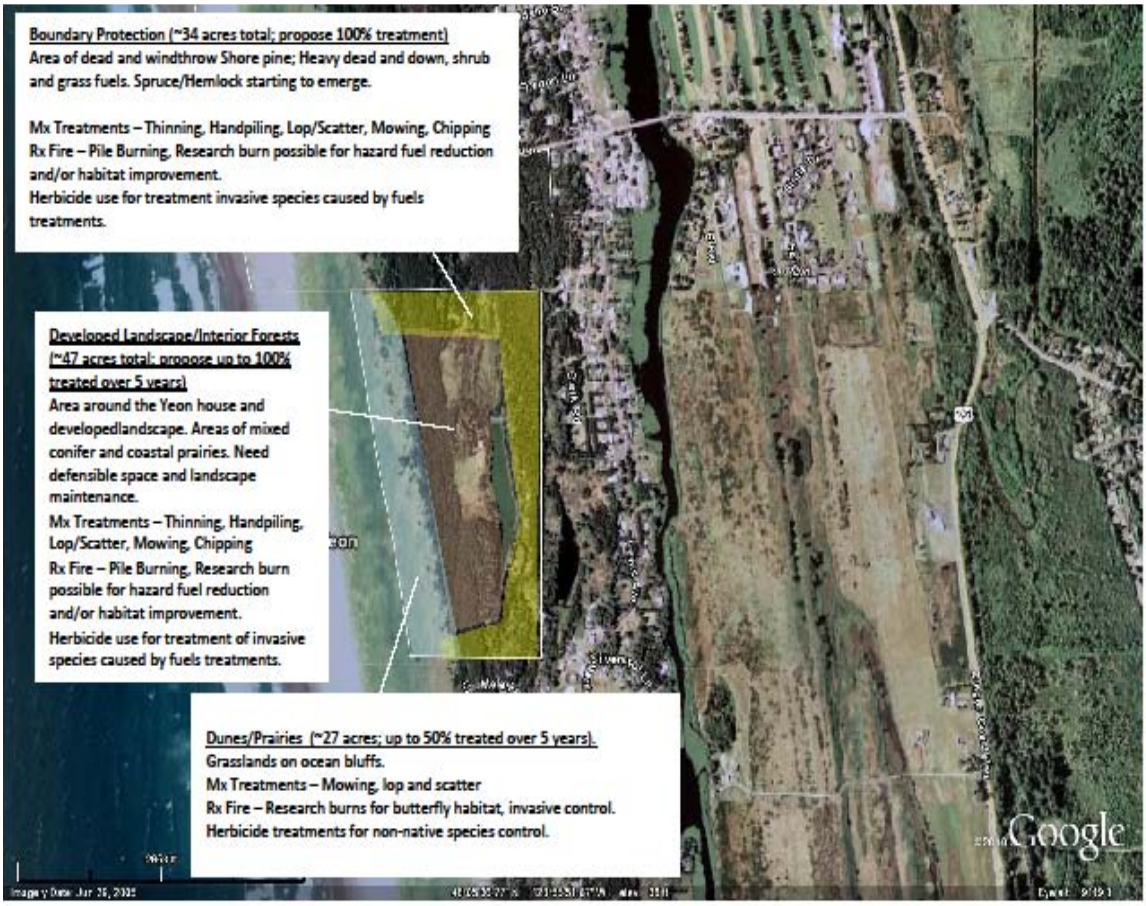
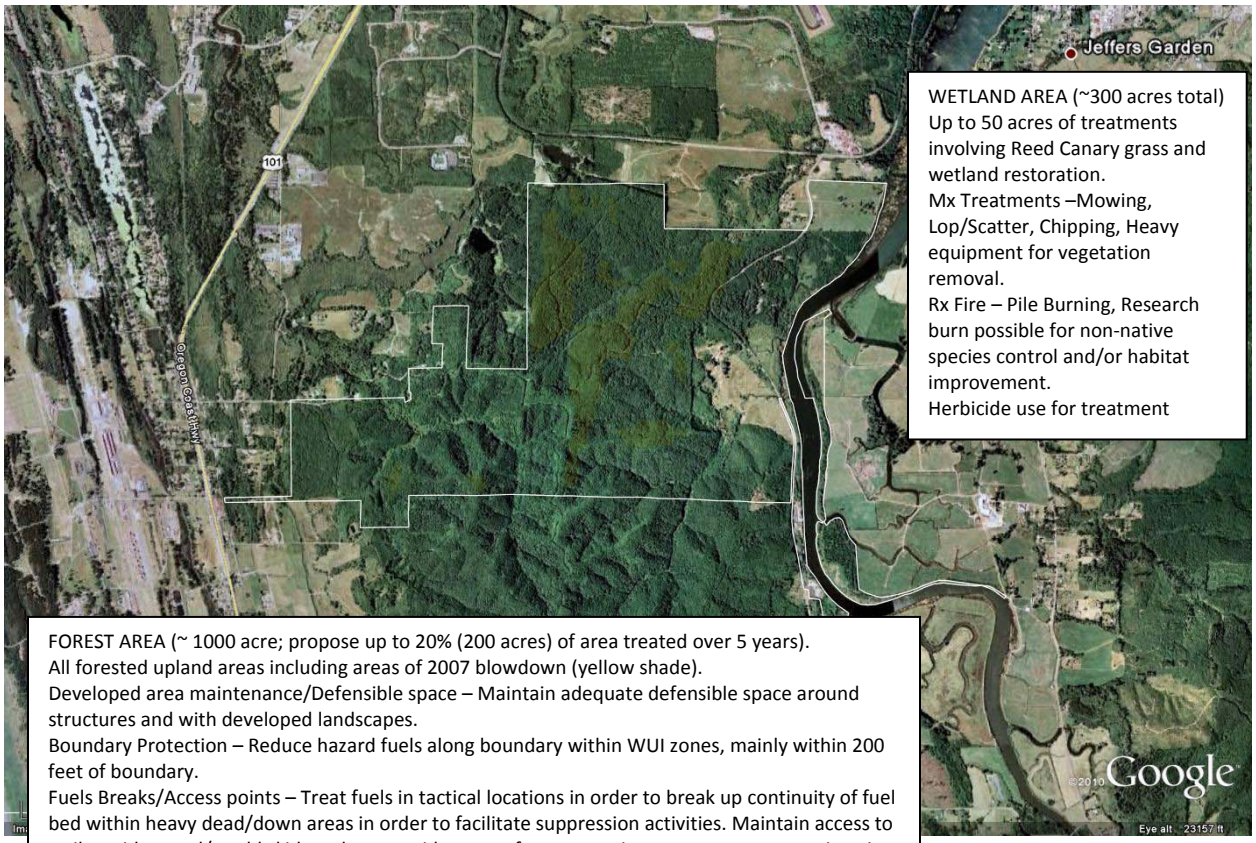


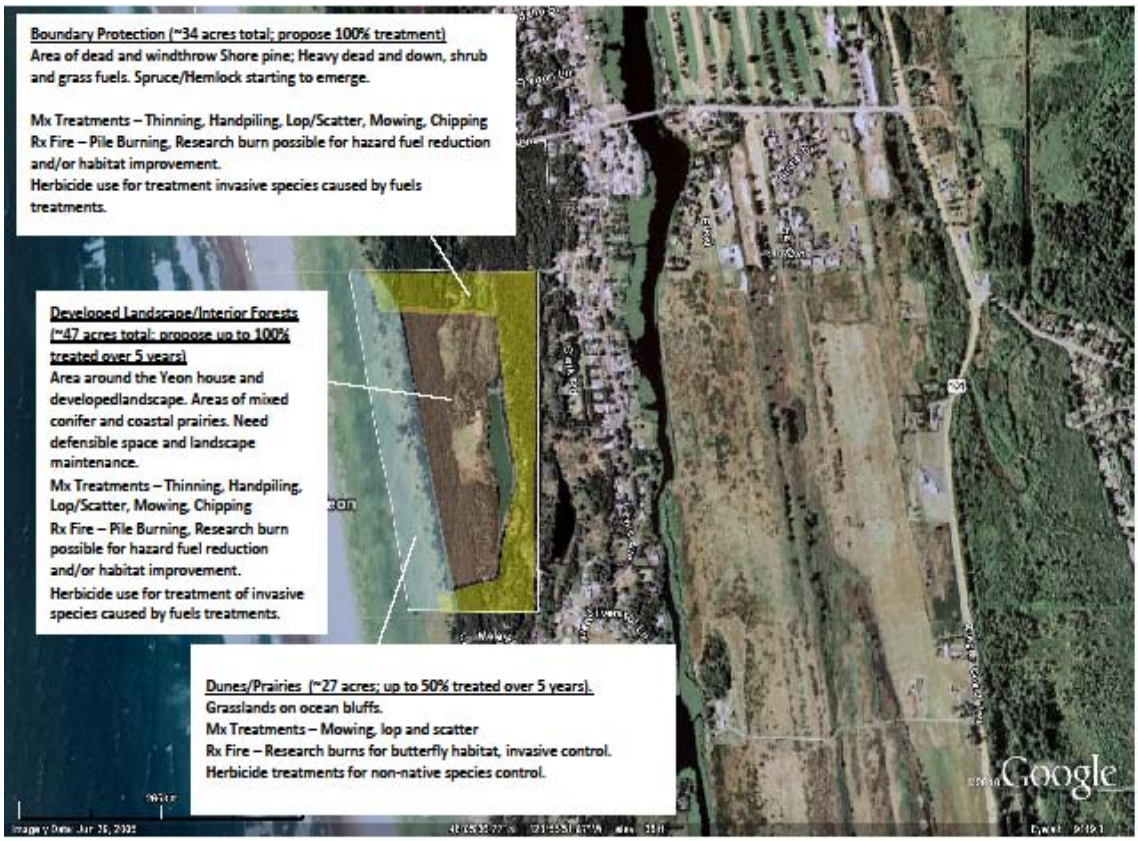
Figure 3 Forest and Wetland Project Area near Fort Clatsop Summary



WETLAND AREA (~300 acres total)
Up to 50 acres of treatments involving Reed Canary grass and wetland restoration.
Mx Treatments –Mowing, Lop/Scatter, Chipping, Heavy equipment for vegetation removal.
Rx Fire – Pile Burning, Research burn possible for non-native species control and/or habitat improvement.
Herbicide use for treatment

FOREST AREA (~ 1000 acre; propose up to 20% (200 acres) of area treated over 5 years).
All forested upland areas including areas of 2007 blowdown (yellow shade).
Developed area maintenance/Defensible space – Maintain adequate defensible space around structures and with developed landscapes.
Boundary Protection – Reduce hazard fuels along boundary within WUI zones, mainly within 200 feet of boundary.
Fuels Breaks/Access points – Treat fuels in tactical locations in order to break up continuity of fuel bed within heavy dead/down areas in order to facilitate suppression activities. Maintain access to trail corridors and/or old skid roads to provide routes for suppression resources to access interior fires.
Mx Treatments – Thinning, Handpiling, Lop/Scatter, Chipping
Rx Fire – Pile Burning, Research burn possible for hazard fuel reduction and/or habitat improvement.
Herbicide use for treatment of invasive species caused by fuels treatments.

Figure 4 Washington State Units: Cape Disappointment, Station Camp and Dismal Nitch Project Area Summary



FIRE MANAGEMENT GOALS AND OBJECTIVES

NPS Wildland Fire Management Guidelines (DO-18) require that all parks with vegetation capable of sustaining fire develop a wildland fire management plan that will meet the specific resource management objectives for that park and to ensure that firefighter and public safety are not compromised. This guideline identifies fire as the most aggressive natural resource management tool employed by the NPS.

DO-18 identifies the following as major goals for the National Park Service fire program:

- **Protect Values Through Effective Risk Management**: Protect life, communities and resources from adverse effects of wildland fire without compromising safety.
- **Restore and Maintain Fire-adapted Ecosystems**: Maintain and restore fire adapted ecosystems using appropriate tools and techniques in a manner that will provide sustainable, environmental and social benefits.
- **Science Based Management**: General and park-specific science and research guides the wildland fire program.
- **Integrate Wildland Fire With Other NPS Programs**: Fire management programs are responsive to Service-wide and park priorities and are integrated with other NPS programs.
- **External Audiences Understand and Support Wildland Fire Programs**: NPS fire management will communicate and coordinate with interagency organizations and other stakeholders to pursue common goals, programs and projects.
- **Build and Promote Organizational Effectiveness**: Fire management programs achieve desired outcomes by building program capacity, leadership and effective management practices.

The overall goals of the Lewis and Clark NHP FMP are the following:

- Ensure that firefighter and public safety is the highest priority for all fire management activities;
- All fire management prescriptive or preventative treatments will be scaled to the relative risk of wildfire.
- Prevent fire spread to adjacent public and private lands by containing all fires within the park boundary;
- Maintain an active fire prevention program to reduce the incidence of human-caused wild fires;
- Ensure adequate suppression response capability to meet expected wildland fire complexity;
- Take special precautions to preserve historical and cultural landscapes;
- Quantify fire behavior and effects through monitoring and evaluations of all prescribed fires in order to refine prescriptions to achieve objectives;
- Initiate research concerning the role of fire in various Lewis and Clark NHP ecosystems. This effort will include monitoring of ecological effects of prescribed fires, as well as acquisition of information on fuel accumulations, forest insects and diseases, vegetation dynamics and other topics important to fire management and planning;

Overall goals of the Lewis and Clark NHP FMP (continued)

- Implement a public information program that includes prevention, education, and interpretation, and ensures that socioeconomic considerations are included with ecological concerns when informing the public;
- Comply with air pollution control regulations and smoke management concerns as required by the Clean Air Act and in cooperation with the Washington State Department of Natural Resources, Resource Protection Division, Smoke Management and the Oregon Department of Forestry, Smoke Management;
- Take special precautions to preserve and perpetuate sensitive, rare, threatened, or endangered plant/animal species.

Specific goals and objectives related to the fire management program, regardless of alternative chosen are:

- Provide for firefighter and public safety during wildland fire and prescribed fire operations.

Objective: All fire personnel will receive required training and be fully qualified for positions for which they hold during wildland fire operations. Personal protective equipment will be utilized as required during all fire management activities.

Objective: Public information and/or area closures will be used to ensure the safety of park visitors during every fire project.

- Reduce the risk of wildland fire to private and public property.

Objective: Within 80% of the park's developed zones (areas adjacent to structures, roadsides, trails, and other park infrastructure), alter live and dead fuel accumulations and fuel continuity so that predicted flame lengths under extreme weather conditions will be less than four feet.

Objective: In cooperation with local fire protection agencies, complete a wildland fire risk analysis that rates fuels, terrain, access/egress, construction material, and emergency response times for properties adjacent to the park. This would be a planning exercise in emergency wildland fire response

- Use mechanical and manual treatments to reduce fuel accumulations that have accumulated naturally and as a result of human activities, including fire suppression, for the purpose of minimizing the chances of catastrophic wildfire.

Objective: Reduce dead and down and ladder fuel accumulations by 40% on at least 50% of areas that are within 100 feet of structures and in areas where potential for fire ignition is considered high due to high visitor use and/or historical trends (i.e. picnic areas, road corridors). Under Alternatives 2 and 3 this work would extend to NPS managed facilities throughout the park and the "*No Action*" alternative work would be limited to the area covered in the 2004 NEPA analysis.

Overall goals of the Lewis and Clark NHP FMP (continued)

- Recognize the role that fire has in vegetative communities within the park and manage fire as a resource management tool through the appropriate use of prescribed fire.

Objective: Use prescribed fire to help restore and maintain desired vegetation characteristics to at most 16% (approximately 50 acres) of the park's invasive species impacted areas, at most 20% (approximately 300 acres) of the park's timber stand conversion areas outside of the proposed sites for forest restoration, and at most 50% (approximately 13 acres) of native plant beach vegetation conversion under the preferred alternative. Prescribed fire in the timber stand conversion areas would be pile burning only, and would only be utilized if mechanical treatments (chipping, lopping and scattering, etc.) were not feasible or not meeting management goals. Direct burning impacts on a site averages 0.01 acre per acre of handpiled area.

- Mitigate unacceptable environmental impacts on biotic communities.

Objective: Within each project plan, identify and implement appropriate management responses and strategies for wildland fire activities that address site-specific resource management concerns such as exotic species control and erosion.

Objective: In each project plan, list the mitigation measures to protect rare and/or sensitive flora and fauna.

- Preserve historic structures, landscapes, and archaeological resources from adverse effects from fire and fire management activities and use fire, where appropriate, to restore and maintain these cultural resources.

Objective: Complete site-specific plans prior to conducting fuels management projects that will list mitigation measures that will minimize impacts and protect cultural resources.

Objective: Utilize fire and manual fuel treatments to restore and maintain the desired conditions of 80% of historical sites as specified in the General Management Plan by 2020.

- Coordinate a safe, aggressive and appropriate management response to all wildland fires.

Objective: Maintain a fire management program during fire season that will contain 95% of all unwanted fires in the park within one operational period.

Objective: Identify roles and responsibilities for each park position. Review and update the fire management plan annually to ensure efficient distribution of workload.

- Foster and maintain interagency fire management partnerships and contribute to the firefighting efforts at the local, state, and federal levels.

Objective: On an annual basis, review, update, and initiate cooperative agreements to assure that interagency approaches to managing wildland fires are implemented.

Overall goals of the Lewis and Clark NHP FMP (continued)

Objective: On an annual basis, review treatment projects with adjacent agencies to facilitate cooperative, cross-boundary treatments where possible.

Objective: On an annual basis, review and revise the FMP as necessary with appropriate compliance updates, if needed.

- Promote public understanding of fire management program and objectives.

Objective: Revise and implement the “Public Fire Information Plan” and “Prevention Plan” as included in the fire management plan annually.

- Refine management practices by improving knowledge and understanding of fire through research and monitoring.

Objective: Update fire management program objectives and/or actions, based on the evaluations and results of fire effects and fuel treatment monitoring information, annually.

Objective: Solicit at least one high-priority fire research project every five years that supports the national planning process for fire management decision-making.

- Identify information gaps that hamper science-based decision-making and solicit fire research to help fill these gaps.

Objective: Consult and coordinate with American Indian groups to gather additional information regarding aboriginal burning and ethno-botanical resource use within the park.

Objective: Create ecological models of our systems to place our historical fire regime into the context of the park's fire and disturbance history, and in the process identify any gaps in our knowledge of this fire regime.

- Park staff and visitors are protected from unhealthy levels of air pollution from management ignited fires.

Objective: Public information and/or area closure will be used to limit public exposure of smoke generated from wildland and prescribed fires.

Objective: Line supervisors will minimize fire fighter exposure to smoke and heat by rotating crew personnel when working on wildland and prescribed fires.

RELATED LAWS, POLICIES, AND PLANNING DOCUMENTS

The NPS is directed by the requirements of the 1916 Organic Act and other laws, such as the Clean Air Act, Clean Water Act, and Endangered Species Act. The authority for the conservation and management of the NPS is clearly stated in the Organic Act, which states the agency's purpose is

> "to promote and regulate the use of national parks in conformance with their fundamental purpose which is to conserve the scenery and the natural and historical objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as to leave them unimpaired for the enjoyment of future generations."

This authority was further clarified in the National Parks and Recreation Act of 1978:

> "Congress declares that…these areas, though distinct in character, are united…into one national park system… The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

Lewis and Clark National Historical Park enabling legislation is found in Public Law 108-387-OCT 30, 2004. ***Lewis and Clark National Historical Park and Eastern Legacy Study***. The designation as outlined in the legislation is:

> "In order to preserve for the benefit of the people of the United States the historic, cultural, scenic, and natural resources associated with the arrival of the Lewis and Clark Expedition in the lower Columbia River area, and for the purpose of commemorating the culmination and winter encampment of the Lewis and Clark Expedition in the winter of 1805-1806 following its successful crossing of the North American Continent, there is designated as a unit of the National Park System the Lewis and Clark National Historical Park."

NPS *Management Policies 2006*, section 4.5 states the following: "Parks with vegetation capable of burning will prepare a fire management plan that is consistent with federal law and departmental fire management policies, and that includes addressing the need for adequate funding and staffing to support the planned fire management program." *Director's Order 18*, section 4.1 and 5.1.H reiterates the requirements contained in *Management Policies.* NPS Guidelines for Fire Management, RM-18, further define the Park Service wide goal of wildland fire management to achieve resource objectives of the park through the prevention of human-caused wildfire, to minimize the negative impacts on resources from all wildfires that occur, to protect cultural resources, and to perpetuate the natural resources and their associated natural processes.

The 1995 Lewis and Clark NHP General Management Plan established the overall framework for the management of the historical park. The alternative courses of action to be considered at this time are crafted to be consistent with the concepts established in the 1995 General

Management Plan. The Forest Restoration Plan, released concurrently with this Fire Management Plan, provides resource management goals for most of the Fort Clatsop Unit.

SCOPING ISSUES AND IMPACT TOPICS

Scoping Background

Scoping occurred between October 1st and November 15th. A total of 19 scoping letters were sent to individuals, organizations, and agencies requesting feedback on the fire management program. Along with letters, an attachment outlining the general park management direction and the fire management plan process was provided. A public meeting was held at park headquarters the evening of November 3rd with a turnout of approximately 25 individuals.

Identified Public Scoping Issues

The following issues came out of the public scoping meeting as well as written correspondence.

Hazard Fuels: Concerns about 2007 wind event creating blow-down areas in timber stands, Scotch broom and dead and down shore pine stands on Yeon property and defensible space around park structure all relate to the hazard associated with various fuel types found within Lewis and Clark NHP.

Interagency Coordination/Cooperation: Opinions expressed the need for close cooperation between the park and fire departments/districts.

Air Quality: Concern about the legality of burning within a specified distance of cities and towns in the area.

Fire protection: Concern about the actual infra-structure to fight a wildfire if it were to occur

Wildfire risk: Many comments were directed towards the risk of wildfire by fuel type, especially areas adjacent to the wildland urban interface.

Insect Disease: One comment was focused on insect and disease and the role of fire management for containment.

Wildland fire vs. structural fire: One comment questioned how the National Park Service wildland fire management fire management plan deals with structural fires.

Policy: Several comments were related to National Park Service wildland fire management policy.

Plan coverage: One comment asked why there is a need to change the 2004 plan.

Impact Topics Considered and Analyzed

Soils
Soils can potentially be adversely affected by intense fires as well as by wildland fire activities, therefore, impacts to soils are analyzed in this analysis.

Water Resources
NPS policies require protection of water resources consistent with the Federal Clean Water Act. Suppression, prescribed fire and mechanical fuel reduction activities can affect water resources by exposing soils, which leads to erosion during storm events and subsequent suspended solids and turbidity in downstream surface water and the application of fire retardant can impact water resources. Therefore, impacts to water resources are analyzed in this analysis.

Wetlands
Presidential Executive Orders mandate the protection of wetlands. Wetlands and floodplains occur near Fort Clatsop and most of the other units of the park. These have been surveyed and mapped the U. S. Fish and Wildlife Service (National Wetlands Inventory).
Fire suppression and prescribed fire activities can influence wetlands, and therefore impacts are analyzed in this analysis.

Vegetation
Since the plant associations in the park are influenced by fire disturbance, this EA considers the impacts of the proposed FMP alternatives on the park's vegetation.

Wildlife
There are resident populations of various species of reptiles, amphibians, birds, mammals, and invertebrates in the park; impacts of the FMP alternatives on wildlife are evaluated in this analysis.

Threatened, Endangered and Sensitive Species
The Federal Endangered Species Act prohibits harm to any species of fauna or flora listed by the U.S. Fish and Wildlife Service (USFWS) as being threatened or endangered. Such harm includes not only direct injury or mortality, but also disrupting the habitat on which these species depend. There are several threatened, endangered, or sensitive species that reside within or near the park, including the marbled murrelet, purple martins, five bats, and thirteen salmonids. This impact topic is included in this analysis.

Soundscape
Noise is defined as unwanted or unnatural sound. Fuels reduction, prescribed burns, and fire suppression efforts can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws, trucks, helicopters, and airplanes. Each of these devices, in particular helicopters and chain saws at close range, are quite loud. Therefore, this impact topic is included in this analysis.

Air Quality
The Federal 1970 Clean Air Act stipulates that Federal agencies have an affirmative responsibility to protect a park's air quality from adverse air pollution impacts. All types of fires generate smoke and particulate matter, which can impact air quality within the park and surrounding region to some extent. Both the viewsheds of the park and the night sky could be impacted by smoke and particulate matter. All of these considerations warrant the inclusion of impacts to air quality in this analysis.

Visitor Use and Experience (Recreation and Visual Resources)
The 1916 NPS Organic Act directs the Service to provide for public enjoyment of the scenery, wildlife, and natural and historic resources of national parks "in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations." Fire management activities can result in the temporary closure of certain areas and/or result in visual impacts that may affect visitor use of and experience at the park. Therefore, the potential impacts of the proposed FMP on visitor use and experience are addressed in this analysis.

Land Use
Fire management activities may affect land use within and adjacent to the park. Therefore, impacts to land use will be addressed in this analysis.

Human Health and Safety
Fires can be extremely hazardous, even life-threatening, to humans, and current federal fire management policies emphasize that firefighter and public safety is the first priority; all FMP's must reflect this commitment (NIFC, 2009). Therefore, impacts to human health and safety are addressed in this analysis.

Cultural Resources
Section 106 of the National Historic Preservation Act of 1966 provides the framework for federal review and protection of cultural resources, and ensures that they are considered during federal project planning and execution. The park contains many cultural resource sites. These cultural resources can be affected both by fire itself and fire suppression activities, thus potential impacts to cultural resources are addressed in this analysis.

Park Operations/Interagency Cooperation
Severe fires can potentially affect operations at national parks, especially in more developed sites such as visitor centers, campgrounds, administrative and maintenance facilities. These impacts can occur directly from the threat to facilities of an approaching fire, and more indirectly from smoke and the diversion of personnel to firefighting. NPS and interagency personnel are required for the success of the fire program. Thus, the potential effects of the FMP alternatives on park operations will be considered in this analysis.

Impact Topics Considered But Dismissed From Further Analysis

The following topics are not further addressed in this document because there are no potential effects to these resources, which are not in the project area:

Wilderness
Designated ecologically significant or critical areas
Wild or scenic rivers
Floodplains
Designated coastal zones
Indian Trust Resources
Prime and unique agriculture lands
Sites listed on US Department of Interior's National Registry of Natural Landmarks
Sole or principal drinking water aquifers

In addition, there are no potential conflicts between the project and land use plans, policies, or controls (including state, local, or Native American) for the project area.

Neither the no action alternative nor the proposed action would appreciably affect local businesses outside Lewis and Clark NHP. While there are numerous wood fiber companies, logging outfits, small forest products initiatives, mushroom gatherers and other resource extraction businesses in the communities surrounding the park, no for-profit activities of this sort are permitted in any of the national park units (the area of potential effect); therefore, a discussion on the socioeconomic environment was dismissed as an impact topic.

Regarding energy requirements and conservation potential, fire management activities would require the increased use of energy for transporting personnel and materials. However, total energy from petroleum products required to implement action alternatives would be insubstantial when viewed in light of production costs and the effect on the national and worldwide petroleum reserves.

There are no potential effects to local or regional employment, occupation, income changes, or tax base as a result of this project. The project area of effect is not populated and, per EO 12898 on Environmental Justice, there are no potential effects on minorities, Native Americans, women, or the civil liberties (associated with age, race, creed, color, national origin, or sex) of any American citizen. No disproportionate high or adverse effects to minority populations or low-income populations are expected to occur as a result of implementing any alternative. NEPA and the CEQ Regulations direct agencies to "avoid useless bulk…and concentrate effort and attention on important issues" (40 CFR 1502.15). Certain impact topics that are sometimes addressed in NEPA documents on other kinds of proposed actions or projects have been judged to not be substantively affected by any of the alternatives considered in this EA. These topics are listed and briefly described below, along with the rationale for dropping them from further analysis.

Waste Management
None of the alternatives would generate noteworthy quantities of either hazardous or solid waste that need to be disposed of in hazardous waste or general sanitary landfills. Therefore this impact topic is dropped from additional consideration.

Transportation
None of the alternatives would substantially affect road, railroad, water-based, or aerial transportation in and around the park. One exception to this general rule would be the temporary closure of nearby roads during fire suppression activities or from heavy smoke emanating from wildland fires or prescribed burns. Over the long term, such closures would be very infrequent and would not significantly impinge on local transportation. Therefore, this topic is dismissed from any further analysis.

Utilities
Generally, some kinds of projects, especially those involving construction, may temporarily impact above and below-ground telephone, electrical, natural gas, water, and sewer lines and cables, potentially disrupting service to customers. Other proposed actions may exert a substantial, long-term demand on telephone, electrical, natural gas, water, and sewage infrastructure, sources, and service, thereby compromising existing service levels or causing a need for new facilities to be constructed. None of the alternatives will cause any of these effects to any extent, and therefore utilities are eliminated from any additional analysis.

Prime and Unique Agricultural Lands
Prime farmland has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Unique land is land other than prime farmland that is used for production of specific high-value food and fiber crops. Both categories require that the land is available for farming uses. Lands within Lewis and Clark NHP are not available for farming and, therefore, do not meet these definitions. This impact topic is not evaluated further in this EA.

Indian Trust Resources
Indian trust assets are owned by Native Americans but held in trust by the United States. Indian trust assets do not occur within Lewis and Clark NHP and, therefore, are not evaluated further in this EA.

Resource Conservation, Including Energy, and Pollution Prevention
The NPS's Guiding Principles of Sustainable Design provides a basis for achieving sustainability in facility planning and design, emphasizes the importance of biodiversity, and encourages responsible decisions. The guidebook articulates principles to be used such as resource conservation and recycling. Proposed project actions would not minimize or add to resource conservation or pollution prevention within Lewis and Clark NHP and, therefore, this impact topic is not evaluated further in this EA.

Table 1 Impact Topics Retained for Further Evaluation for Lewis and Clark National Historical Park FMP Environmental Assessment

Impact Topic	**Retained for Further Evaluation**	**Relevant Regulations or Policies**
Soils	Retained	NPS Management Policies 2006
Water Resources	Retained	Clean Water Act; Executive Order 12088; NPS Management Policies 2006
Wetlands	Retained	Executive Order 11988; Executive Order 11990; Rivers and Harbors Act; Clean Water Act; NPS Management Policies
Vegetation	Retained	NPS Management Policies 2006
Wildlife	Retained	NPS Management Policies 2006
Threatened, Endangered, and Sensitive Species	Retained	Endangered Species Act; NPS Management Policies 2006
Soundscape	Retained	NPS Management Policies 2006
Air Quality	Retained	Federal Clean Air Act (CAA); CAA Amendments of 1990; NPS Management Policies 2006 Washington and Oregon Smoke Implementation Plans
Visitor Use and Experience (Recreation and Visual Resources)	Retained	NPS Management Policies 2006
Land Use	Retained	NPS Management Policies 2006
Human Health and Safety	Retained	NPS Management Policies 2006
Cultural Resources	Retained	Section 106; National Historic Preservation Act; 36 CFR 800; NEPA; Executive Order 13007; Director's Order #28
Park Operations/Interagency Cooperation	Retained	NPS Management Policies 2006

Table 2 Impact Topics Dismissed from Further Evaluation for Lewis and Clark National Historical Park FMP Environmental Assessment

Impact Topic	Dismissed from Further Evaluation	Relevant Regulations or Policies
Socioeconomics	Dismissed	40 CFR Regulations for Implementing NEPA; NPS Management Policies
Environmental Justice	Dismissed	Executive Order 12898
Wilderness	Dismissed	The Wilderness Act; Director's Order #41; NPS Management Policies 2006
Coastal Zone Management	Dismissed	Coastal Zone Management Act; NPS Management Policies 2006
Transportation	Dismissed	NPS Management Policies 2006
Waste Management	Dismissed	NPS Management Policies 2006
Transportation	Dismissed	NPS Management Policies 2006
Utilities	Dismissed	NPS Management Policies 2006
Prime and Unique Agriculture Lands	Dismissed	Council on Environmental Quality 1980 memorandum on prime and unique farmlands
Indian Trust Resources	Dismissed	Department of the Interior Secretarial Orders No. 3206 and No. 3175
Resource Conservation, Including Energy, and Pollution Prevention	Dismissed	NEPA; NPS Guiding Principles of Sustainable Design; NPS Management Policies

CHAPTER 2: ALTERNATIVES

This chapter describes the range of alternatives formulated to address the purpose of and need for the proposed plan. These alternatives were developed through evaluation of the comments provided by individuals, organizations, governmental agencies, and the park's fire management planning interdisciplinary team (IDT).

ALTERNATIVES CONSIDERED AND ANALYZED

Alternative 1: ***No Action***

Continue with current program of Wildfire Suppression with Mechanical/Manual Fuel Reduction, and Prescribed Fire to help managers achieve protection and resource objectives as approved in the 2004 Lewis and Clark NHP Fire Management Plan.

Under this alternative full suppression actions would be taken on all human/natural-caused wildland fires, mechanical treatment of vegetation would be performed and prescribed fire could be used for protection and resource management purposes. All wildland fires would be suppressed as quickly as possible, while ensuring public and firefighter safety and protection of natural/cultural/historic resources and developments.

Under this alternative, treatments would be limited to the 300 acres around Fort Clatsop which are covered by the 2004 Lewis and Clark NHP Fire Management Plan and EA. A map for this alternative showing general areas of activities and types of activities is Figure 3 page 15. More detailed descriptions are found in Appendix E.

Prescribed fire would be used to:

Restore the natural landscape. Prescribed fire would be used to help enhance wildlife habitat, notably elk habitat, which was an important part of the landscape experienced by the Lewis and Clark party and assist in ecosystem development projects, such as developing the Sitka spruce forest ecosystem.
Treat forest fuels. Prescribed fire use would treat piles of woody debris resulting from forest restoration and hazardous fuel reduction projects.
Control unwanted vegetation. Prescribed fire could be applied to help control noxious weeds and exotic plants including reed canary grass, if determined to be effective.

Prescribed fire is defined by the National Wildfire Coordinating Group as: A management ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produces fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives. .Prescribed fire would only be applied to achieve identified management objectives in the Fire Management Plan and only when prescribed conditions were met. A prescribed fire prescription includes measurable criteria that define conditions under which a prescribed fire may be ignited. Prescription criteria may include weather, specific control and holding

forces, firing techniques, and timing. Measures will be taken in project implementation to protect cultural resources, sensitive plants and animals, and wildlife habitat.

Mechanical fuel treatment and vegetative management projects may be conducted to accomplish some objectives in the park, including hazard fuel reduction and stand thinning. Mechanical methods include the use of chainsaws to fall, limb and buck trees. Handsaws and, or, power saws would be used prune tree branches to reduce ladder fuels. Small size tractors or rubber tire skidders could be used to remove woody materials, or it may be chipped with a mechanical chipper and left on-site. Mechanical hazard fuel reduction would also be utilized around structures (including historic buildings) to provide defensible space should a wildland fire occur. Debris associated with these projects could be lopped and scattered, chipped and scattered, piled and handpiled and burned later, or hauled off-site. Any mechanical equipment used would meet established requirements for protecting natural and cultural resources in the park. There would be no new roads constructed for these purposes. This treatment may also be used to protect natural resources such as rare plant populations and cultural resources.

The thinning of some forest stands to meet the ecological objectives laid out in the Lewis and Clark NHP Forest Restoration Plan will also reduce the risk of catastrophic wildfire. These treatments will reduce fuel loading and ladder fuel continuity in project areas containing dense, small and growth suppressed trees. After treatment, wildland fires that do occur would be easier to control. Individual large snags will be retained where they don't pose a significant safety hazard and occasional untreated patches within the project areas will be left for wildlife habitat purposes.

The **No Action** Alternative proposes 30 acres of mechanical/manual fuels reduction projects, 40 acres of prescribed burning, (25 acres of pile burning (Boundary Protection Projects 2-5) and 15 acres of broadcast burning), The 15 acres of broadcast burning involves Canary Grass Eradication Projects 1 and 2 utilizing prescribed fire. Table 3 summarizes project information for the No Action Alternative.

Table 3 ***No Action*** *Alternative 5- Year Project Plan*

No Action Alternative Five– Year Plan by **UNIT**	**Project Name**	**Type of Treatment**	**Acres**	**Notes**
Fiscal Year 2011				
Clatsop	Boundary Protection Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Fiscal Year 2012				
Clatsop	Boundary Protection Project 2	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Fiscal Year 2013				
Clatsop	Fuel Breaks/Access Points Project 1	Manual/Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later.
Clatsop	Boundary Protection Project 3	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Fiscal Year 2014				
Clatsop	Boundary Protection Project 4	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Clatsop	Canary Grass Eradication Project 1	Rx Fire	10	Broadcast burn for canary grass control
Fiscal Year 2015				
Clatsop	Boundary Protection Project 5	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning

No Action Alternative Five– Year Plan by **UNIT**	**Project Name**	**Type of Treatment**	**Acres**	**Notes**
				later.
Clatsop	Canary Grass Eradication Project 2	Rx Fire	5	Broadcast burn for canary grass control

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations. Total acreage possible to treat in each unit is listed on the treatment area maps. (Figure 3).

Alternative 2: Agency Preferred ***Mechanical and Limited Prescribed Fire Option***

The **Mechanical and Limited Prescribed Fire Option** alternative allows the full range of fire management implementation procedures with one limitation. Lewis and Clark NHP will not allow as a wildfire management strategy "Use of Wildland Fire – wildfire", which is the management of unplanned ignitions to achieve natural resource objectives. "Use of Wildland Fire – Prescribed fire" will be allowed after utilizing all of the procedural requirements set by policy and law. The reason for the restriction on Use of Wildland Fire – wildfire is that the park is small, not much room for development of a reasonable maximum manageable area, there is a lack of on-site management expertise available at the park for initiating long-term management of an incident and finally the small size of park units and the close proximity of the wildland urban interface make this management strategy to risky.

The **Mechanical and Limited Prescribed Fire Option** continues the current program of Wildfire Suppression with Mechanical/Manual Fuel Reduction, and Prescribed Fire to help achieve protection and resource objectives.

Under this alternative full suppression actions (control strategy) would be taken on all human/natural-caused wildland fires, mechanical treatment of vegetation would be performed and prescribed fire could be used for protection and resource management purposes. All wildland fires would be suppressed as quickly as possible, while ensuring public and firefighter safety and protection of natural/cultural/historic resources and developments.

Under this alternative, treatments would be allowed on the 300 acres around Fort Clatsop which are covered by the 2004 Lewis and Clark NHP Fire Management Plan and EA and includes all of the remaining acreage of the park. A map for this alternative showing general areas of activities and types of activities is Figures 2, 3 and 4 pages 15, 16 and 17 respectively. Detailed locations and project descriptions are located in Appendix E.

Prescribed fire would be used to:

Restore the natural landscape. Prescribed fire would be used to restore coastal rainforest, which includes dead and down trees, per the forest restoration plan, and coastal prairie. Another goal is to help enhance wildlife habitat, notably elk habitat, which was an important part of the landscape experienced by the Lewis and Clark party.

Treat forest fuels. Prescribed fire use could treat piles of woody debris resulting from forest restoration and hazardous fuel reduction projects.

Control unwanted vegetation. Prescribed fire could be applied to help control noxious weeds and exotic plants including reed canary grass, if determined to be effective.

Prescribed fire is defined by the National Wildfire Coordinating Group as: A management ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produces fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives. .Prescribed fire would only be applied to achieve identified management objectives in the Fire Management Plan and only when prescribed conditions were

met. A prescribed fire prescription includes measurable criteria that define conditions under which a prescribed fire may be ignited. Prescription criteria may include weather, specific control and holding forces, firing techniques, and timing. Measures will be taken in project implementation to protect cultural resources, sensitive plants and animals, and wildlife habitat.

Mechanical fuel treatment and vegetative management projects may be conducted to accomplish some objectives in the unit, including hazard fuel reduction and stand thinning. Mechanical methods include the use of chainsaws to fall, limb and buck trees. Handsaws and, or, power saws would be used prune tree branches to reduce ladder fuels. Small size tractors or rubber tire skidders could be used to remove woody materials, or it may be chipped with a mechanical chipper and left on-site. Mechanical hazard fuel reduction would also be utilized around structures (including historic buildings) to provide defensible space should a wildland fire occur. Debris associated with these projects could be lopped and scattered, chipped and scattered, piled and left to deteriorate or burned, or hauled off-site.. Any mechanical equipment used would meet established requirements for protecting natural and cultural resources in the park. There would be no new roads constructed for these purposes. This treatment may also be used to protect natural resources such as rare plant populations and cultural resources.

Some forest stands, such as those at the Yeon unit, will require mechanical thinning to further reduce the low risk of catastrophic wildfire in this ecosystem. Such treatment would be designed to reduce fuel loading and ladder fuel continuity in project areas containing dense, small and growth suppressed trees. After treatment, wildland fires that do occur would be easier to control. Individual large snags will be retained where they don't pose a significant safety hazard and occasional untreated patches within the project areas will be left for wildlife habitat purposes. Any manipulation of forest stands in the Fort Clatsop unit will follow desired conditions defined in the Forest Restoration Plan (2011) as much as possible in order to accomplish both fire management and resource management objectives.

Table 4 Agency Preferred ***Mechanical and Limited Prescribed Fire Option Proposed*** Five –Year Project Plan

UNIT	Project Name	Type of Treatment	Acres	Notes
Fiscal Year 2011				
Yeon	Boundary Protection Project A	Manual/Pile Burning	15	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning planned for 10 acres of area treated.
Yeon	Developed Landscape Project 1	Manual	2	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 1	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for

UNIT	Project Name	Type of Treatment	Acres	Notes
				burning later, ,.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 1	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2012				
Yeon	Boundary Protection Project B	Manual/Pile Burning	10	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning planned for 10 acres of area treated.
Yeon	Developed Landscape Project 2	Manual	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 2	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later,
Clatsop	Canary Reed Grass Eradication Project 1	Rx Fire	5	Prescribed burn near willow stand on the east bank of the Lewis and Clark River, in combination with herbicide treatment, to eradicate reed canary grass and Canada thistle, and prepare the land for revegetation with native plant species.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 2	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2013				

UNIT	Project Name	Type of Treatment	Acres	Notes
Yeon	Boundary Protection Project C	Manual/Pile Burning	9	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning may be planned for up to 5 acres of area treated.
Yeon	Developed Landscape/Interior Forests Project 1	Manual/Pile Burning	10	Thinning of shore pine within interior forests to reduce canopy continuity and meet resource objectives. Material will be cut and/or piled, chipped, or removed. Pile burning may be planned for up to 5 acres of area treated.
Yeon	Research Burn Project 1	Rx Fire	5	Coastal prairie research burn.
Clatsop	Fuel Breaks/Access Points Project 1	Manual/Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later. Up to 5 acres of pile burning may occur.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 3	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2014				
Yeon	Research Burn Project 2	Rx Fire	5	Coastal prairie research burn
Yeon	Developed Landscape/Interior Forests Project 2	Manual/Pile Burning	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 4	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later,

UNIT	Project Name	Type of Treatment	Acres	Notes
Clatsop	Canary Grass Eradication Project 2	Rx Fire	10	Broadcast burn for canary grass control
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 4	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2015				
Yeon	Boundary Protection Project D	Manual/Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later. Up to 5 acres of pile burning may occur.
Yeon	Developed Landscape/Interior Forests Project 3	Manual/Pile Burning	10	Developed landscape maintenance and defensible space preparation around Yeon house. Up to 6 acres of pile burning may occur.
Yeon	Research Burn Project 3	Rx Fire	5	Coastal prairie research burn
Clatsop	Boundary Protection Project 5	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later. Up to 5 acres of treated area may occur.
Clatsop	Canary Grass Eradication Project 3	Rx Fire	5	Broadcast burn for canary grass control
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 5	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations. Total acreage possible to treat in each unit is listed on the treatment area maps. (Figure 2, 3 and 4).

The *Mechanical and Limited Prescribed Fire Alternative* proposes 101 acres of mechanical/manual fuels reduction projects, (see Appendix E for lists and locations), 106 acres of prescribed burning, (71 acres of pile burning and 35 acres of broadcast burning). Broadcast burns include 20 acres of invasive species eradication utilizing prescribed fire, and 15 acres of research burns promoting prairie restoration.

Alternative 3: ***Mechanical Treatments Only Option***

This alternative would not include use of wildland fire, removing as options: Use of Wildland Fire, wildfire and Use of Wildland Fire - prescribed fire. This alternative only includes projects that would not use fire, creating less short-term impacts on air quality (no burning equates to no smoke) and could in most instances meet the needs of fire management in reducing hazard fuels. Examples of the types of projects would be mowing tall grass/brush, chipping forest fuels (scattering on-site, or transporting off-site), lopping and scattering slash or piling slash without follow-up burning. This alternative would be more costly as managers would need to manipulate fuel loadings utilizing more costly methods. There would also be instances where support for other resource projects may not be as effective.

A map for this alternative showing general areas of activities are found in Figures 2, 3 and 4 pages 15, 16 and 17 respectively. Descriptions and project locations are in Appendix E. It is important to note that only mechanical treatments are applicable to this alternative. The impacted areas are the same (projects are in the same areas), only the fire management action is restricted to mechanical only.

The **Mechanical Treatments Only Alternative** proposes 116 acres of mechanical/manual fuels reduction projects, covering 19 areas of the park. The Yeon Boundary Protection Projects, Clatsop Boundary Protection Projects and the Yeon Developed Landscape/Interior Forests projects have a concurrent resource objective of creating and maintaining native vegetation.

Suppression strategies would remain the same as for all of the alternatives. Initial response strategy would be "control" in the safest most cost-effective manner possible.

Table 5 ***Mechanical Treatments Only Proposed*** Five – Year Plan

UNIT	Project Name	Type of Treatment	Acres	Notes
Fiscal Year 2011				
Yeon	Boundary Protection Project A3	Manual	10	Manual thinning project on the east side of the property. Material will be cut, lopped/scattered, chipped, and/or removed.
Yeon	Developed Landscape Project 1	Manual	2	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp	Developed area maintenance and defensible space Project 1	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.

UNIT	Project Name	Type of Treatment	Acres	Notes
Dismal Nitch				
Fiscal Year 2012				
Yeon	Boundary Protection Project B3	Manual	10	Manual thinning project on the east side of the property. Material will be cut, lopped/scattered, chipped, and/or removed.
Yeon	Developed Landscape Project 2	Manual	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 2	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 2	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2013				
Yeon	Boundary Protection Project C3	Manual	9	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed.
Yeon	Developed Landscape/Interior Forests Project 1	Manual	10	Thinning of Shore pine within interior forests to reduce canopy continuity and meet resource objectives.
Clatsop	Fuel Breaks/Access Points Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 3	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2014				
Yeon	Developed	Manual	5	Developed landscape maintenance and defensible space

UNIT	Project Name	Type of Treatment	Acres	Notes
	Landscape/Interior Forests Project 2			preparation around Yeon house.
Clatsop	Boundary Protection Project 3	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 4	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2015				
Yeon	Boundary Protection Project D3	Manual	5	Boundary fuel reduction maintenance.
Yeon	Developed Landscape/Interior Forests Project 3	Manual	10	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 4	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 5	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations. Total acreage possible to treat in each unit is listed on the treatment area maps. (Figure 2,3 and 4).

ALTERNATIVES PRELIMINARY OPTIONS CONSIDERED BUT DROPPED

Alternative 4: ***Use of Wildland Fire – Wildfire Option (Preliminary Option Considered but Dropped)***

The ***Use of Wildland Fire – Wildfire Option*** allows park managers the full range of options for managing wildland fire in the park. This option allows use of wildland fire – wildfire for management/resource objectives.

This alternative allows prescribed fire, mechanical fuels reduction and chemical vegetative control for hazard fuels reduction and ecosystem management.

The reason for dropping this alternative is the inclusion of **Use of Wildland Fire – wildfire** due to the fact that the park is small, not much room for development of a reasonable and safe maximum manageable area, there is a lack of on-site management expertise available at the park for initiating long-term management of an incident and finally the close proximity of the wildland urban interface to all of the park boundaries make this management strategy too risky.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The NPS is required to identify the environmentally preferred alternative(s) for any of its proposed plans. That alternative is the alternative that will promote the national environmental policy expressed in NEPA (Section 101 (b)). This includes alternatives that:

1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2) Ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;

3) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

4) Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5) Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6) Enhance the quality of renewable resources and approach the maximum attainable recycling of non-renewable resources.

In essence, the environmentally preferred alternative would be the one(s) that "causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (DOI, 2001a).

In this case, Alternative 2 **Mechanical and Limited Prescribed Fire Option** is the environmentally preferred alternative for Lewis and Clark NHP since it meets goals 1, 2, 3, and 4. It fulfills the NPS responsibility as a trustee of the environment by preserving park resources through wildland fire suppression and restoring cultural landscapes and local ecosystems through specific applications of prescribed fire. Alternative 3 ensures a safe environment by reducing the risk of fire from the accumulation of hazardous fuel, and helps restore natural ecological processes, including native vegetation function and structure, and ensures the cultural landscape is maintained. Alternative 2 helps protect park resources, the public and adjacent lands from the threat of wildfires. Finally, the alternative would provide an updated management document that best protects and helps preserve the historic, cultural, and natural resources in the park for current and future generations.

Alternative 1, the **No Action** alternative, would be a continuation of the current fire program, which includes mechanical/manual fuel reduction and prescribed fire. This alternative would reduce the risks associated with wildland fire to the public and park resources by allowing mechanical and manual fuel reduction. This alternative falls short in that the application of these fire management tools is limited to the 300 acres in the vicinity of the Fort Clatsop site. Utilization of these tools is not covered for the Yeon property, or any of the Washington State sites. Therefore this alternative is not beneficial in reducing fuel loadings, reducing wildland fire risk or promoting ecosystem enhancement projects in a large percentage of the park.

Alternative 3 the **Mechanical Treatments Only** alternative would reduce the risks associated with wildland fire to the public and park resources by allowing mechanical and manual fuel reduction. There would be no prescribed fire activities, which includes broadcast burning and pile burning. This alternative meets the goals for protecting park resources, public safety, and adjacent lands from the threat of wildfires at a higher cost of implementation. However, due to the staff time needed to support this alternative, the protection and restoration of historic landscapes and development of projects for resource benefit would be a lesser priority. Therefore, it is not the alternative that would best protect and preserve the historic and cultural resources of the park or promote the development of native ecosystems. The use of prescribed fire could be an important tool in reducing populations of invasive species and could be beneficial in promoting populations of landscape disturbance dependent species.

MONITORING AND MITIGATION MEASURES

Monitoring

Lewis and Clark NHP follows the methods outlined in the NPS National Fire Monitoring Handbook (2003) to acquire standardized information on fire behavior and the effects of fire on park resources, especially vegetation. This allows the park to document basic information, to detect trends, and to ensure that fire and resource management objectives are being met in areas that are subject to manual treatment or prescribed fire. This monitoring program is reviewed annually by the park's fire program staff.

Each fire management project would be monitored at the appropriate level, and each mitigation measure listed below would be evaluated to determine if it was implemented as stated and if it was effective at mitigating impacts to the resource it was designed to protect.

Mitigation Measures for Fire Management Activities by Impact Topic

The use of specific mitigation measures to reduce negative impacts to specific natural resources, human health and safety, park operations and visitor experiences are paramount to the successful implementation of a fire management program in the park. The following is a list of general mitigation measures that will be implemented by park staff during fire management operations. The general list is followed by listings of specific required mitigation measures by impact topic.

General Fire Management Activity Mitigation Measures

- Whenever consistent with safe, effective suppression techniques, the use of natural or human-made barriers would be used as extensively as possible;
- Fire retardant agents must be on an approved list for use by the NPS;
- Tracked vehicles would generally not be used for fire suppression. The superintendent can authorize tracked vehicles if needed
- When handline construction is required, construction standards would be issued requiring the handlines to be built to Minimum Impact Suppression Tactic (MIST) standards.
- No handlines exposing mineral soil would be allowed through cultural sites, and all handlines would be rehabilitated.
- Erosion control methods would be used on slopes exceeding 10% where handline construction takes place;
- All sites where improvements are made or obstructions removed would be rehabilitated to pre-fire conditions, to the extent practicable;
- Educational/informational materials would be developed and distributed to park visitors on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, and information on where and when these activities would occur;
- A rehabilitation plan as required by NPS RM-18, with the use of a Burned Area Emergency Rehabilitation (BAER) Team, would be formulated and implemented in advance of demobilization from major fire events.

Soil and Water Resources: mitigation measures

- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan;
- Fire lines would be located outside of highly erosive areas, steep slopes, and other sensitive areas;
- Fire control strategies would be sensitive to wetland values, and firelines would not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Foams and retardants would not be used within 300 feet of surface waters, except in the event of a life threatening situation;
- Heavy earth-moving equipment would not be used in any “fragile environment;” ;
- Crews would implement Minimum Impact Suppression Techniques (MIST) fire suppression guidelines to minimize and/or eliminate adverse soil impacts resulting from ground crew activities;
- Mechanical equipment would use multiple entry and exit points within a treated area to minimize concentrated soil compaction or soil disturbance impacts resulting from continued use of a single entrance and/or exit;
- Crews would implement MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources.

Air Quality: mitigation measures

For prescribed fires, there are three principle strategies to manage smoke and reduce air quality impacts. They include:

- Avoidance – This strategy relies on monitoring meteorological conditions when scheduling prescribed fires to prevent smoke from drifting into sensitive receptors, or suspending burning until favorable weather conditions. Dilution – This strategy ensures proper smoke dispersion in smoke-sensitive areas by controlling the rate of smoke emissions or scheduling prescribed fires when weather systems are unstable, not under conditions when a stable high-pressure area is forming with an associated subsidence inversion. An inversion would trap smoke near the ground.
- Emission Reduction – This strategy utilizes techniques to minimize the smoke output per unit area treated. Smoke emission is affected by the number of acres burned at one time, pre-burn fuel loadings, fuel consumption, and the emission factor. Reducing the number of acres that are burned at one time would reduce the amount of emissions generated by that burn. Reducing fuel beforehand, i.e. removing wood for utilization purposes reduces the amount of fuel available. Emission factors can be reduced by pile burning or by using certain firing techniques. If weather conditions changed unexpectedly during a prescribed fire, and there was a potential for violating air quality standards or for adverse smoke impacts on sensitive receptors, the park would cease burn operations at an appropriate and safe location to avoid further smoke impacts.

Visitor Experience and Use: mitigation measures

- Fire management activities (excluding fire suppression) would not be conducted on holidays;
- Public information in the form of pamphlets, signs, and/or information stations would be used to inform park visitors of project activities and purpose;
- Area closures due to safety concerns would be implemented for the least amount of time possible.

Wildlife and Plants: mitigation measures

- If threatened, endangered, or sensitive wildlife are found in or a adjacent to a treatment area, in park biologists would be consulted with respect to designating buffer zones and/or scheduling of the project so as to minimize impacts to the wildland from noise, smoke, or change in habitat structure;
- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants would be imposed that prohibits physical damage to the identified population;
- Park staff would survey for noxious weeds in treatment units prior to ignition of prescribed fires and provide mitigation measures deemed necessary by exotic vegetation management specialists.

Cultural Resources: mitigation measures

- Prior to all fire management activities, cultural resources in treatment areas would be surveyed, identified and avoided;
- Fire retardant use would be prohibited within 100 feet of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park cultural resources manager or a designated representative would conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.

Table 6 compares the fire management activities employed under the three alternatives, while Tables 7 and 8 briefly summarize the environmental effects of the various alternatives. The tables provide a quick comparison of how well the alternatives respond to the project need, objectives and key resources. Chapter 4 discusses the environmental consequences of the proposed alternatives in detail.

Table 6 Comparison of Fire Management Activities

Alternative	Fire Suppression	Prescribed Fire	Manual Fuels Reduction	Mechanical Fuels Reduction	Fire Effects Monitoring	Research
Alt. 1 No Action	X	X	X	X	X	X
Alt. 2 Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)	X	X	X	X	X	X
Alt. 3 Mechanical Treatments Only	X		X	X	Limited to post-suppression	No fire effects research

Table7 Comparison of Alternatives given Project Need and Goals

Project Need	**Alt. 1 – No Action**	**Alt. 2 – Mechanical and Limited Prescribed Fire Option Agency Preferred Alternative)**	**Alt. 3 – Mechanical Treatments Only**
Reduces hazardous fuel accumulations.	Yes. Mechanical/Manual fuel reduction would occur in and around developed areas, but is limited to only developed areas within the 300 acres analyzed in the 2004 Fire Management Plan. NPS managed sites incorporated into Lewis and Clark NHP since 2004 would not be included. Proposed projects would cover 25 acres over five years. Prescribed fire would also be allowed, again restricted to sites analyzed in the 2004 FMP compliance documentation. Proposed projects would cover a maximum of 25 acres over five years and would entail burning the piles created under mechanical/manual treatments. This alternative provides the least amount of opportunity for hazard fuel reduction activities.	Yes. Mechanical/Manual fuel reduction would occur in and around developed areas throughout NPS administered park sites. Proposed projects would cover 121 acres over five years. Prescribed fire would be utilized where appropriate throughout NPS administered park sites. Proposed projects would cover a maximum of 101 acres over five years and would entail pile burning. This alternative provides the most opportunity for effective hazard fuel reduction opportunities	Yes. Mechanical/Manual fuel reduction would occur in and around developed areas throughout NPS administered sites Proposed projects would cover a maximum of 116 acres over five years. No prescribed fire would be allowed in the park, this includes Research burns. This alternative provides the second best opportunity for effective hazard fuel reduction opportunities

Project Need	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Restore and maintain cultural and natural landscapes.	Yes This alternative utilizing mechanical/manual vegetation management techniques does allow managers to restore and maintain cultural and natural landscapes limited to the 300 acres analyzed in the 2004 FMP compliance documentation. Proposed projects could cover 15 acres over five years (Canary grass eradication) or a maximum of 40 acres as part of dual objective: hazard fuel reduction and resource objectives projects . Prescribed fire would also be allowed, again restricted to sites analyzed in the 2004 FMP compliance documentation. Prescribed fire could be utilized for a maximum of 40 acres (15 acres specific resource objective – canary grass eradication and potentially 25 acres as part of a dual management objective) over the next five years. This alternative provides the least amount of opportunity for restoration and maintenance of cultural and natural landscapes.	Yes This alternative utilizing mechanical/manual vegetation management techniques does allow managers to restore and maintain cultural and natural landscapes where deemed appropriate throughout NPS administered sites in the park. . Proposed projects could cover 32 acres over five years (Canary grass eradication, ecosystem restoration) or a maximum of 141 acres as part of dual objective: hazard fuel reduction and resource objectives projects . Opportunities to utilize prescribed fire to meet resource and management objectives are allowed on all NPS administered sites within the park. This alternative provides the greatest opportunity and flexibility for restoring and maintaining cultural and natural landscapes.	Yes This alternative utilizing mechanical/manual vegetation management techniques does allow managers to restore and maintain cultural and natural landscapes where deemed appropriate throughout NPS administered sites in the park. Proposed projects could cover 57 acres over five years, or a maximum of 116 acres as part of dual objective: hazard fuel reduction and resource objectives projects. This alternative does not allow the use of prescribed fire in NPS administered sites in the park. This alternative provides the second best opportunity for restoration and maintenance of cultural and natural landscapes.

Project Need	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Protect human life and property both within and adjacent to the park.	Yes. All wildland fires – wildfire, would be suppressed throughout the park as soon as detected. Mechanical/Manual and prescribed fire fuel reduction projects would be used to modify wildland fuel loadings reducing wildfire potential, but would be limited to the 300 acres analyzed in the 2004 FMP compliance document. Maximum dual treatment acres of mechanical/manual fuels reduction and prescribed fire treatment projects is 25 acres.	Yes. All wildland fires – wildfire, would be suppressed throughout the park as soon as detected. Mechanical/Manual fuel reduction projects would be used to modify wildland fuel loadings reducing wildfire potential near developed areas and in areas with heavy fuel accumulations where deemed necessary throughout the park. Maximum acres of projects over 5 years are 121 acres. Prescribed fire would be utilized to meet wildfire hazard abatement goals where appropriate, throughout the park. The maximum acres of prescribed fire projects designed to reduce wildfire potential is 101 acres	Yes. All wildland fires – wildfire, would be suppressed throughout the park as soon as detected. Mechanical/Manual fuel reduction projects would be used to modify wildland fuel loadings reducing wildfire potential near developed areas and in areas with heavy fuel accumulations where deemed necessary throughout the park. Maximum acres of projects over 5 years are 116 acres. Prescribed fire is not allowed in this alternative eliminating any risk associated with escaped prescribed fires.

Project Need	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Perpetuate, restore, replace, or replicate natural processes to the greatest extent practicable.	Yes. Mechanical/Manual and prescribed fire treatments would be used to restore and maintain natural processes in specified areas, within the 300 acres analyzed in the 2004 FMP compliance document. At this time there are 0 acres of mechanical/manual projects planned over the next 5 years. It is possible that the 25 acres of hazard fuel reduction projects could be designed to meet resource objectives. 15 acres of prescribed fire projects to eradicate canary grass are planned over the next 5 years	Yes. Mechanical/Manual and prescribed fire treatments would be used to restore and maintain natural processes in specified areas throughout the park. 89 acres of fuel reduction will help meet forest restoration objectives 20 acres of prescribed fire projects to eradicate canary grass and research burns are planned over the next 5 years.	Yes. Mechanical/Manual treatments would be used to restore and maintain natural processes in specified areas throughout the park. It is possible that a maximum of 69 acres of mechanical/manual fuel reduction projects could be designed to meet other resource objectives. No prescribed fire possible in this alternative
Protect natural and cultural resources and intrinsic values from unacceptable impacts attributable to fire and fire management activities.	Yes. All fire management activities would have mitigation measures in place that would help avoid or minimize impacts.	Yes. All fire management activities would have mitigation measures in place that would help avoid or minimize impacts.	Yes. Fire management activities would have mitigation measures in place that would help avoid or minimize impacts from fire suppression and mechanical/manual activities.

Table 8 Comparison of Alternatives given Impact Topics

Impact Topics	**Alt. 1 – No Action**	**Alt. 2 – Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)**	**Alt. 3 – Mechanical Treatments Only**
Soils	Suppression would cause short-term erosion and soil compaction if heavy equipment is used or vehicles are driven off roadways. Minor short-term erosion and compaction would result from manual fuel reduction and prescribed fire projects. Benefits to soil development and nitrification would result from prescribe fires.	Suppression would cause short-term erosion and soil compaction if heavy equipment is used or vehicles are driven off roadways. Minor short-term erosion and compaction would result from manual fuel reduction and prescribed fire projects. Benefits to soil development and nitrification would result from prescribe fires.	Minor short-term erosion and compaction would result from manual fuel reduction projects and suppression activities if heavy equipment is used or vehicles are driven off roadways.
Water Resources (Including Wetlands)	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Water usage for suppression activities may stress local water supplies during the summer season.	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Water usage for suppression activities may stress local water supplies during the summer season. Manual fuel reduction projects would not impact water resources. Prescribed fire activities would not take place near surface water areas. Water usage to support prescribed fires would be planned to avoid water use issues.	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Manual fuel reduction projects would not impact water resources. Water usage for suppression activities may stress local water supplies during the summer season.

Impact Topics	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Wetlands	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Water usage for suppression activities may stress local water supplies during the summer season.	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Water usage for suppression activities may stress local water supplies during the summer season. Manual fuel reduction projects would not impact water resources. Prescribed fire activities would not take place near surface water areas. Water usage to support prescribed fires would be planned to avoid water use issues.	Fire suppression activities such as foam use and retardant may have impacts on surface water. However very little surface water supplies exist in the park. Manual fuel reduction projects would not impact water resources. Water usage for suppression activities may stress local water supplies during the summer season.
Vegetation	Minor short-term impacts would result from suppression activities. Plant habitat and diversity improved, native plant and fire-tolerant species favored by this alternative. Noxious weed species may increase in the short term but would be reduced over time.	Minor short-term impacts would result from suppression activities. Plant habitat and diversity improved, native plant and fire-tolerant species favored by this alternative. Noxious weed species may increase in the short term but would be reduced over time.	Minor short-term impacts would result from suppression activities. Manual fuel reduction treatments would promote plant habitat and diversity Noxious weed species would continue to increase.
Wildlife	Manual fuel reduction and prescribed fire activities would temporarily displace some wildlife species. Wildlife habitat would improve in the long-term with restoration of natural landscapes and the reduced potential for catastrophic fire.	Manual fuel reduction and prescribed fire activities would temporarily displace some wildlife species. Wildlife habitat would improve in the long-term with restoration of natural landscapes and the reduced potential for catastrophic fire. Fire suppression activities could cause short term, minor impacts to wildlife	Manual fuel reduction activities would temporarily displace some wildlife species. Fire suppression activities could cause short term, minor impacts to wildlife.

Impact Topics	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Threatened, Endangered and Sensitive Species	Minor short-term impacts on T&E species habitat from fire suppression, prescribed fire, and hazard fuel reduction activities. Wildlife habitat and T&E habitat would improve in the long-term with restoration of natural landscapes and the reduced potential for catastrophic fire.	Minor short-term impacts on T&E species habitat from fire suppression, prescribed fire, and hazard fuel reduction activities. Wildlife habitat and T&E habitat would improve in the long-term with restoration of natural landscapes and the reduced potential for catastrophic fire.	Minor short-term impacts on T&E species habitat from fire suppression and hazard fuel reduction activities.
Soundscape	Minor short-term impacts from short duration fire suppression activities. Manual fuel reduction and prescribed fire activities would generate noise from chainsaws, pumps and vehicles.	Minor short-term impacts from short duration fire suppression activities. Manual fuel reduction and prescribed fire activities would generate noise from chainsaws, pumps and vehicles.	Minor short-term impacts from short duration fire suppression activities. Manual fuel reduction activities would generate noise from chainsaws and vehicles.
Air Quality	Impacts from management- ignited burns would occur resulting in minor to moderate, short-term adverse impacts to area air quality, during the duration of the burn. The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.	Impacts from management- ignited burns would occur resulting in minor to moderate, short-term adverse impacts to area air quality, during the duration of the burn. The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.	The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. Under this alternative there is a higher potential over time for increased fuel loads and potential for larger and longer duration suppression fires, resulting in minor to moderate short- term impacts to air quality from smoke.
Visitor Use and Experience (Recreational and Visual Resources)	Visitors would continue to face temporary closures due to management activities related to these alternatives, resulting in minor to major, short term adverse impacts.	Visitors would continue to face temporary closures due to management activities related to these alternatives, resulting in minor to major, short term adverse impacts.	Visitors would continue to face temporary closures due to management activities related to these alternatives, resulting in minor to major, short term adverse impacts.

Impact Topics	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
Land Use	Work adjacent to park boundaries could have negligible to minor, short-term impacts on adjacent land owners from the presence of work crews, the use of fire, and visual impacts from smoke and manual fuel reduction activities. In the long-term, ecological conditions would improve in these areas as restoration goals are accomplished. Fuel reduction activities would result in reduced risk of wildland fire to adjacent lands.	Same as Alternative 1.	Same as Alternative 1.
Human Health and Safety	Fire fighter and public safety is the primary objective of all fire activities. A proactive fire management program would provide for the protection of life and property by using hazard fuel reduction and prescribed fire to reduce the threat of wildland fire.	Fire fighter and public safety is the primary objective of all fire activities. A proactive fire management program would provide for the protection of life and property by using hazard fuel reduction and prescribed fire to reduce the threat of wildland fire.	Fire fighter and public safety is the primary objective of all fire activities. A proactive fire management program would provide for the protection of life and property by using hazard fuel reduction to reduce the threat of wildland fire.
Cultural Resources	Sites would be avoided and/or protected during project activities. The alternative would allow for a proactive program that could plan manual fuel reduction and prescribed fire treatments in and around cultural resource sites to reduce the potential for wildland fire thus protecting the sites during suppression activities.	Sites would be avoided and/or protected during project activities. The alternative would allow for a proactive program that could plan manual fuel reduction and prescribed fire treatments in and around cultural resource sites to reduce the potential for wildland fire thus protecting the sites during suppression activities.	Sites would be avoided and/or protected during project activities. The alternative would allow for a proactive program that could plan manual fuel reduction treatments in and around cultural resource sites to reduce the potential for wildland fire thus protecting the sites during suppression activities.
Park Operations/ Interagency Cooperation	Park operations would be affected during large suppression fire incidents requiring area closure and/or evacuations. Interagency cooperation would be critical to	Park operations would be affected during large suppression fire incidents requiring area closure and/or evacuations. Interagency cooperation would be critical to	Park operations would be affected during large suppression fire incidents requiring area closure and/or evacuations. Interagency cooperation would be critical to

Impact Topics	Alt. 1 – No Action	Alt. 2 – Mechanical and Limited Prescribed Fire Option (Agency Preferred Alternative)	Alt. 3 – Mechanical Treatments Only
	provide closest resource for initial attack on suppression fires and support on prescribed fires. NPS personnel would be available to respond to significant incidents that require multiple operational periods so not to strain or overextend the local firefighting resources.	provide closest resource for initial attack on suppression fires and support on prescribed fires. NPS personnel would be available to respond to significant incidents that require multiple operational periods so not to strain or overextend the local firefighting resources.	provide closest resource for initial attack on suppression fires. NPS personnel would be available to respond to significant incidents that require multiple operational periods so not to strain or overextend the local firefighting resources.

CHAPTER 3 – AFFECTED ENVIRONMENT

This section describes the environment expected to be affected by the Fire Management alternatives proposed in this assessment. The environments/issues discussed include the physical environment, the biological and natural resources, threatened and endangered species, historical and cultural resources, visitor use and experience, human health and safety, and Park operations.

GENERAL INFORMATION

Lewis and Clark National Historical Park is located on the Pacific coast in Clatsop County, Oregon and Pacific County, Washington. There are five main Park Service units affected by this assessment: Cape Disappointment, Middle Village/Station Camp, Dismal Nitch, Yeon, and Fort Clatsop. In addition to their historical significance, the Lewis and Clark NHP lands preserve declining coastal habitats and provide important resources for wildlife.

Three of the units are located in Washington State. The largest is Cape Disappointment State Park, an entirely coastal park located on the peninsula at the extreme south-western tip of Washington. It includes headlands, forests, wetlands, dunes and several miles of beach line. This unit is managed by Washington State Parks, under a Federal Land Lease that expires in 2015. It is within the legislative boundaries of Lewis and Clark NHP as defined in the 2004 Lewis and Clark NHP designation act. The other two Washington units are located upstream along the Columbia River. They are Middle Village/Station Camp, a site of both pre- and post-contact international significance located west of the Astoria Bridge, and Clark's Dismal Nitch, a smaller unit located just east of the Astoria Bridge.

The original National Memorial, Fort Clatsop, is located on the Lewis and Clark River south-east of the city of Astoria, Oregon. Aside from the wetlands and riparian habitats along the river, this 1,200 acre unit is a mostly forested area which now includes the Fort to Sea trail east of Highway 101, connecting the fort to the ocean. The Fort to Sea trail terminates at Sunset Beach State Recreation Area, which is owned by Oregon State Parks but is within the legislative boundaries of Lewis and Clark NHP, and is cooperatively managed between the two agencies. Directly south of Sunset Beach is the recently acquired 104 acre Yeon property.

PHYSICAL ENVIRONMENT: SOILS (GEOLOGY, SOILS, AND TOPOGRAPHY)

Geology

Volcanic rocks of the Eocene [55.8-33.9 million years ago (mya)] Crescent Formation, the oldest rocks in the park, are in the Cape Disappointment area of southwestern Washington. The Crescent Formation formed as a chain of seamounts (submarine volcanoes) in the Pacific Ocean basin. Active subduction of the Pacific Plate beneath the North American Plate eventually caused the seamounts to collide with the western continental margin of North America. The Crescent Formation contains submarine-pillowed, columnar jointed and massive basalt flows (Wells 1989).

South across the Columbia River, younger, Miocene-age (23.03-5.332 mya), marine sedimentary rocks of the Astoria Formation anchor the city of Astoria (Niem et al. 1985). The east-west trending fault that separates the older rocks in southwestern Washington from the younger rocks in northwestern Oregon lies beneath the Columbia River. Inland along the Lewis and Clark River, a tributary to the Columbia River, the Corps of Discovery constructed Fort Clatsop on top of the Upper Eocene mudstones and siltstones of the Smuggler Cove Formation. Now exposed at the surface, these sediments were originally deposited in deep marine environments.

The Tertiary exposures are overlain by a variety of Quaternary deposits including shoreline sediments; fluvial, terrace, and estuarine deposits; and landslide material. Current depositional environments from Long Beach to Cannon Beach include sand spits, beaches, elongate sand dunes, and low swales containing ponds or peat bogs. Old beach ridges that run parallel to the coast mark past positions of the shoreline as the influx of new sand built the beach seaward. Today, dams along the Columbia River trap most of the sediment before it reaches the coast.

Topography

The topography of the park in Oregon consists of the relatively flat ocean shores at or near sea level to the top of Clatsop Ridge at 300 feet elevation. Clatsop Ridge is a rolling ridgeline separating the site of Fort Clatsop from the Pacific Ocean. Washington sites are located adjacent to the Columbia River and NPS administered land on Cape Disappointment. This area is hillier with short segments adjacent to the river near sea level.

Mass Wasting

Landslides continually adjust the landscape of northwestern Oregon and southwestern Washington. It's been said that "anything not flat" moves. Landslides and debris flows present potential hazards to the Fort-to-Sea Trail and Station Camp. The Visitor Center at Fort Clatsop was constructed on the terrace of a past landslide.

Seismic Activity

Landslides may occur from the weight of increased precipitation on steep slopes or they may be initiated by earthquakes. Lewis and Clark National Park units lie within a regional tectonic system in which clockwise rotation of the Coast Range is being distributed along both right-lateral and left-lateral strike-slip faults. Compressive forces act in southwestern Washington to produce anticlines (convex folds), synclines (concave folds), and reverse faults, while normal faults result from the extensional forces pulling apart northwestern Oregon. Northwest-southeast

trending faults in Oregon and northeast-southwest trending faults in Washington may trigger onshore mass wasting processes such as landslides and slumps.

Offshore earthquakes related to the Cascadia Subduction Zone may generate tsunamis and trigger onshore landslides. The subduction zone lies between 50 and 60 km (31-37 mi) offshore, but the rupture zone is only 20-30 km (12-18 mi) offshore. The rupture zone measures 32 km (20 mi) wide by 970 km (600 mi) long. In a worst case scenario, a magnitude 9.5 earthquake could generate 17 m (56 ft) tsunami waves that would inundate all infrastructures, the Plate Boundary Observatory, and the Salt Works in Seaside, Oregon, as well as drown other communities along the coast. At Seaside, tsunami waves may be deflected by Tillamook Head and redirected to the north where they may superimpose on other waves, creating mountains of water rather than simply a plateau of water coming ashore. Such an earthquake last occurred in January, 1700. Evidence of this quake is preserved in buried spruce boles along the Lewis and Clark River. With a recurrence interval of approximately 460 years, another earthquake of that magnitude may be imminent.

Soils

Throughout all units, soils have been altered from past management practices. Logging has resulted in increased erosion, decreased nutrient cycling, and compaction. Pasturelands have compacted soils. Original soils have been buried under dredge spoils behind dikes.

Fort Clatsop Unit: According to Natural Resource Conservation Service data, soils in the project area primarily belong to the Templeton, Ecola, and Walluski soil types. All soils are characterized by low strength and are prone to rutting.

Yeon unit: This unit consists of sandy soils which have been altered by plantings of dune-stabilization species in the 1930's such as dune grasses and scotch broom. The broom has had the additional impact of increasing soil nitrogen, which actually harms native dune prairie species by creating a more nutrient-rich environment which favors establishment of weedy invasives.

Dismal Nitch: Data not available.

Station Camp: According to the US Department of Agriculture(USDA) Web Soil Survey, the project area consists of a majority of Montesa silt loam (1 to 8 percent slopes) and Ocosta silty clay loam; Soil permeability is very slow and water capacity is high with limited water erosion hazard.

Cape D: recent alluvium for the lowland areas, marine sediments for part of the uplands, and basalts, Eocene basaltic sandstones, and gabbros for the rest.

WATER RESOURCES

Aquatic systems within the area surrounding the park have been greatly altered. The Columbia River Estuary, which contains all of the park units, has been extensively diked, reducing or eliminating fertile floodplains. These past floodplains are now used for agriculture, dairy and rural and industrial development. Other potential impacts consist of pesticide and fertilizer use, illegal dumping of household and industrial rubbish and toxic waste, and soil erosion from forest management activities.

Fort Clatsop: Infrequent sampling by the Oregon DEQ indicates that the Lewis and Clark River and Youngs Bay has aluminum, dissolved oxygen and fecal coliform levels that do not meet state water quality level standards (NPS 1994). The park has been collecting water quality data in the Fort Clatsop unit since 1995, and will be expanding the water quality monitoring program into other park units. In the Fort Clatsop Unit there are three fish bearing tributaries (Colewort Creek, Alder Creek, and Hansen Creek) to the Lewis and Clark River, one fish bearing tributary to the Skipanon River (Perkins Creek), and numerous small headwater streams and springs.

The Yeon property contains both a freshwater wetland that was expanded by the previous owner ino a dune lake. There has been no water quality sampling yet in this unit.

Dismal Nitch: Meglar Creek has been identified as potential high-quality salmonid rearing and spawning habitat.

Station Camp: Natural drainage patterns have been altered through past townsite development and state hwy 101. stormwater is confined in culverts under Hwy 101. Stormwater draining from the project site is either infiltrated or flows into the culverts then discharging to the Columbia River

Cape D: Cape Disappointment lands administered by the NPS are contained within the steep forested or brushy slopes of Cape Disappointment. Rainfall on the Cape Disappointment unit is absorbed into the soil draining into Fort Canby or drains into the Pacific Ocean or to the Columbia River. There are no lakes or major streams on this site.

Wetlands (Floodplains and Wetlands)
Several wetlands occur throughout the park units, and Station Camp, Dismal Nitch, and Fort Clatsop units all contain historic floodplains which have been diked in some manner.

Fort Clatsop: Approximately 85 acres of former Netul River floodplain wetlands are being restored to their natural hydrology in this unit. In addition to these estuarine wetlands, several freshwater wetlands associated with Perkins, Colewort, and Hansen creeks are found in this unit. A small area of forested sphagnum swamp habitat was discovered adjacent to the Fort to Sea Trail during a bryological inventory of Fort Clatsop National Memorial in 2000 by John Christy. According to his report, the occurrence of sphagnum in the small Sitka spruce/skunk cabbage swamp along the boardwalk is the only known stand of its type in Oregon, and should be protected. (Christy 2000).

Yeon: One high-quality interndunal freshwater willow/scrub-shrub wetland occurs on the Yeon property.

Dismal Nitch: There is a freshwater lagoon just north of hwy 101 which is being invaded by yellow iris and purple loosestrife. The park has been treating these since 2007.

Station Camp: There are two wetlands located within and adjacent to the project site, which are fed by two Type F streams that originate in the upland forest to the north of the project area. Onsite observations indicate that the western stream is perennial, and the eastern stream is seasonal.

Cape D: Cape Disappointment State Park has outstanding wetland habitats. Shrubby wetlands of Hooker's willow / slough sedge are common. Extensive marshes of slough sedge are very common: slough sedge may be the single most common plant in the entire Park.

BIOLOGICAL RESOURCES

Vegetation

Lewis and Clark NHP is located within the Sitka Spruce Zone as defined by Franklin and Dyrness (1973). This vegetation zone is found along the west coast from northern California to southeastern Alaska. Sitka spruce is the most common tree species but western hemlock, western redcedar, red alder and Douglas-fir are major components in this zone. Minor species include Pacific silver fir, grand fir, shore pine, western white pine, and big leaf maple.

Cape Disappointment, Station Camp, Dismal Nitch, and Fort Clatsop are all largely comprised of second and third growth timber, with freshwater wetlands and some remnant old-growth spruce at Cape Disappointment. The Fort Clatsop unit also contains a significant amount of estuarine wetland habitat, some of which is undergoing active restoration. While most of the Yeon property contains artificially planted habitats of shorepine and beach grasses, there is also some remnant native coastal prairie communities and one freshwater wetland.

In 2010, Lewis and Clark NHP completed a comprehensive vascular plant inventory, bringing the total number of vascular species recorded in the park to 467. The locations of 6 rare community types, 10 rare species, and 18 weed species of concern have been mapped in park units. The park's flora is dominated by perennial forbs and graminoids. Perennial forbs represent 39% of all taxa, while perennial graminoids make up 14%. Annual or biennial forbs represent 25% of the park flora, with annual graminoids representing 4%. Trees and shrubs make up a relatively small percentage of the flora (9% and 8% respectively) but contribute greatly to habitat structure and community characteristics. Most of the park's species have a wide range, occurring in neighboring states or countries. Seven percent are regional endemics occurring only on the Pacific coast in a limited area. One percent are local endemics occurring in a restricted range in the Pacific Northwest.

Although the majority of the park's plants are native, a large proportion of the flora is introduced (40%) and this number is expected to increase as new species are introduced by winds, tides, animals, visitors, and vehicles. While individual introduced species may have minimal impact on native species, the cumulative effect of non-native species on communities is often detrimental by increasing competition for resources or changing habitat structure. In addition some individual non-native species that are known to aggressively spread or have been documented as being invasive or detrimental to natural habitats elsewhere should be watched for. As a result, controlling these species has become a focus for the NPS.

Plant communities of special concern

Of the list of associations thought to be present or are potentially present in the park, twelve are considered to be rare in Oregon or Washington (with a NatureServe Global Rank of G1 or G2, or with a State Rank of S1 or S2). Six are known to occur at Lewis and Clark NHP (Table 9).

Table 9 Rare communities that are or may be present at Lewis and Clark NHP.

Scientific Name	Common Name	RANK[1]	present in Park?	Comments
Calamagrostis nutkaensis -Elymus glaucus Perennial Grassland	Pacific reedgrass - blue wildrye	G2S1	yes	Cape D North Head headland; may occur on Ecola headlands
Carex lyngbyei - Argentina egedii Herbaceous Vegetation	Lyngby sedge - Pacific silverweed salt marsh	G4S2	yes	Fort Clatsop at canoe landing; Cape D at Bakers Bay
Carex macrocephala Herbaceous Vegetation	big-headed sedge	G1G2S1	yes	Cape D
Deschampsia caespitosa - Argentina egedii Herbaceous Vegetation	Tufted hairgrass - Pacific silverweed high salt marsh	G3G4S2	unlikely	May be at Ft. Stevens salt marsh
Empetrum nigrum - Gaultheria shallon Dwarf-shrubland	crowberry - salal oceanfront shrubland	G2S2	unlikely	Known from southern OR
Festuca rubra - Ambrosia chamissonis Herbaceous Vegetation	Red Fescue - Beach Bursage Herbaceous Vegetation	G1S1	unlikely	Known only from Puget Lowlands
Festuca rubra coastal headland	red fescue coastal headland	G2S2	yes	Cape Disappointment headlands
Festuca rubra Stabilized Dune Herbaceous Vegetation	red fescue stabilized sand dunes	G1S1	unlikely	Sensitive to trampling, vehicles, beachgrass
Leymus mollis ssp. mollis - Abronia latifolia Herbaceous Vegetation	unstabilized coastal dune wildrye	G1S1	unlikely	Needs unstabilized dunes
Picea sitchensis/Carex obnupta - Lysichiton americanus Forest	Sitka spruce / slough sedge - skunk cabbage swamp	G2G3S1	yes	Cape Disappointment
Pinus contorta var. contorta / Gaultheria shallon - Rhododendron macrophyllum - Vaccinium ovatum Forest	shore pine / western rhododendron - evergreen huckleberry	G1S1	unlikely	Known from southern OR
Pseudotsuga menziesii-Tsuga heterophylla/Mahonia nervosa Forest	Douglas-fir - Western Hemlock / Dwarf Oregon-grape Forest	G2	unlikely	Known from Puget Lowlands; fire-dependent
Salicornia virginica Herbaceous Vegetation	glasswort salt marsh	G3G4S2	unlikely	Saltmarsh habitat not present in units

1. Global Ranks as reported by NatureServe. State rank for Oregon as determined by Oregon Biodiversity Information Center. Rank Definitions: G=Global, S=State, T=Taxon (variety, subspecies). 1=Critically imperiled; 2=Imperiled; 3=Rare, uncommon, or threatened; 4=Not rare and apparently secure; 5=Demonstrably widespread, abundant, and secure; NR=Not Ranked.

Non-native species and noxious weeds

35 species of invasive non-native plants have been documented in the park. Eight species have been identified by the North Coast Cooperative Weed Management Group as early detection, rapid response (EDRR) species. These invasive plants have not yet become well-established in Clatsop County, Oregon and are targeted for public education and prevention. They are: garlic mustard (*Alliaria petiolata*), false brome (*Brachypodium sylvaticum*), traveler's joy (*Clematis vitalba*), spurge laurel (*Daphne laureola*), shining geranium (*Geranium lucidum*), herb robert *(Geranium robertianum*), policeman's helmet (*Impatiens glandulifera*), and common reed (*Phragmites australis*). Park staff are removing or treating these species as soon as they are encountered on Park lands.

Table 10. Weedy or invasive species that are known to occur or have the potential to occur at Lewis and Clark NHP.

Scientific Name	Common Name	Mgt Priority[1]	OR Listing[2]	WA Listing[3]	In Park[4]
Agropyron repens	quackgrass	4	B		x
Alliaria petiolata	Garlic mustard	1	B	A	
Brachypodium sylvaticum	False Brome	1	B	A	
Buddleja davidii	Butterfly bush	3	B		
Cabomba caroliniana	fanwort	4		B	x
Centaurea pratensis	Meadow knapweed	1	B	B	
Cirsium arvense	Canada thistle	4	B	C	x
Cirsium vulgare	Bull thistle	4	B	C	x
Clematis vitalba	Clematis, Old Man's Beard	1	B	C	
Conium maculatum	poison hemlock	3	B	B	x
Convolvulus arvensis	field bindweed	3	B	C	
Cortaderia selloana	Pampas Grass	3			
Cotoneaster rugosus	cotoneaster	2			x
Cytisus scoparius	Scots broom	1	B	B	x
Daphne laureola	spurge laurel	1	B	B	x
Daucus carota	Queen Anne's lace	4		B	x
Digitalis purpurea	Foxglove	3			x
Egeria densa	Brazilian waterweed	3	B	B	x
Genista monspessulana	French Broom	3	B		
Geranium lucidum	shining geranium	1	B	A	
Geranium robertianum	herb robert	2	B	B	x
Hedera helix	English ivy	2	B	C	x
Heracleum mantegazzianum	Giant Hogweed	1	A	A	
Hypericum perforatum	St. Johnswort	4	B	C	x
Hypochaeris radicata	hairy cat's-ear	4		B	x
Ilex aquifolium	English holly	2			x
Impatiens glandulifera	Policeman's Helmet	1	B	B	
Iris pseudacorus	Yellow flag iris	1	B	C	x
Lathyrus latifolius	Everlasting Peavine	2	B		x

Scientific Name	Common Name	Mgt Priority[1]	OR Listing[2]	WA Listing[3]	In Park[4]
Leucanthemum vulgare	oxeye daisy	3		B	x
Linaria vulgaris	yellow toadflax	3	B	C	?
Lonicera periclymenum	European honeysuckle	3			x
Lythrum salicaria	Purple loosestrife	1	B	B	x
Myriophyllum aquaticum	Parrot feather watermilfoil	4	B	B	x
Myriophyllum spicatum	Eurasian watermilfoil	4	B	B	?
Nymphaea odorata	American white waterlily	4			x
Nymphoides peltata	Yellow floating heart	1	A	B	
Phalaris arundinacea	Reed canary grass	3		C	x
Phragmites australis	Common Reed	2	A	B	x
Polygonum cuspidatum	Japanese knotweed	1	B	B	x
Polygonum polystachyum	Himalayan knotweed	1	B	B	
Polygonum sachalinense	Giant knotweed	1	B	B	
Polygonum x bohemicum	Hybrid knotweed	1		B	
Potamogeton crispus	curly pondweed	4		C	x
Pueraria lobata	Kudzu	1	A	A	
Ranunculus ficaria	lesser celandine	2	B		x
Rubus armeniacus	Himalayan blackberry	3	B	C	x
Rubus laciniatus	Cutleaf blackberry	3		C	x
Senecio jacobaea	Tansy ragwort	4	B	B	x
Senecio vulgaris	common groundsel	3		C	x
Soliva sessilis	field burreed	4		B	x
Sonchus arvensis	perennial sowthistle	4		B	
Sorbus aucuparia	European mountain ash	1			x
Spartina patens	Saltmarsh/meadow cordgrass	1	A	A	
Spartina sp.	Cordgrasses	1	A	A or B	
Tanacetum vulgare	common tansy	3		C	?
Tribulus terrestris	Puncturevine	1	B		
Ulex europaeus	Gorse	2	B	B	x

1. Management priorities: 1=top, 2=high, 3=medium, 4=low.
2. Oregon List A and B are both quarantined in Oregon. List A weeds can potentially (and should) be eradicated. List B weeds are more widely distributed but are priorities for control or containment. Ranks current as of Feb. 4, 2010.
3. Washington List A weeds are required by law to be eradicated. List B weeds should be controlled and contained where feasible and new infestations prevented. List C weed control may be enforced by individual counties at their discretion.
4. x - denotes species has been documented in the park, but may not persist due to treatments or life cycle. ? - denotes the presence of this species on a local unit list but its presence has not been documented and was not encountered in the 2009-2010 field seasons.

Seventy three species of non-vascular plants (mosses and liverworts) have been identified, but a comprehensive survey of all of the newly acquired lands has not been completed. The Fort Clatsop unit of Lewis and Clark NHP features a rich diversity of fungi and lichen species. Park surveys, while not comprehensive, have identified 111 fungi and 57 lichen species within the park. Hardwood and riparian areas in the park have particularly high lichen diversity. Forest areas in the Park with old remnant spruce trees are also hotspots of lichen diversity.

Wildlife
Lewis and Clark NHP contains a diverse collection of wildlife habitat and wildlife species. Inventories of the park's birds, insectivores, rodents, fish, reptiles and amphibians have been initiated. Little is known of the park's invertebrate species.

Mammals
Roosevelt elk played a key role in the survival of the Lewis and Clark Expedition by providing an important food source (NPS 1995). The elk population was severely depleted by 1900 but conservation efforts have been successful in re-establishing their numbers in the Fort Clatsop area. The Oregon Department of Fish and Wildlife reports their numbers are now stable in Clatsop County. Other mammals recorded at Lewis and Clark NHP include black-tail deer, cougar, black bear, raccoon, chipmunks, squirrels, beaver, mink, river otter, coyote, bobcat, weasel, skunk, rabbit, muskrats, and seven bat species. The white-footed vole, a federal Species of Concern, was documented within the Fort Clatsop Unit in 1940, but has not been found in more recent park small mammal surveys. Five bat species documented in the park are Federal Species of Concern: the Townsend's big-eared bat and long-eared, fringed, long-legged and Yuma myotis. The hoary bat and the California myotis are both Oregon State listed SV (Sensitive - vulnerable). Introduced mammals include the Norwegian rat, black rat, opossum, and nutria.

Birds
A high percentage of bird species found at Lewis and Clark NHP prefer mature to old-growth forests. These species may be remnant or isolated populations, since most of the region's old-growth had been cut by the early 1980's. Thinning densely stocked, second growth stands has been shown to increase bird species diversity, especially in western Oregon (ODF 2008).

Bird species commonly observed in the Fort Clatsop unit include woodpeckers, flycatchers, wrens, kinglets, thrushes, vireos, owls, kingfishers, swallows, sandpipers, rails, hawks, eagles, mergansers, mallards, herons, cormorants and grebes. Habitat for marbled murrelets and western snowy plovers, both federally threatened, occurs within Lewis and Clark NHP's boundary . Barred owls are beginning to colonize the area. This species has recently expanded its range into western Oregon, and there is strong correlative evidence for negative interspecific interactions between it and federally threatened spotted owls. The purple martin, band-tailed pigeon, harlequin duck, and olive-sided flycatcher are federal Species of Concern. Peregrine falcons, an Oregon SV species, are observed within the Fort Clatsop unit. Oregon sensitive species include olive-sided flycatchers, peregrine falcons, purple martins, red-necked grebes, black oystercatchers, rhinoceros auklets and willow flycatcher. Bald eagles, while recently federally delisted, are still listed as Threatened in Oregon. They are sited frequently along the Lewis and Clark River.

Fish
Initial fish surveys of Lewis and Clark NHP were conducted in 2002 and 2005 and a total of ten fish species were observed within the Fort Clatsop Unit. Additional species were added after additional surveys in 2006. Despite the limited timeframe and scope of these surveys, species identified during these efforts provide a baseline for tracking fish assemblages at Lewis and Clark NHP.

Species found during the 2005 and 2006 surveys include:

Chinook salmon	*Oncorhynchus tshawytcha*
Coho salmon	*Oncorhynchus kisutch*
Chum Salmon	*Oncorhynchus keta*
Steelhead Trout	*Oncorhynchus mykiss*
Cutthroat Trout	*Oncorhynchus clarkii clarkii*
Threespine stickleback	*Gasterosteus aculeatus*
Riffle Sculpin	*Cottus gulosus*
Reticulate sculpin	*Cottus perplexus*
Coastrange sculpin	*Cottus aleuticus*
Prickly Sculpin	*Cottus asper*
Pacific Staghorn sculpin	*Leptocottus armatus*
Western brook lamprey	*Lampetra richardsoni*
Banded Killifish	*Fundulus diaphanus*
Peamouth	*Mylocheilus caurinus*

Amphibians

Amphibian surveys conducted in 2002 and 2005 confirmed the presence of 10 native amphibian species and 1 invasive. Amphibian species known to occur in Lewis and Clark NHP include:

Pacific Chorus Frog	*Pseudacris regilla*
Northern Red-legged Frog	*Rana aurora aurora*
Northwestern Salamander	*Ambystoma gracile*
Pacific Giant Salamander	*Dicamptodon tenebrosus*
Cope's Giant Salamander	*Dicamptodon copei*
Ensatina	*Ensatina eschscholtzii*
Dunn’s Salamander	*Plethodon dunni*
Western Red-backed Salamander	*Plethodon vehiculum*
Columbia Torrent Salamander	*Rhyacotriton kezeri*
Rough-skinned Newt	*Taricha granulosa*

Bullfrog (Invasive)	*Rana catesbeiana*

The northern red-legged frog, Dunn's salamander and Columbia torrent salamander are all federal species of concern. Coastal populations of red-legged frogs were delisted in OR in 2009. Columbia torrent salamander is Oregon SV and Cope's giant salamander is OR Sensitive - Vulnerable and a Monitor species in Washington. Copes's giant salamanders inhabit several streams in the park's Cape Disappointment unit. Furthermore, Lewis and Clark NHP is within the range of the Olympic clouded salamander which is classified as a sensitive species. The Columbia torrent salamander is Oregon Sensitive - Vulnerable.

Reptiles

The January 2007 update to Lewis and Clark NHP's list of confirmed reptile species includes three species, none of which are protected or listed as having an elevated conservation status. Reptiles at Lewis and Clark NHP include:

Northern Alligator Lizard	*Elgaria coerulea*
Northwestern Garter Snake	*Thamnophis ordinoides*
Common Garter Snake	*Thamnophis sirtalis*

Invertebrates

Invertebrates have not been inventoried at Lewis and Clark NHP.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES:

Thirty-one animals are listed as Endangered, Threatened, Candidate, or Sensitive species (Table 3.4). Most of these are birds or fish with wide ranges and that therefore spend only a portion of their life cycles at Lewis and Clark NHP. Eight species are listed as threatened at the federal level, 12 are classified as 'Species of Concern' (not a legal listing designation), and two have been delisted due to recovery. In Oregon, two species are listed as endangered, three are listed as threatened, and 16 are listed as sensitive. In Washington, three species are listed as endangered, one as threatened, 12 as candidates, and three as sensitive.

Table 11. *Endangered, Threatened, Sensitive, and Candidate species in Lewis and Clark NHP.* Data are sorted alphabetically by taxon and then by scientific name. Status codes are defined in Table 2.9. E – endangered; T – threatened; C – candidate; Co – species of concern (only reported at federal level for those species that are listed in either OR or WA); S – sensitive.

Scientific Name	Common Name	Taxon	Federal	OR	WA
Baccharis pilularis	Coyote bush	Plant	-	-	T
Poa unilateralis	Ocean bluff bluegrass	Plant	-	-	T
Dicamptodon copei	Cope's giant salamander	Amphibian	- `	S	-
Rhyacotriton kezeri	Columbia torrent salamander	Amphibian	Co	S	-
Plethodon dunni	Dunn's salamander	Amphibian	Co	-	C
Rana aurora aurora	Northern red-legged frog	Amphibian	Co	S	-
Aechmophorus occidentalis	Western grebe	Bird	Co	-	C
Brachyramphus marmoratus	Marbled murrelet	Bird	T	T	T
Cerorhinca monocerata	Rhinoceros auklet	Bird	-	S	-
Charadrius alexandrinus nivosus	Western snowy plover	Bird	T	T	E
Dryocopus pileatus	Pileated woodpecker	Bird	Co	S	C
Falco columbarius	Merlin	Bird	Co	-	C
Falco peregrinus	Peregrine falcon	Bird	Co	-	S
Gavia immer	Common loon	Bird	Co	-	S
Haematopus bachmani	Black oystercatcher	Bird	-	S	-
Haliaeetus leucocephalus	Bald eagle	Bird	*	T	S
Pelecanus occidentalis Californicus	Brown pelican	Bird	*	E	E
Phalacrocorax penicillatus	Brandt's cormorant	Bird	-	-	C
Podiceps grisegena	Red-necked grebe	Bird	-	S	-
Progne subis	Purple martin	Bird	Co	S	C
Uria aalge	Common murre	Bird	-	-	C
Speyeria zerene hippolyta	Oregon silver-spot butterfly	Insect	T	E	-
Acipenser medirostris	Green sturgeon	Fish	T	-	-
Lampetra richardsoni	Western brook lamprey	Fish	-	S	-
Oncorhynchus keta	Chum salmon (Columbia River ESU)	Fish	T	S	C
Oncorhynchus kisutch	Coho salmon (Lower Columbia River ESU)	Fish	T	E	C
Oncorhynchus mykiss	Steelhead salmon (Lower Columbia River ESUs)	Fish	T	S	C
Oncorhynchus tshawytscha	Chinook salmon (Lower Columbia River ESUs)	Fish	T	S	C
Thaleichthys pacificus	Eulachon	Fish	-	-	C
Lasiurus cinereus	Hoary bat	Mammal	-	S	-
Myotis californicus	California myotis	Mammal	Co	S	-
Myotis thysanodes	Fringed myotis	Mammal	Co	S	-
Myotis volans	Long-legged myotis	Mammal	Co	S	-

* Delisted due to recovery

Table 12 The following table summarizes all State and Federal Threatened, Endangered, and Species of Concern known to occur in Lewis and Clark NHP.

LEWI 2010 Special Status Species				
Last update 11/22/2010				
Fish Species				
Name		**ESU**	**Fed Status**	**ODFW Status**	**WDFW Status**
Riffle sculpin	*Cottus gulosus*		none	none	Monitor
Reticulate sculpin	*Cottus perplexus*		none	none	Monitor
Western brook lamprey	*Lampetra richardsoni*		none	SV	none
Coastal cutthroat trout	*Oncorhynchus clarki*				
		SW Washington/Columbia River	SOC	SV	none
		Upper Willamette River	SOC	none	none
Chum salmon	*Oncorhynchus keta*				
		Columbia River	LT	SC	Candidate
Coho salmon	*Oncorhynchus kisutch*				
		Lower Columbia River	LT	LE	none
Steelhead	*Oncorhynchus mykiss*				
		Snake River Basin	LT	SV	Candidate
		Lower Columbia River	LT	SC	Candidate
		Upper Columbia River	LT		Candidate
		Middle Columbia River, summer	LT	SC	Candidate
		Middle Columbia River, winter	LT	none	Candidate
		Upper Willamette River	LT	SC	none
Chinook salmon	*Oncorhynchus tshawytscha*				
		Snake River, fall	LT	LT	Candidate
		Snake River, spring/summer	LT	LT	Candidate
		Lower Columbia River, fall/spring	LT	SC	Candidate
		Upper Columbia River, spring	LE	none	Candidate
		Upper Willamette River	LT	SC	none
Eulachon	*Thaleichthys pacificus*		LT	none	Candidate
Amphibian Species					
Name			**Fed Status**	**ODFW Status**	**WDFW Status**
Cope's giant salamander	*Dicamptodon copei*		none	SV	Monitor
Pacific giant salamander	*Dicamptodon tenebrosus*		none	none	Monitor
Dunn's salamander	*Plethodon dunni*		SOC	none	Candidate
Northern red-legged frog	*Rana aurora aurora*		SOC	none-coast populations	none
Columbia torrent salamander	*Rhyacotriton kezeri*		SOC	SV	none
LEWI 2010 Special Status Species					
Bird Species					
Name			**Fed Status**	**ODFW Status**	**WDFW Status**
Western grebe	*Aechmophorus occidentalis*		none	none	Candidate
Great egret	*Ardea alba*		none	none	Monitor
Great blue heron	*Ardea herodias*		none	none	Monitor
Marbled murrelet	*Brachyramphus marmoratus*		LT	LT	T
Green heron	*Butorides virescens*		none	none	Monitor
Turkey vulture	*Cathartes aura*		none	none	Monitor
Rhinoceros auklet	*Cerorhinca monocerata*		none	SV	none
Western snowy plover	*Charadrius alexandrinus nivosus*		LT	LT	E
Olive-sided flycatcher	*Contopus cooperi*		SOC	SV	none
Pileated woodpecker	*Dryocopus pileatus*		none	none	Candidate
Little willow flycatcher	*Empidonax traillI brewsteri*		none	SV	none
Merlin	*Falco columbarius*		none	none	Candidate
American peregrine falcon	*Falco peregrinus anatum*		delisted LE 1999	SV	Sensitive
Common loon	*Gavia immer*		none	none	Sensitive
Black oystercatcher	*Haematopus bachmani*		none	SV	Monitor
Bald eagle	*Haliaeetus leucocephalus*		delisted LT 2007	LT	Sensitive
Harlequin duck	*Histrionicus histrionicus*		SOC	none	none
Caspian tern	*Hydroprogne caspia*		none	none	Monitor
Osprey	*Pandion haliaetus*		none	none	Monitor
Band-tailed pigeon	*Patagioenas fasciata*		SOC	none	none
Brown pelican	*Pelecanus occidentalis californicus*		delisted LE 2009	LE	E
Brandt's cormorant	*Phalacrocorax penicillatus*		none	none	Candidate
Horned grebe	*Podiceps auritus*		none	none	Monitor
Red-necked grebe	*Podiceps grisegena*		none	SC, breeding populatio	Monitor
Purple martin	*Progne subis*		SOC	SC	Candidate
Common murre	*Uria aalge*		none	none	Candidate
Mammal Species					
Name			**Fed Status**	**ODFW Status**	**WDFW Status**
White-footed vole	*Arborimus albipes*		SOC	none	none
Hoary bat	*Lasiurus cinereus*		none	SV	none
California myotis	*Myotis californicus*		none	SV	none
Long-eared myotis	*Myotis evotis*		SOC	none	Monitor
Townsend's big-eared bat	*Plecotus townsendii townsendii*		SOC	SC	Candidate
LEWI 2010 Special Status Species					
Mammal Species continued					
Fringed myotis	*Myotis thysanodes*		SOC	SV	Monitor
Long-legged myotis	*Myotis volans*		SOC	SV	Monitor
Yuma myotis	*Myotis yumanensis*		SOC	none	none
Harbor seal	*Phoca vitulina*		none	none	Monitor
Marsh shrew	*Sorex bendiri*		none	none	Monitor
Vascular Plant Species					
Name			**Fed Status**	**ODFW Status**	**WDFW Status**
Coyote brush	*Baccharis pilularis*		none	none	T
Ocean-bluff-bluegrass	*Poa unilateralis*		SOC	none	T
Henderson's sidalcea	*Sidalcea hendersonii*		SOC	none	T
USESA Status Codes:					
LE	Listed Endangered. In danger of extinction.				
LT	Listed Threatened. Likely to become endangered.				
PE	Proposed Endangered.				
PT	Proposed Threatened.				
C	Candidate species. Sufficient information exists to support listing as Endangered or Threatened.				
SOC	Species of Concern. Conservation status is of concern, but additional information is needed.				
PS	Partial Status. Taxa for which some, but not all, infraspecific taxa have status.				
ODFW Status Codes:					
LE	Endangered. In danger of becoming extinct or extirpated from Oregon.				
LT	Threatened. Likely to become endangered in Oregon.				
SC	Sensitive Critical; species for which listing as threatened or endangered would be appropriate if immediate conservation actions were not taken. Some peripheral species, at risk throughout their range and some disjunct populations are also considered Critical.				
SV	Sensitive Vulnurable; species not in imminent danger of being listed as threatened or endangered, but with the potential to become so with changes in populations, habitat or threats				
SP	Sensitive Peripheral or Naturally Rare; species on the edge of their range or with historically low population numbers in Oregon				
SU	Status Undetermined; potentially susceptible species for which status is unclear.				
WDFW Status Codes:					
E	Endangered. In danger of becoming extinct or extirpated from Washington.				
T	Threatened. Likely to become endangered in Washington.				
S	Sensitive. Vulnerable or declining and could become Endangered or Threatened.				
C	Candidate. Under review for listing.				
M	Monitor. Taxa of potential concern.				
Data Sources:					
	Bald Eagle; Removal of the Bald Eagle from the Federal List of Endangered and Threatened Wildlife. August 8, 2007 (50 CFR Part 17)				
	Brown Pelican; Removal of the Brown Pelican from the Federal List of Endangered and Threatened Wildlife. December 17, 2009 (74 FR 220, 50 CFR Part 17)				
	Eulachon USFWS Threatened Status for Southern Distinct Population Segment of Eulachon. March 18, 2010 (50 CFR Part 223)				
	Oregon Natural Heritage Information Center. 2007. Rare, Threatened and Endangered Species of Oregon. Oregon State University, Portland, OR. http://oregonstate.edu/ornhic/documents/2007_t&e_book.pdf				
	ORNHIC Animal Updates, May 2009. animals_final_pub_Spr09.xls				
	ORNHIC Vascular Plant Updates, May 2009. Plants_Update_Sp09_final-Vascular.pdf				
	Peregrine Falcon; Removal of the Peregrine Falcon from the Federal List of Endangered and Threatened Wildlife. August 25, 1999 (64 FR 46542)				
	U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office. May 23, 2009. Federally Listed, Proposed, Candidate Species and Species of Concern under the jurisdiction of the Fish and Wildlife Service which may occur within Clatsop County, Oregon.				
	U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office. Endangered, Threatened, Proposed, and Candidate Species, Critical Habitat, and Species of Concern in Western Washington. http://www.fws.gov/wafwo/pdf/species_list_Aug2007.pdf				
	Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. http://wdfw.wa.gov.hab/psh_list_2008.pdf				
	Washington Natural Heritage Program. 2009. List of Plants Tracked by the WNHP. http://www1.dnr.wa.gov/nhp/refdesk/lists/plantrnk.html				

MARBLED MURRELET: Federally listed as Threatened, marbled murrelets have been noted within the vicinity of Cape Disappointment and Station Camp. Marbled murrelets are found year-round in late-successional and old-growth forests near the western Oregon coast, but they are not common at the mouth of the Columbia River. Suitable mature Sitka spruce-western hemlock maritime forest nest habitat exists in limited patches within the park, but there are no known nest sites at present.

WESTERN SNOWY PLOVER: The Pacific coast population of the western snowy plover was federally listed as threatened on March 5, 1993 (58 FR 12864) due to population declines from habitat loss, human disturbances and predators. Snowy plovers have nested in the Sunset Beach dunes adjacent to the Yeon site as recently as 1983 and on nearby Necanicum spit as recently as 2002. The park is looking in to possible recovery efforts on the Yeon property, but no plovers have been documented at this site. One snowy plover was documented on a beach at Cape Disappointment in 2008.

CHUM SALMON (Lower Columbia River): Federally listed as Threatened, chum salmon have been documented within the park in the South Clatsop Slough estuarine restoration project and in Meglar Creek at Dismal Nitch. They are present as juveniles during their out-migration from mid-March through May and are expected to migrate upstream as adults from early October through mid-November.

CHINOOK SALMON (Lower Columbia River Fall, Upper Willamette River, Snake River): Federally listed as Threatened, Upper Columbia River Spring Chinook are listed Endangered. Recently, juvenile Chinook salmon have been documented utilizing the South Clatsop Slough restoration site. In the Lewis and Clark River, juvenile Chinook salmon out-migration occurs from mid-March through mid-June. Adult Chinook salmon upstream migration occurs from late August through October/November.

COHO SALMON (Lower Columbia River): Coho salmon have been documented in several streams within the park, including the South Clatsop Slough restoration site (Brenkman 2007, CREST 2009)..

STEELHEAD (Columbia and Snake River): Steelhead have been documented in the South Clatsop Slough restoration site during monitoring conducted by CREST in 2008.

PACIFIC EULACHON : Federally listed as Threatened. Also known as candlefish and Pacific smelt, eulochon once swam in vast numbers and were a staple food and trade good of northwest tribes. They pass through the mouth of the Columbia adjacent to the Washington units during their migrations. They are not known from the Lewis and Clark river and are not present in the Oregon units.

OREGON SILVERSPOT BUTTERFLY: Federally listed as Threatened, the Oregon silverspot butterfly occupied early successional coastal grasslands in Clatsop County containing its host plant, nectar sources and adult courtship areas. Its historic population center on the plains is approximately five miles long and one mile wide, extending from Camp Rilea on the north to the Gearhart Golf Course on the south. The Yeon unit is within the butterfly's historic range (Gearhart Beach to Clatsop Spit). The last documented sighting of this butterfly was in 1998 near Camp Rilea, previously the population stronghold in the county (Vanbuskirk 1998). Lewis and Clark NHP is working with partners on a regional effort to restore historic butterfly habitat and re-introduce the species to its historic range.

Plants: There are no federally listed plant species within Lewis and Clark NHP.

Species of Concern

Animals:

COASTAL CUTTHROAT (Columbia River): Proposed as a Federally Threatened Species in 1999, coastal cutthroat trout were transferred to a Species of Concern after more information indicated they were not as imperiled as originally suspected. They have been documented in several park streams.

VOLES: The white-footed vole was historically documented at the Fort Clatsop site in 1940 (Csuti 1997), but has not been found in more recent small mammal surveys (1993, 2001). This species is most frequently found in riparian (especially alder) habitat within coniferous forests. Small clearings with forb growth may also provide important habitat. Red tree voles are found along the coast in Sitka spruce forests that contain some Douglas fir, but have not been documented in the Fort Clatsop unit.

BATS: Fringed, California and long-eared myotis, Townsend's big-eared, hoary bat, long-legged and Yuma myotis were mist-netted in coniferous forest habitat near the Fort Clatsop replica during 1995 surveys. Vouchers of these species were obtained during an earlier 1940 mammal survey at the site. A 2001 survey netted a single long-eared myotis at Clay Pit Pond.

Pacific big-eared bats have not been found within the Fort Clatsop unit. A 1958 Clatsop County record reports a Cannon Beach collection location for the species. West of the Oregon Cascades, the species is associated with moderate to older coniferous forests.

Silver-haired bats have not been found within the park. These bats occur throughout Oregon except most areas of the Columbia Basin. Their primary habitat is older Douglas fir/western hemlock forests with riparian forage areas.

BAND-TAILED PIGEON: Band-tailed pigeons are present throughout the Columbia River estuary. Preferred habitats are closed-canopy forests for nesting and open-canopy forests for foraging and mineral sites. They are highly mobile and may travel 32 miles from nest locations to food or mineral sites. Band-tailed pigeons have been documented during bird surveys in the Fort Clatsop unit (Patterson 2007).

OLIVE-SIDED FLYCATCHER: Olive-sided flycatchers are summer residents in coniferous forests of the Columbia River estuary. They are most frequently found in open coniferous forests with tall snags for perching. The birds have been documented during linear transect surveys in the park

PURPLE MARTIN: Purple martins are summer residents in the Columbia River estuary, nesting and feeding primarily in riparian habitats. The birds were documented on the Lewis and

Clark River within the park during a 2006 survey and more recently have been noted to be nesting in piling near the park's Netul Landing site.

HARLEQUIN DUCK: Harlequin ducks inhabit surf zones of the outer coast and breed in fast moving mountain streams. They may be seen off the coast of Cape Disappointment.

NORTHERN RED-LEGGED FROG: Numerous observation and voucher records document the occurrence of northern red-legged frogs in the Fort Clatsop unit's forest and riparian habitats (Ek 1997). Lewis and Clark NHP also has portions of wetland habitat that contain populations of red-legged frogs.

COLUMBIA TORRENT SALAMANDER: Torrent salamanders live in very cold seeps, headwaters, and springs, foraging in adjacent moist forests. They were documented in the Fort Clatsop unit of Lewis and Clark NHP during amphibian surveys conducted in 2005 by North Coast Cascades Network Inventory and Monitoring team.

DUNN'S SALAMANDER: This woodland salamander is associated with springs and seeps. It has been documented in the Fort Clatsop unit of Lewis and Clark NHP during amphibian surveys conducted in 2005 by North Coast Cascades Network Inventory and Monitoring team.

GREEN STURGEON: Green sturgeons occur in brackish and seawater salinity zones within the Columbia River estuary.

RIVER LAMPREY, PACIFIC LAMPREY: River and Pacific lamprey have not been confirmed in streams within the Fort Clatsop unit, although a 2002 fish survey of Hansen Creek netted a juvenile lamprey of unknown identity. Western Brook lamprey, listed in Oregon as Sensitive/Vulnerable, were found in a 2005 survey of Perkins Creek. Alder Creek and South Clatsop Slough are potential habitat, as is the Lewis and Clark River (Bottom 1984).

Plants:

Table 13 Rare or sensitive species known to occur or that may occur at Lewis and Clark NHP. Washington ranks were last updated in January 2009; Oregon ranks in February 2010.

Scientific Name	Common Name	Federal Status	State Status	Global Rank*	OR Rank*	WA Rank*	In Park
Abronia umbellata ssp. breviflora	Pink sandverbena	SOC	OR:LE	G4G5T2	S1	S1	
Baccharis pilularis	Coyotebrush		WA:LT	G5	SNR	S1	x
Callitriche hermaphroditica	Autumnal water starwort			G5	SNR	SNR	x
Carex brevicaulis	Short-stemmed sedge			G5	S2	SNR	x
Carex macrocephala	Big-headed sedge			G5	S2	SNR	x
Carex pluriflora	Many flowered sedge			G4	S1	S1S2	
Hydrocotyle ranunculoides	Floating marsh-pennywort			G5	SNR	SNR	x
Lilaea scilloides	Flowering quillwort			G5?	S3?	SNR	x
Myriophyllum ussuriense	Asian water-milfoil			G3	S1?	SNR	
Poa unilateralis	Ocean-bluff bluegrass	SOC	WA:LT	G3	S1?	S2	x
Samolus parviflorus	Water-pimpernel			G5	SNR	S1	x
Sidalcea hendersonii	Henderson's sidalcea	SOC		G3	S1	SNR	x
Viola adunca	Early blue violet			G5	SNR	SNR	x

* Global Ranks as reported by NatureServe. State rank for Oregon as determined by Oregon Biodiversity Information Center, and Washington as determined by Washington Natural Heritage. Rank Definitions: G=Global, S=State, T=Taxon (variety, subspecies). 1=Critically imperiled; 2=Imperiled; 3=Rare, uncommon, or threatened; 4=Not rare and apparently secure; 5=Demonstrably widespread, abundant, and secure; NR=Not Ranked.

Baccharis pilularis - Coyotebrush

Coyotebrush is an evergreen shrub in the Aster family found in coastal ecosystems from California to Washington. It is common in California and southern Oregon where it is found in oak woodlands and on ocean bluffs. In Washington it is only known from Cape Disappointment, where a few patches and individual shrubs are scattered in the dunes and along cliffs. Sea cliff habitat has changed with the building of the jetty, filling these areas in with dunes that are gradually becoming shrubland and forestland. Changing habitat and encroachment of invasive species such as Scots broom are threats to these Washington plants.

Callitriche hermaphroditica – autumnal water starwort

Autumnal water starwort is a delicate aquatic plant in the water-starwort family usually found in shallow water occurring over much of western and northern North America and Canada. While it is ranked as critically imperiled in the north-eastern extent of its range, it is not currently ranked in Oregon or Washington. Autumnal water starwort is present in the Fort Clatsop and Cape Disappointment units.

Carex brevicaulis – short-stemmed sedge

Short-stemmed sedge is found on stabilized sand dunes free of European beachgrass from California to British Columbia. It grows 2 to 20 cm tall and is reddish at the base of the stems.

The inflorescences have terminal and lateral male spikes and female basal spikes, most being less than a centimeter long. This sedge is losing habitat due to dune stabilization by European beachgrass, succession of shore pine, and housing developments (Wilson et al. 2008). There is a small population of short-stemmed sedge in the Sunset Beach/Yeon unit.

***Carex macrocephala* – big-headed sedge**

Big-headed sedge (Figure 8) is one of the few sedges that live in shifting sand from California to Alaska. Its large fruiting heads are distinctive, being 3.5-8 cm long and 2.5-5 cm wide, deep brown, with spreading spikes. Once a dominant dune community species, big-headed sedge has lost habitat to dune stabilization by beachgrass and housing developments (Wilson et al. 2008). Several large populations are present at Cape Disappointment, where there are still large stretches of open beach habitat. Two small patches were also found at Fort Stevens.

There is a look-alike sedge native to Asia, Japanese sedge (*Carex kobomugi*), that occurs in similar habitats and can be confused with big-headed sedge (Figure 9). Japanese sedge differs from big-headed sedge in having slightly smaller fruiting heads ranging from 3-6 cm long and 2-4 cm wide which are generally green-tinged rather than deep brown with ascending rather than spreading spikes. Perigynia of Japanese sedge have 12 or more ventral nerves, whereas the perigynia of big-headed sedge have only 7 to 9 ventral nerves (Wilson et al. 2008). Japanese sedge was planted for dune stabilization on the east coast of North America, where it is now being eradicated as it has spread to cover many miles of beaches. Japanese sedge is present and expanding at Cape Disappointment where it can be found alongside big-headed sedge.

***Hydrocotyle ranunculoides* - floating marsh-pennywort**

Floating marsh-pennywort is an aquatic plant in the carrot family found in much of the southern United States as well as California, Oregon, and Washington. It is generally found in slow-moving waters or ponds. It has long, thin stems that can float on the water surface and bright green, glossy, lobed leaves. It is endangered in Illinois, New Jersey, and New York and was historically present in British Columbia but is not currently ranked for Oregon or Washington. Floating marsh-pennywort is present at Cape Disappointment, Fort Clatsop, Fort Stevens, Fort Columbia, and Sunset Beach.

***Lilaea scilloides* – flowering quillwort**

Flowering quillwort is a small wetland plant in the arrow-grass family with fleshy, grass-like leaves and small flowering spikes that are much shorter than the leaves that is native to western North America. It is an easily overlooked plant found in shallow waters or coastal tide flats in alkaline, saline, or brackish areas (Washington DOE 2010). Flowering quillwort is present at the Fort Clatsop unit.

***Poa unilateralis* – ocean-bluff bluegrass**

Ocean-bluff bluegrass is a short perennial bunchgrass growing 15-40 cm tall growing on rocky headlands, sea cliffs, or sandy coastal bluffs in California, Oregon, and Washington. Though it is rare due to its limited habitat, those populations growing on steep or protected cliffs appear to be

stable (NatureServe 2009; Sayce and Eid 2004). Ocean-bluff bluegrass is present at Cape Disappointment.

***Samolus parviflorus* – water pimpernel**

Water-pimpernel is a clumping wetland perennial in the primrose family found in much of the United States, Canada, and South America. It grows to 40 cm tall with a basal rosette of broad, light-green leaves and a raceme of small white flowers. It is found in wet soils in lowland wetlands generally below 1300 m elevation (Washington Natural Heritage Program 2005). Water-pimpernel is present in the Fort Clatsop unit.

***Sidalcea hendersonii* – Henderson's sidalcea**

Henderson's sidalcea is a showy perennial in the mallow family found from Oregon to Alaska. It grows to 150 cm tall and has a spikel inflorescence of large deep pink to pink-lavender flowers. It is found along the coast, generally on or near tidelands (Hitchcock and Cronquist 1973). Henderson's sidalcea was planted at Cape Disappointment as part of a native landscaping project using plants sprouted from seeds collected from a Baker's Bay population (Kathleen Sayce, personal communication, 14 October 2009).

***Viola adunca* – early blue violet**

Early blue violet is a perennial violet found in much of the United States and Canada. It is found in dry to moist meadows, woods, and on open ground (Hitchcock and Cronquist 1973). It is the larval host plant for the Oregon silverspot butterfly (*Speyeria zerene hippolyta*), a federally listed threatened species that had a small population near the park in the 1990s (ORBIC 2010). The Clatsop County population of the Oregon silverspot, like the Washingon State populations, has likely vanished, but the recovery plan includes a viable population in this area. Due to the importance of early blue violet to the Oregon silverspot, early blue violet locations are being mapped as a way to assess the potential for restoration or management of silverspot habitat. Multiple small patches of early blue violet occur at the Sunset Beach/Yeon unit.

SOUNDSCAPE

The NPS mission emphasizes the preservation and restoration of park natural resources, including natural sounds, referred to as soundscape. Due to the parks generally rural nature the natural ambient sound is generally quiet at the NHP. Heard from many of the trails, natural quiet sounds include bird calls, wildlife rustling in the underbrush, and the movement of wind in the trees and grasses. Louder natural sounds such as the crashing of waves are associated with the bluffs and beaches and river banks. The natural quiet preserved at the park appeals to many visitors, and it contributes to the purpose of their visit. Vehicular traffic and ship/boat traffic are the number one source of sound pollution in the park, especially impacting sites along the Columbia River. Aircraft noise is common along the beaches due to general aviation associated with the local airports and Coast Guard helicopter training and rescue missions, routine ground/structure maintenance and human voices are especially prevalent in the vicinity of Fort Clatsop on a busy day.

AIR QUALITY (CLIMATE): AFFECTED ENVIRONMENT

The climate of the park is heavily influenced by the Pacific Ocean. The marine climate is warm and dry in the summer and fall, mild and wet in the spring and winter. Mean annual precipitation averages 74 inches mostly in the form of rain. There are short periods of drying under off-shore "East Winds". These periods represent the driest periods for influencing wildfire growth. It should be noted that winter storms can be extreme with winds reaching 70 to 100 miles per hour on the ocean bluffs.

Changes of climate are not anticipated to have an appreciable impact during the 5 year planning cycle for this fire management plan.

Weather Stations

The NFDRS stations within the National Weather Service Fire Weather 601 Coastal Zones are as follows:

Table 14: 601 Coastal Zone Weather Stations

601 Coastal Zones											
Station #	Name	County	T	Agency	LAT	LON	Elev	Aspect	T	R	S
450404	Willapa	Pacific	M	DNR	46.60	123.60	60	W – in valley	13N	8W	10
450407	Huckleberry	Pacific	R	DNR	46.50	123.40	2500	S – on mid-slope	12N	6W	22
350208	Tillamook	Tillamook	R	ODF	45.26	123.50	22	Flat	1S	9W	29
350215	Cedar Creek	Clatsop	R	USFS	45.21	123.77	2240	Ridgetop	4S	9W	22

The two weather stations most representative of the weather conditions at the park are: Willapa NWS ID #450404 and Tillamook - NWS ID# 350208

Air Quality

Air quality in the Pacific Northwest region is very good compared with other areas of the United States (Eilers, Rose, and Sullivan, 1994). Principal air masses for the region are derived from the atmosphere over the Pacific Ocean where the air is clean and moist. Occurring on a regular basis, wind-driven mixing along the coastal areas and through the Columbia River basin effectively disperses air pollution. As a consequence, air pollutant loads are relatively low. Air quality monitoring at the park is not conducted by the Department of Environmental Quality because coastal winds generally maintain clean air conditions in the area.

Under certain conditions, air quality can be occasionally impacted by nearby forest slash burning and from living history fires within the park. Odors from pulp mills in western Washington can infrequently

be detected at the park, but such impacts are generally of short duration. Increasing industrial and urban development in the surrounding area may cause air quality problems in the future.

Lewis and Clark National Historic Park has been designated a Class II[1] area for purposes of controlling increases in air pollution under the 1997 Clean Air Act. This designation was established by Congress to facilitate the implementation of air quality provisions of the Clean Air Act. It allows a moderate increase in certain air pollutants. The Clean Air Act requires that the National Park Service comply with all federal, state, and local air pollution control laws (Section 118). Because there are park units in both Washington and Oregon, the park is required to follow smoke management plans implemented by Washington Department of Natural Resources and Oregon Department of Forestry, respectively. The smoke management plans provide regulatory direction, operating procedures, and advisory information regarding the management of smoke and fuels on the forestlands in each state. The plans apply to all persons, landowners, companies, state and federal land management agencies within each state. See OAR 629-048-0100 for specifics on smoke management within Oregon. The Washington Smoke Management Plan is supplemental to the forest fire protection laws of Washington State (RCW 76.04) and the Clean Air Acts of Washington State (RCW 70.94) and the United States (42 USC 7401 et seq.).

[1] The 1997 Clean Air Act amendments designated all national parks over 6,000 acres and wilderness areas over 5,000 acres as Class I. This classification affords the most protection from new major emitting sources. All other areas that meet the National Ambient A

VISITOR USE AND EXPERIENCE

Visitor and Audience Profiles

Based on a three-year average of visitation for calendar years 2005, 2006, and 2007, approximately 232,000 visitors come to Lewis and Clark National Historical Park annually. On-site visitors mainly come to learn about and experience the history of the Lewis and Clark Expedition and the expedition's winter encampment of 1805-06.

In 2004, after the park expanded from 125 acres in Oregon to over 1,500 acres in both Oregon and Washington, visitors (both local and distance) began to use the park for recreational experiences—hiking and exercise, kayaking/canoeing, picnicking, fishing, birding and wildlife viewing, or simply contemplating nature—and the park created a 6.5-mile Fort to Sea Trail and a 1.5 mile Netul River Trail. Planning for new units at Dismal Nitch, Station Camp, Yeon and new trails continue. The average length of stay in the park is one to two hours, although the length of use by visitors to the park for recreational purposes has not been studied.

In a typical year, summer (June through September) receives the highest visitation with the last weeks in July and first weeks in August containing the highest visitation days of the year. Peak daytime visitation is between 11:00 AM and 3:00 PM. During March through June and September and October, the visitation is mainly school groups and tours groups. Generally, weekends draw a higher number of visitors than weekdays, as do the holiday weekends and school breaks.

During the fall and spring, the majority of the park's visitation consists of adult tour groups (mainly seniors) and school groups. Adult groups are the most numerous of the organized groups visiting the park. They account for about 65% of all park groups. The majority of the adult groups are commercial tours from 100- to 200-passenger ships offering cruises of the Columbia River and from 1,500-passenger ocean cruise ships, stopping at the Port of Astoria during their cruise of the Pacific Coast.

School groups account for 33% of the organized groups—the majority are fourth (35%) and eighth (24%) graders. The park offers a variety of education programs from self-guided to two-hour ranger-guided to all day hands-on programs. The self-guided programs are offered year around, while the ranger-guided programs are offered in October and March through mid-June. Although the park is not the sole destination for many area visitors, it is one of the main sites they want to see. Most of these visitors are vacationing in the area in the communities of Astoria or Seaside, Oregon, or Long Beach, Washington. Others are traveling Oregon Coast Highway or following the Lewis and Clark Trail. Of the park visitors, 66% stay in the area.
International visitors come from Canada, Europe, and other countries of the world. The park provides German, French, Spanish, Japanese, and Russian translations of the park's brochure. International visitors have an expressed interest in visiting U.S. national parks and sites associated with the Lewis and Clark story. With the newly expanded lands and recreational opportunities, the park has noticed anecdotally an increase in visitors enjoying recreational activities like hiking, running, wildlife viewing, fishing, and kayaking.

Historical and Recreation Facilities

The Fort Clatsop replica and historical area is often viewed as the primary resource of the park. The first fort replica was built by citizens of area for the 150th anniversary of the Lewis and Clark Expedition, and then given to the park service in 1958. The replica was built in the general location of the original Fort Clatsop, constructed by the Lewis and Clark Expedition in December1805 and occupied through the winter. In October 2005, an accidental fire destroyed the 1955 fort. Over 700 community volunteers assisted in rebuilding another replica.

The current replica is an interpretive exhibit to help visitors understand the Lewis and Clark Expedition's stay on the coast and their journey across the continent. The fort is now the primary site of formal interpretive programs in the summer and for visitor and educational programs in the spring. An interpretive wayside explaining the fort layout is located in this area.
The historical area around the fort includes a spring and historical canoe landing, where the expedition landed their canoes and then hauled their supplies out of the tidal marshes to the fort site. Located at the landing is an interpretive wayside on canoe building and usage by the expedition. Also currently located on this site are three replica dugout canoes including one that is accessible to visitors. A viewing platform at the canoe landing provides views of the Lewis and Clark River, Saddle Mountain, estuarine wildlife, and pilings from the logging industry. A bridge and boardwalk over a slough and tidal marsh begin the Netul River Trail. The 1.5-mile trail along the Lewis and Clark River, through wetlands, connects the visitor center and fort area to Netul Landing. No interpretive media have been developed for the trail.

The spring site interprets how the expedition obtained fresh water, a critical factor in determining the fort's location. Visitors can view the spring via a boardwalk and viewing platform. An interpretive wayside explains the expedition's water supply.

These three sites (replica fort, canoe landing, and spring) are connected with trails and are within 200 yards of each other. In addition to the interpretive wayside located at each site, over 10 small plant identification signs, with Lewis and Clark descriptions of plants, are along the connecting trails.

A picnic area, across the visitor center parking lot, has picnic tables, water, and four picnic shelters. It provides a great opportunity for making formal and informal interpretive contacts and, in the past, has been used for special events and education school programs.
Netul Landing is located one mile south of the fort replica and is accessed by road or by a 1.5-mile trail. During the bicentennial the landing was developed as visitor parking and park shuttle access. The shuttle shelter contains eight interpretive panels that orient visitors to the Lewis and Clark Expedition, preparing them for their visit to the fort. Currently in the works for the site are four interpretive panels that will interpret the logging industry's use of the area and the bioswales. This site also has been used for special events, programs (like the campsite of the Bicentennial Corps of Discovery Re-enactors and Nature Camp), and special use permits. In the summer of 2008, construction began on a picnic area and enhanced kayak/canoe launch at the south end of Netul Landing.

The Fort to Sea Trail is a 6.5-mile hiking trail connecting the visitor center and fort area to the Pacific Ocean. The trail travels through landscapes and ecosystems similar to those experienced by the expedition during their stay on the coast. No interpretive media have been developed for the trail.

The Salt Works is located 15 miles south of Fort Clatsop. This small city lot contains a rock oven commemorating the one that the expedition used to boil seawater and make salt for their return trip. An interpretive wayside is located at the site.

Dismal Nitch is located 30 minutes north of the fort in Washington. The site is currently a Washington Department of Transportation Rest Stop with potential for future development of interpretive facilities. It currently is managed by the NPS. There are interpretive and informational waysides linking the site to the expedition.

Station Camp is located five miles west of Dismal Nitch. The site is significant as an expedition campsite, and the place where they decided to stay on the coast for the winter. However, the site is more culturally significant as the location of "Middle Village" of the Chinook People—over 30 plank houses once were located on the site. Although currently undeveloped, the site has interpretive potential and, when developed, will be managed by the NPS. There is a wayside adjacent to a highway pull-off.

Cape Disappointment and Fort Columbia are Washington state parks. As part of the Lewis and Clark National Historical Park legislation, the NPS and Washington State Parks will work together to promote the stories of the Columbia-Pacific and specifically Lewis and Clark. Ecola and Fort Stevens are Oregon state parks. As part of the Lewis and Clark National Historical Park legislation, the NPS and Washington State Parks will work together to promote the stories of the Columbia-Pacific and specifically Lewis and Clark.

Interpretation

Interpretation and resource education is an important component at Lewis and Clark NHP. The cultural and natural resources are integral to the program. The current permanent interpretive staff is comprised of two interpreters: one GS-11 Chief of Visitor Services and one GS-09 Park Ranger-Interpretation. Seasonal staff includes three to four GS-04 and GS-05 Park Ranger-Interpretation and Visitor Use Assistants. Currently, a part-time Education Coordinator funded by Lewis and Clark National Park Association fills the Educational Specialist position. During the summer, the seasonal staff increases to seven to 13 GS-05 Park Ranger-Interpretation positions. All staff are stationed out of the visitor center. During fire management activities, fire specialists are available and utilized to assist with public education.

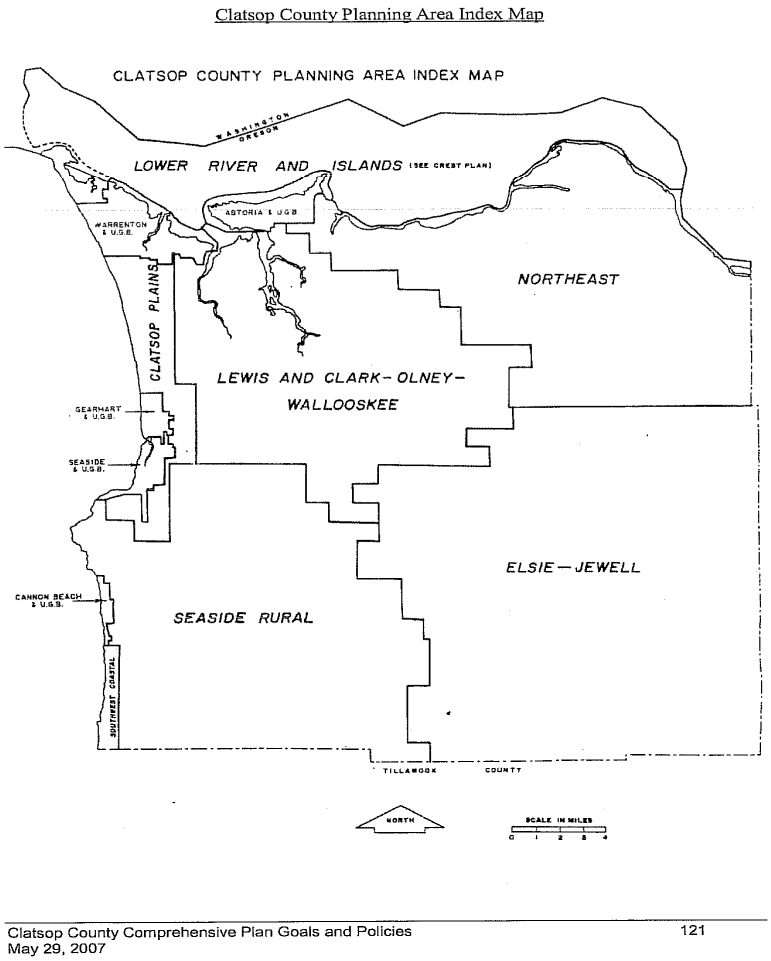
LAND USE: AFFECTED ENVIRONMENT

Land Use

The park consists of fairly small management sites developed to interpret the Lewis and Clark Expedition experience near the Mouth of the Columbia River. Each of the sites has developed infra-structure that is designed to impart knowledge about the Lewis and Clark expedition, or interpretation of the natural features of the park. The infrastructure can be as simple as kiosks, signage, trails and pathways to complex visitor interpretation centers and replicas of important structures.

Clatsop County, OR zoning rules are tiered from the guidelines stated in the Oregon Department of Land Conservation and Development statewide goals. The county is required by Oregon State law to prepare an "acknowledged" local comprehensive plan. The Clatsop County Comprehensive Plan was codified May 29, 2007. A map of the Clatsop County planning areas is shown in figure 5

Figure 5 Clatsop County Planning Areas



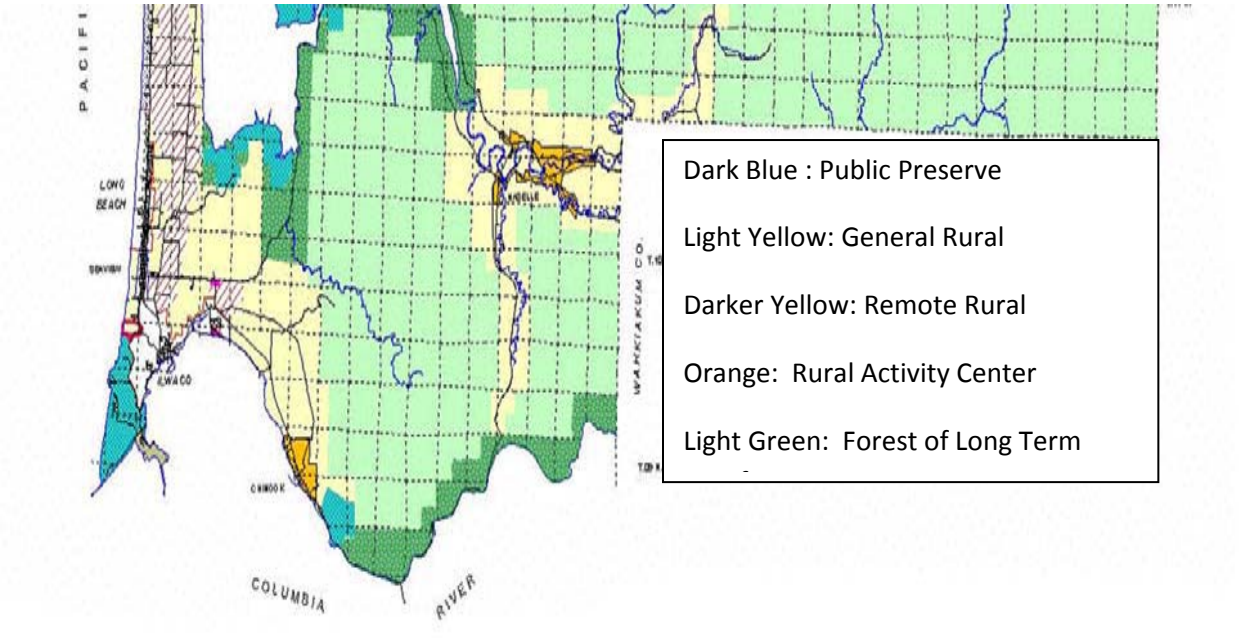
In Clatsop county each of the planning areas developed their set of standards for zoning. Lewis and Clark NHP also has units in the state of Washington.

Washington State passed the Washington State Growth Management Act (GMA) in 1990 as required in RCW 36.70A.010. The GMA requires all cities and counties to:

- Designate and protect wetlands, frequently flooded areas and other critical areas.
- Designate farm lands, forest lands, and other natural resource areas.
- Determine that new residential subdivisions have appropriate provisions for public services and facilities.

Growth management in Pacific County is regulated by the Pacific County Growth Management Plan. Figure 6 shows the general categories for growth management in the county.

Figure 6 Pacific County Comprehensive Plan Map 1998 (SW Pacific County)



In all cases adjacent lands have been developed and zoned for a variety of uses. Some of the prominent uses are: commercial timber lands, farms, permanent home sites, recreation home sites and commercial enterprises.

HUMAN HEALTH AND SAFETY

Related Laws, Regulations, and Policies: *The Federal Wildland Fire Management Policy Review*, 2009, provides fire policies related to safety. The guiding principles are fundamental and establish firefighter and public safety as the first priority in every fire management activity. Public safety and the safety of all personnel engaged in a fire event is the primary concern of park managers.

The park needs to insure the safety of visitors, neighbors and staff from the risk of wildland fire, both wildfire and prescribed fire occurring within park boundaries. Over 200,000 visitors frequent park sites, mostly during the drier summer and fall seasons.

There are areas of wildland urban interface near the Yeon Property and along the north and northwest borders of the Fort Clatsop forest area. Other smaller interface areas occur along the Station Camp site.

CULTURAL RESOURCES: AFFECTED ENVIRONMENT

The National Park Service recognizes five types of cultural resources: archeological resources, structures, cultural landscapes, ethnographic resources and museum objects (National Park Service, 1997).

Archeological resources are the physical evidences of past human activity, including evidences of the effects of that activity on the environment, and are frequently conceptualized and managed as spatially discrete archeological sites.

Structures—constructed works built to serve some human activity—are usually immobile and can be of either prehistoric or historic age. Examples include buildings and monuments, trails, roads, dams, canals, fences and structural ruins. The National Park Service manages structures through the List of Classified Structures (LCS), an inventory of all prehistoric and historic structures with historical, architectural, or engineering significance.

Broadly defined, **cultural landscapes** are a reflection of human adaptation and use of natural resources and often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

Ethnographic resources are basic expressions of human culture and the basis for continuity of cultural systems. These encompass both the tangible and the intangible, and include traditional arts and native languages, religious beliefs and subsistence activities.

Finally, **museum objects** include specimens, objects and manuscript and archival collections. These are frequently kept in a museum or designated curation facility.

It is important to note that a given cultural resource may qualify as one or more of these types. For example, an archeological site or structure could be part of a cultural landscape.

Prehistory, Ethnography and History

Prehistory

Prehistory of the lower Columbia River has been divided into four temporal phases (Minor 1983):

> The *Youngs River Phase* (8,000-6,000 BP) is marked by the presence of shouldered and leaf-shaped lanceolate projectile points, stemmed scrapers, bifaces, choppers, cobble spall tools, bolas, and baked clay objects (possible netsinkers). Archeological manifestations indicate seasonally mobile groups subsisting primarily on terrestrial mammals and plants.
>
> The *Seal Island Phase* (6,000-2,000 BP) is coincident with a warming and drying climatic period. Archeological markers include broad-necked stemmed projectile points,

bifaces and unifaces, chipped stone choppers, groundstone abraders, anvils, single-piece non-toggling and composite toggling bone harpoons, wedge-based bone points and harpoon valves, girdled netsinkers, and atlatl weights. Settlement patterns are indicative of seasonally mobile groups, while terrestrial and marine mammals, supplemented by fish, shellfish and plants, were the focus of subsistence efforts.

The *Ilwaco I* (2,000 to 900 BP) and *Ilwaco II* (900 to 200 BP) *Phases* signal the appearance of cultural traits associated with the Developed Northwest Coast Cultural Pattern, including dense populations occupying large, multifamily houses within semi to fully sedentary villages, emphasis on resource and craft intensification using highly specialized technologies, food storage, and social hierarchies with permanent inherited leadership positions (Ames and Maschner 1999). The succeeding *Ethnographic Phase* (AD 1775 to AD 1851) is marked by the retention of those traits, as well as the adoption of manufactured goods from the Orient, Europe and America.

Ethnography

The historical Native inhabitants on the lower Columbia River were tribal groups that spoke different dialects of the Chinookan language. In the case of the various units of Lewis and Clark NHP, the Clatsop Tribe held the Oregon side of the Columbia, while the Chinook Tribe proper resided in southwestern Washington. Ethnographic data for these groups were obtained largely from individuals that lived long after major cultural disruptions of the late 1700s and early 1800s (e.g., European and American settlement, population declines due to disease). As such, the biased and incomplete observations of early explorers and settlers provide some of the best accounts of early Chinook lifeways.

The Chinook resided in large villages containing from one to twenty-plus multi-family wooden plank houses along the banks of the Columbia River and Pacific Coast. Several of these villages are known or reported to have occurred within or very close to the boundaries of Lewis and Clark NHP units. Smaller camps were also established for the extraction of seasonally-available resources. Although each major village was autonomous, economic and political ties were established through trade and intervillage and intertribal marriage. Chinook society was stratified; high ranking members distinguished themselves through the acquisition of slaves and material goods.

Hunting of terrestrial and marine mammals was important to the Chinook, as was fishing for salmon, sturgeon and other species using highly specialized technologies (e.g., canoes, seines, weirs). Wild plants served as food, medicines, and construction materials. Craft specialization in the form of stone, bone and woodworking and basket making were highly developed.
Today, descendents of the pre-contact Chinookan people are members of several recognized and unrecognized tribal nations, including the Chinook Indian Nation, the Clatsop-Nehalem Confederated Tribe, the Confederated Tribes of the Grande Ronde, the Quinault Indian Tribe and others. These groups retain a strong interest in preserving and protecting culturally important sites. Likewise many Tribal members still undertake traditional pursuits (e.g., collecting basketry materials, fishing) within their ancestral lands.

History

The various units of Lewis and Clark NHP share a common association as locations where the Corps of Discovery had a physical presence between November 1805 and March 1806. Many of these units also preserve unique and important facets of Pacific Northwest history that took place before and/or after the arrival of the Lewis and Clark expedition. A general history of the lower Columbia River region is presented below, followed by unit-specific summaries (see Tolon 1993; Smith and Fagan 2003; Smits et al. 2005; Wilson et al. 2009; Horton 2010).

The earliest well documented appearance of non-natives in the region occurred when the Spanish galleon *Santiago* sighted the Columbia River from its mouth in 1775. In 1792, the brig *Columbia Rediviva*, commanded by Robert Gray, entered the river, explored the estuary and made contact with the Chinook. Other vessels soon followed, many of which were associated with the region's burgeoning fur trade. By the time the Corps of Discovery arrived in 1805, the Chinook were routinely interacting with European and Euroamerican merchants through trade. Further, even prior to direct contacts with outsiders, the Chinook suffered the effects of infectious diseases that were passed along indigenous trade routes from the interior. Cartographic renderings and geographic descriptions of the lower Columbia River produced by the Lewis and Clark expedition have allowed researchers to plot the locations of their activities with a high level of accuracy and, hence, attribution to specific units now comprising Lewis and Clark NHP. These same locations also have the potential to contain archeological remnants directly or indirectly associated with the expedition. Further, during their five months on the lower Columbia River, Lewis and Clark produced detailed observations on the geology, flora and fauna of the region. These data could be utilized to guide the restoration of the natural communities that existed on the lower Columbia River in the early 1800s. The specific Corp of Discovery activities undertaken in Lewis and Clark NHP are described for each respective park unit below.

In 1811, the increasingly competitive fur trade prompted American John Jacob Astor of the Pacific Fur Company to establish Fort Astoria at the site of the present town of Astoria, OR. As tensions between the United States and Britain mounted with the onset of the War of 1812, Astor transferred the property—which included a fortification and several structures— to the British-owned Northwest Fur Company, which changed the name to Fort George. In 1821, the Northwest Fur Company was absorbed into the Hudson's Bay Company, and Fort George served as the administrative center for the latter until 1825, when Fort Vancouver was completed farther up the Columbia River. The Hudson's Bay Company retained Fort George as a regional outpost. Despite the new arrivals, the lower Columbia River remained a remote location until the 1840s, occupied almost exclusively by the remaining Chinook and fur company employees and their families. Interestingly, the ethnic make-up of fur companies was extremely diverse, including Europeans, Americans, French Canadians, Pacific Islanders and Native Americans representing many tribal groups. The Chinook, by virtue of a long-standing acumen in commerce, were readily able to establish social and economic ties with the newcomers through exchange and intermarriage. For their part, managers of the fur companies fostered economic dependence by maintaining a trading post at Fort Astoria/George and, later, a store on the northern shore of the Columbia River near Point Ellice (established by the Hudson's Bay Company in 1840).
With a dramatic increase in westward overland migration during the 1840s, the United States and Britain vied for control over disputed lands in what became the northwestern portion of

Washington State. The Oregon Treaty of 1846 ceded all lands south of the 49th parallel to the United States. As a consequence, the Hudson's Bay Company retreated to the north. The U.S. Army took possession of the strategically located Fort George (restoring the name to Fort Astoria) and opportunistic settlers descended on the lower Columbia River. In addition to the existing community at Astoria, several new towns –Pacific City, Chinookville, and Lexington—were established on both sides of the Columbia River in the late 1840s and early 1850s. Though some of these settlements were more successful than others, their presence marked the beginning of new economic era, one focused on extractive enterprises such as salmon fishing and logging, that would define the region for the next century.

This transition also posed challenges for the few remaining Chinook. Missionaries began arriving in the region in the 1830s, and missions were established north and south of the Columbia River mouth by the 1840s. Although some Chinook accepted conversion, the effort was largely perceived as unsuccessful. New settlers, seeking to plat towns and establish commercial enterprises, frequently encroached on Chinook lands and resource procurement areas. For example, Washington Hall created the community of Chinookville on the northern bank of the Columbia River at the site of a large Chinook summer village and, in doing so, fenced off access to the freshwater spring used by the village inhabitants. Such encroachments prompted both the Clatsop and Chinook Tribes to negotiate treaties in 1851 ceding huge amounts of territory in exchange for small reservations, although neither was ever ratified. As they had with fur trading companies, however, some Chinook were able to adapt to these changes and gain an economic foothold. For example, Native fisherman provided a steady supply of salmon to the numerous fish processing operations that sprang up along the banks of the Columbia River.

During this period of economic expansion shipping along the Columbia River assumed heightened importance, particularly between the mouth and rapidly growing community of Portland, located about 80 miles upstream. Safely navigating the lower Columbia, however, was no small feat—it had earned the name "Graveyard of the Pacific" on account of the large number of shipwrecks. A lighthouse was established on Cape Disappointment in the 1850s, and in the late 1800s and early 1900s several rock jetties were built to concentrate the river flow into a single deepwater channel. The U.S. Army also expanded its presence at the river mouth with the construction of Fort Canby near Cape Disappointment and Fort Stevens west of Astoria beginning in the 1860s. Both underwent extensive re-fortification in the late 1800s and were augmented by the construction of another fort—Fort Columbia—and numerous batteries as part of the Columbia Harbor Defense System. These facilities were largely deactivated following World War II.

Development and population growth along the lower Columbia River prompted enhancement to the local transportation systems. A narrow gauge railroad was constructed along the northern shore in the 1880s and underwent gradual improvements through the early 1900s. It was used to short haul both passengers and freight. By the 1920s, dominance of the automobile spurred extensive road building and development of trans-river ferries, but it was 1966 before an automobile bridge was completed across the Columbia River.

As a result of overharvest and upriver habitat loss, the commercial salmon fishery of the lower Columbia River was in severe decline by the mid-1900s, and the timber industry suffered a similar fate in the decades that followed. The local economy responded through a shift from extraction industries to those based on tourism. Part and parcel with that shift was the establishment of national, state and local parks to preserve and commemorate the unique cultural and natural history of the region, including many of the units comprising Lewis and Clark NHP.

Cape Disappointment: This unit contains the location where Lewis and Clark's Corps of Discovery likely first observed the open Pacific Ocean. Exploring west from their main camp (located within the Middle Village/Station Camp unit) on November 14, 1805, a party led by Merriweather Lewis travelled west along the northern bank of the lower Columbia River and explored the area now comprising Cape Disappointment State Park. Because Lewis did not keep a journal the details of this excursion are unknown. William Clark, however, led a body of 11 men over the same ground four days later and did record their observations. The party learned from Chinook informants that trading vessels frequently anchored on the lee side of the cape. Shoreline trees contained the carved names of numerous traders, and to one of which Clark added his own. Clark and his men contemplated the significance of their journey while watching waves crash against the Pacific shore. Spending the night near McKenzie Head, the party returned to their main camp the following day.

Prior to the arrival of the Corps of Discovery, the Chinook maintained at least one summer village at Cape Disappointment and perhaps others as revealed by ethnographic and archeological data. Cape Disappointment received its name from John Meares, captain of British trading vessel, who was drawn to the area in 1788 by earlier maps depicting the mouth of a large river. Apparently fearing shipwreck, Meares did not sail far enough and concluded that there was no river. Subsequent vessels, beginning with the *Columbia Rediviva* in 1792, proved that the river did indeed exist and Cape Disappointment became, as noted, a popular anchorage and place of exchange.

When the Pacific Fur Company decided to construct its headquarters at the mouth of the Columbia River in 1811, some members of the party preferred the Cape Disappointment area over the chosen site of Astoria. For the next 40 years, Cape Disappointment served primarily as a lookout. In 1845, the Hudson's Bay Company surveyed the area with the intent of establishing military batteries, and thereby solidify the interests of Britain in the Pacific Northwest. This plan was abandoned with the signing of the Oregon Treaty of 1846.

In 1849, missionary Elijah White attempted to establish a settlement—Pacific City—on the lee shore of Cape Disappointment. Pacific City failed to achieve the lofty expectations of its founder and was dealt a final blow when Cape Disappointment was withdrawn as a military reservation through presidential proclamation in 1852, although lack of appropriations delayed development of military facilities until the early 1860s. However, a much-needed lighthouse was constructed on the south end of the cape in 1856 (another was added to the north end in 1898).

A new fort, first called Fort Cape Disappointment and later Fort Canby, was officially activated in 1864. Initially consisting of earthworks and gun batteries, other structures and features—

barracks and officer quarters, hospital, stables, sawmill, parade ground, cemetery—were added over the next two decades.

While lighthouses improved navigation, at least 21 documented shipwrecks occurred off of Cape Disappointment in the late 1800s and early 1900s. Wrecks were common enough, in fact, that both voluntary and official life saving stations were established on the cape. Further improvements to navigation came in the form of a rock jetty constructed off the south end of Cape Disappointment in the 1880s. When this structure proved insufficient, a better version was built between 1913 and 1917. The jetty construction workers resided on site within temporary buildings constructed near the fort.

In the mid 1930s, a Civilian Conservation Corps (CCC) camp was established at Fort Canby. This again resulted in a number of temporary buildings being constructed. CCC enrollees primarily constructed and improved roads within the fort. With the onset of World War II, Fort Canby underwent significant modifications. These included a new garrison, barracks and other structures, and new and upgraded batteries. By 1947, Fort Canby was deemed expendable, and many of the structures were dismantled and salvaged. In 1957, the property was transferred to Washington State to be managed as a state park.

Middle Village/Station Camp Unit: This unit marks the location of a Chinook summer village called *qí'qayaqilxam* or "Middle Village." On November 15th, 1805, the Lewis and Clark party landed near the then-deserted village following an exhausting effort to round Point Ellice by canoe from the east. Battered by torrential rain, endless waves and high winds, the party recuperated at the site, which they called "Station Camp," for ten days. During this time they engaged local Chinooks in trade and Clark established a mapping station from which he produced a detailed map of the mouth of the Columbia River. It was at Station Camp that the party voted on the most appropriate location in which to spend the winter, and decided that a camp on the southern shore of the Columbia River would provide better protection from inclement weather. Archeological excavations at Middle Village suggest that the Chinook not only interacted with the Lewis and Clark expedition, but also sailing ships that increasingly frequented the mouth of the Columbia River prior to Corps of Discovery as well as fur traders associated with the nearby settlement of Astoria.

In 1848, a catholic mission—Stella Maris—was established in and around the Middle Village/Station Camp unit. The attempts of priests to convert the Native populations met with mixed results, and in 1853 Patrick J. McGowan purchased one half of the mission grounds on which to establish a salmon packing business. Initially employing Natives, the cannery proved a success and a town—named McGowan—was established surrounding the cannery. In 1901 the cannery operation was moved to a downriver location. That, combined with changes in allowable salmon fishing practices, led to the slow demise of McGowan as a company town. By the 1940s, "Camp McGowan," as it was known, served as a recreational fishing destination. The Middle Village/Station Camp unit contains some of the few remaining vestiges of the town.

Dismal Nitch: This unit lies very close to the location where Lewis and Clark's Corps of Discovery were trapped by inclement weather between November 11 and 15, 1805, before continuing on to Station Camp. Clark's journal entries speak graphically of the misery the party

faced, including perpetual wetness, rotting clothing and dwindling supplies, in the small, driftwood encrusted cove he called "this dismal nitch."

While trapped at the Dismal Nitch, the party was visited twice by Chinook travelling in canoes. From the first group, who were headed downriver to engage in commerce with trading vessels, Clark purchased 13 salmon. As noted, upon escaping the Dismal Nitch, the expedition recuperated in proximity to two Chinook summer villages located just downstream.
In the 1870s and 1880s, German immigrant Joseph Megler operated a fish canning and buying station in what came to be known as Megler Cove (and where Lewis and Clark's Dismal Nitch was located). Megler Cove was formerly known as Todd's Bay, named for the ship *Issac Todd*, which had visited Fort George and the lower Columbia River in 1814. Megler Cove was reportedly a place where fisherman could seek shelter from high winds. Buildings and other structures associated with the Megler operations remained standing until the 1950s.
In the early 1900s, the Ilwaco Railroad and Navigation Company, a subsidiary of Union Pacific, sought to take advantage of the deepwater port at Megler Cove by extending the railroad to that location and constructing a station and landing. This was necessitated by the fact that steamers could only reach the port at Ilwaco during high tide due to heavy siltation in Baker's Bay. The new railroad terminus was called Megler Station, and soon a regular ferry service was running between it and Astoria. The landing at Megler also became, at least for a few years, an important shipping point for canned salmon exports.

By the early 1920s, automobiles were supplanting railroads as the primary form of transportation in the region. In 1927, Union Pacific Railroad removed the narrow gauge railroad tracks and improved, with substantial effort, the grade for automobile traffic, as well as constructing new automobile-friendly ferry slips at Megler and Astoria. Due to competition with nearby ferry operated by Fritz Elfving that provided the same service, the venture proved unprofitable, and Union Pacific was out of the ferry business by 1930. The Columbia Transportation Company subsequently purchased the ferry and resumed service. A legendary, but short-lived "ferry war" erupted between the company and Elfving, which the latter ended by purchasing the mortgage on the company's ferry. Elfving moved his operation to Megler in 1933 and operated until the end of World War II. The Oregon Department of Highways eventually purchased the ferries and contracted service until the Astoria-Megler Bridge was completed in 1966.

In 1968, the Washington Department of Highways oversaw the removal of all remaining ferry infrastructure at Megler. The site was significantly modified by cutting and filling and the present Megler Safety Rest Area was constructed. As a result of these and previous alterations, the location bears only slight resemblance to its past as fishing and ferry operations, let alone a place of refuge for the Corps of Discovery.

Fort Clatsop: As the name suggests, this unit contains the fortification where the 33 members of the Lewis and Clark expedition spent the winter of 1805-1806. The decision to shelter on the south side of the Columbia River was driven by the need to find a location better protected from inclement weather, as well as reports of abundant elk populations. The location was found by Lewis and a small contingent of men in early December, 1805. The entire party arrived at the site on December 7 and by December 31 had constructed a small log fort consisting of two cabins linked by palisade walls. Called "Fort Clatsop," the structure served as home to

the Corps of Discovery until March 23, 1806. The men bided their time hunting elk and readying themselves for the return journey east by making salt and repairing and manufacturing gear, while Lewis and Clark updated and organized journals, maps and scientific data.
The Clatsop were frequent visitors to the fort for the purpose of engaging in trade, and, upon the expedition's departure, the structure was left to Comowool (Coboway), headman of the local Clatsop village. Clatsop oral history records that Coboway utilized the fort as a logistical hunting camp for several seasons, after which lack of maintenance and salvaging of timbers left it in a state of disrepair.

Even as early as 1811, the fort site was an attraction to the newly arrived American and British fur traders at Fort Astoria/George. Each who left a description described the structure as recognizable, but beginning to decay. American scientists, settlers and missionaries who visited the site in the 1830s and 1840s documented further decomposition.

In 1850, the land on which the fort is located was claimed by Carlos Shane. Shane reportedly burned the fort remnants while creating a clearing in which to construct a house. In 1852, Richard Moore constructed a sawmill on Shane's land near the Lewis and Clark River and proceeded to log the surrounding landscape. Moore shipped lumber from a location reportedly near the site of the canoe landing utilized by the Corps of Discovery.

Carlos Shane's brother, Franklin, who assumed ownership of the house and land in 1852 or 1853, planted an orchard in newly cleared land near the house. The Shane house apparently burned in 1860, and Franklin passed away sometime thereafter. Beginning in 1862, the Oregon Steam and Navigation Company established a regular summer service between Portland and the canoe landing site. Passengers were transported by stage to the nearby town of Seaside. This service continued until 1900.

The title for Franklin Shane's property was left to his daughters, one of whom had married a man named William Hampton Smith. The Smith's constructed a new house just south of the former Shane dwelling in the 1870s, and are also believed to have built a road and planted new orchards. The Smith's son, Harlan, recalled that his mother had shown him the last vestiges of Fort Clatsop—a decayed, half-buried log near the north end of their house—when he was a child. William Hampton Smith's relatives operated a major Oregon pottery manufacturing company, and he and his family manufactured bricks on the property. Clay was apparently quarried near their home, both for the brick operation and, later, shipped in raw form to Portland when the Smith's moved to that city in 1880. A family named Stevenson rented the house and property from the Smith's in the 1880s and made charcoal on the site.

In 1901, the Oregon Historical Society (OHS) purchased three acres of land believed, on the basis of pioneer testimonies, to contain the site of Fort Clatsop. The site was commemorated with a brass marker in 1912. The OHS purchased two more acres adjoining the southern boundary of the first tract. These were cleared of brush and a flagpole erected in 1928. Following construction of a new county road, the site began to receive greater visitation. Unfortunately, the OHS lacked funds to staff or maintain the property, and by the end of World War II it had become a place for locals to party and dump garbage.

Lingering questions about the actual location of Fort Clatsop relative to the commemorative site prompted the OHS to contact the National Park Service for assistance in the late 1940s. In 1948, National Park Service archeologist Louis Caywood excavated several trenches and broad exposures in proximity to the bronze marker and flag pole, the results of which were inconclusive. With the approach of the Lewis and Clark Sesquicentennial, the local community decided to construct a replica of Fort Clatsop—based on historical drawings—at the commemorative site. The structure was erected in the summer of 1955, and was followed by a letter writing campaign by the OHS and private citizens to Oregon congressional representatives that led to the creation of Fort Clatsop National Memorial in 1956. The National Park Service assumed management of the Memorial in 1958. Additional exploratory excavations were performed in 1958-1961, which resulted in evidence of the Shane and Smith occupations but, again, no definitive proof of Fort Clatsop.

Since its creation, the land base of Fort Clatsop National Memorial increased significantly with various land acquisitions. However, subsequent archeological explorations, including those conducted in the footprint of the original replica fort after it burned in 2005, have yet to find unequivocal remnants of the fort (although in 1996, a copper bead recovered during excavations likely dates to the late 1700s/early 1800s). This suggests either that the area containing the fort has yet to be tested archeologically or, perhaps more likely, the combination of a brief occupation (only three months), paucity of archeologically deposited material and post-occupation disturbances have rendered the fort remnants extremely difficult to identify.

Sunset Beach and Yeon Property: The Yeon Unit is on the Clatsop Plains, a 0.5 to 2 mile wide strip of coastal plain between the mountains and the ocean. The Clatsop Plains stretch 15 miles from the mouth of the Columbia River to Tillamook Head. The Plains are a region of parallel sand dune ridges separated by inter-dunal lakes and wetland swales. The Clatsop occupied the Plains and numerous shell middens have been found throughout the area. As the plains became settled by Europeans, native coastal prairie was overgrazed by cattle and eroded. To check the erosion, dune stabilizing plant species (such as European beach grass, Scotch broom, and shore pine) were planted by the Soil Conservation Service (SCS) along with a Civilian Conservation Corps (CCC) in the mid 1930's. With 3,000 acres of shifting sand being stabilized, this effort was one of the most extensive dune stabilization efforts in the western United States. Unfortunately, European beach grass and Scot's broom have proved to be aggressively invasive and have come to dominate many coastal tracts, including the Yeon Unit. The park is developing a plan to treat the Unit and restore coastal prairie.

The Yeon Unit was owned by conservationist Norman Yeon until his death in 2004. Mr Yeon bequeathed the land to the Trust for Public Land (TPL) with the intent that it become part of a park unit. In 2009, both the North Coast Land Conservancy and The Conservation Fund helped facilitate transfer to the National Park Service and the unit became part of the national park.

Salt Works: This unit encompasses the presumed location where the Corps of Discovery obtained salt during their stay at Fort Clatsop. Salt was critical as a food preservative and drying agent for animal hides, and the explorers boiled a considerable amount of seawater to obtain sufficient amounts to meet manufacturing and dietary needs for the return trip east. Journal

entries indicate that travel between the site and Fort Clatsop was very difficult on account of rugged terrain and heavy vegetation.

The location of the salt works was identified in 1899 by two long-time residents as well as an elderly Clatsop woman, the latter of whom supposedly visited the site as a small child shortly after its use by the Corps of Discovery. The location was marked by a cairn of fire-altered rocks measuring about 10 x 6 feet in breadth and nearly three feet tall. The OHS enclosed the location with a fence, and in 1910, the property was donated to the society by its owner. By the 1920s, the site was further delineated by a sidewalk and wrought iron fence. At some point during the 1950s, perhaps in conjunction with the Lewis and Clark Sesquicentennial, the Seaside Lions Club produced a reconstruction of the salt works site, complete with stone cairn and metal kettles, within a fenced enclosure. Located in the center of the site, the reconstruction is surrounded by native vegetation characteristic of the coastal setting, including Sitka spruce, shore pine and salal. The Salt Works unit was incorporated into Fort Clatsop National Memorial through a congressional amendment in 1978.

Archeological Resources

Cape Disappointment: Nine archeological resources have been recorded in the Cape Disappointment unit. Three of these are associated with Native American occupations, including an ethnographic village location, buried shell midden and displaced lithic scatter. Historical archeological sites represent military-era activities (World War II, in particular), and include numerous concrete foundations, standing and collapsed wooden structures, trash dumps containing various metal, glass and ceramic artifacts, wooden and metal remnants of a shipwreck, and historic vegetation plantings. None of these has been formally evaluated for National Register eligibility.

Very few cultural resource surveys have been conducted within the Cape Disappointment unit, and most of those occurred in developed areas. Heavy vegetation within the unit probably obscures many sites, and others are likely buried beneath the ground surface as a result of natural processes and historical earth-moving activities.

Middle Village/Station Camp: The location of the Chinook "Middle Village" near where the Lewis and Clark party encamped for ten days in November 1805 comprises the centerpiece archeological resource on this unit (Wilson et al. 2009). Excavations at this site (designated 45PC106) revealed a narrow range of occupation dates (ca. AD 1790 to AD 1820) corresponding to the early contact period. The site retains good integrity as evidenced by the presence of shallowly-buried plank house remains and discrete activity/disposal areas. Interestingly, contact period trade items (e.g., trade beads, coins, metal fasteners, knives, ammunition, ceramics, bottles) and traditional artifacts associated with wealth and prestige in Chinookan culture (e.g., copper objects) are disproportionately well-represented in the Middle Village archeological assemblage, especially compared to other contemporaneous sites in the region. This has prompted the interpretation that trade was an important activity at the site. NPS is working with the Washington Department of Archeology and Historic Preservation to prepare an updated nomination for 45PC106. Known archeological resources associated with the townsite of McGowan in the Middle Village/Station Camp unit are thus far limited to structural debris and artifacts reflective of fishing, canning and agricultural practices in the late 19th and early 20th centuries.

Dismal Nitch: Despite the rich history of this unit, the only documented archeological resources are wooden pilings associated with the 1880s fish receiving station operated by Joseph Megler. It is important to note, however, that only the Megler Safety Rest Area portion has been subjected to inventory (Smits et al. 2005). The balance of the 190 acre unit is comprised of rugged and heavily vegetated terrain variously modified by construction projects along the Columbia River described above and, on the higher slopes, logging. Journal entries made by William Clark indicate that various members of the Corps of Discovery, including himself, hiked up either Megler Creek or adjacent creeks during their time at Dismal Ditch. Whether these activities resulted in tangible archeological manifestations remains to be seen.

Yeon Property: No archeological resources have been documented within the Yeon Unit. However, the area has yet to be surveyed. The Unit's location near the Neacoxie Creek corridor

and on one of the original Donation Land Claims makes it moderate to highly likely to contain archeological resources.

Salt Works: No archeological resources have been documented within the Salt Works unit, and no attempt has yet been made to verify the location as the actual location where the Corps of Discovery obtained salt

Fort Clatsop: Archeological resources documented within the Fort Clatsop unit include the purported fort site, Shane and Smith residences and a mid-20th century trash dump near the Historic Canoe Landing. Horton (2010) identified 15 recorded archeological sites within about three miles of the Fort Clatsop unit. These include shell middens along the Pacific Coast, and Native American occupation sites and lithic scatters in proximity to the Lewis and Clark River. Archeological sensitivity for both prehistoric and historical resources is judged to be moderate to high within the Fort Clatsop unit. The paucity of recorded resources speaks to limited inventories (focused primarily on the replica fort area) and a high likelihood that sites are buried beneath thick vegetation and/or dredge spoils.

Structures and Cultural Landscapes

Cape Disappointment: The Cape Disappointment Historic District, the boundaries of which encompass this unit, was listed on the National Register of Historic Places in 1975. Contributing elements include both natural and constructed features: Cape Disappointment, Cape Disappointment and North Head lighthouses (and associated outbuildings), and extant and ruined military batteries and gun emplacements. All other military structures (e.g., barracks, hospital) were removed at the conclusion of World War II. As described, the significance of this District lies in the fact that Cape Disappointment was a prominent navigational feature for early mariners, marks the location where the Corps of Discovery first observed the open Pacific Ocean, and contains the first coastal defense installation constructed at the mouth of the Columbia River (and oldest in the State of Washington).

The lighthouses are concrete encased in stucco shells, as are the associated outbuildings. Each is located in an open coastal plain vegetated with grasses and low shrubs. The batteries and emplacements are constructed of concrete and iron and, in some cases, partially covered with earth. Vegetation, including heavier fuels, is continually encroaching on these features.

A boundary study for the proposed expansion of Fort Clatsop National Memorial suggested that the Cape Disappointment landscape remains broadly similar to that encountered by the Corps of Discovery, including wind-whipped coastal headlands capped with old-growth forest, estuarine wetlands, coastal dunes and sandy beaches covered with driftwood (National Park Service 2003).

Middle Village/Station Camp: Several standing structures associated with the former town of McGowan are located within or adjacent to the unit. Among these are St. Mary's Church (constructed in 1904) and a couple of deteriorating outbuildings, the McGowan Mansion (constructed in 1911) and a structure known as the "office" (constructed in 1903) . St. Mary's Church, which is clad in wooden siding and has a composition shingle roof, is located in grassy opening. It awaits a National Register of Historic Places eligibility determination. The deteriorating outbuildings are non-contributing structures and slated for eventual demolition.

The Middle Village/Station Camp Unit has not been formally inventoried for potential cultural landscapes (Erica Owens, personal communication 2011). Previous studies have documented substantial alterations to the landscape at this unit, among them bisection by Highway 101, riprap along the Columbia River, and non-native Scot's broom marking heavily disturbed portions of the river terrace (National Park Service 2003, 2010). However, the unit does retain expansive views of the Columbia River estuary—which is significant in that the Corps of Discovery used the site as a mapping station—and forested slopes to the north, which include some old-growth trees.

Chinook Point, which is located in the adjacent Fort Columbia State Park, is a designated National Historic Landmark based on its natural setting, association with discovery of the Columbia River by American and European vessels, and historic structures constructed at Fort Columbia.

Dismal Nitch: The Dismal Nitch Unit has not been formally inventoried for potential cultural landscapes (Erica Owens, personal communication 2011). The degree of alteration to the historical landscape in this unit was described above.

Yeon Property: The Dismal Nitch Unit has not been formally inventoried for potential cultural landscapes.

Salt Works and Fort Clatsop: The Fort Clatsop National Memorial—which included both Fort Clatsop and the Salt Works units—was first listed on the NRHP in 1966, and the record was updated in 1987. Contributing elements of this historic property include the fort replica (the original of which burned in 2005), salt works replica and the entirety of the Fort Clatsop unit as containing the archeological remains of the original fort (and which then encompassed about 125 acres). The fort and salt works cairn replicas are both listed on the LCS for Lewis and Clark NHP.
Restoration of the vegetation condition as it existed at the time of the Lewis and Clark expedition has been a management objective since the creation of Fort Clatsop National Memorial. Agee (1989) developed a conceptual plan for forest restoration at the Fort Clatsop unit. He speculated that the pre-contact forest was dominated by western hemlock, Sitka spruce, and western redcedar. These occurred, the latter two species in particular, as large live trees, some large standing snags, large downed logs, and a multi-layered understory of which small western hemlock comprised a significant percentage. It was recommended that the NPS continue a tree planting program that was begun in the early 1960s, as well as stand-thinning focused on early successional species like red alder. A Cultural Landscape Report for the Fort Clatsop National Memorial advocated old-growth forest restoration and maintenance at the Fort Clatsop unit as a means of enhancing naturalness, promoting interpretive opportunities and screening non-contributing features and views (Tolon 1993).

With the expansion of the Fort Clatsop Unit, the park has assembled a forest restoration plan to be released concurrently with this fire plan.

Approximately 75% of the Salt Works unit is vegetated with native species; predominately shore pine, Sitka spruce and shrubs. Native species are deemed important for interpreting the Lewis and Clark story at the site, and promoting and maintaining these plantings is a management recommendation for the cultural landscape (Tolon 1993).

Ethnographic Resources

Contemporary Chinook and Clatsop peoples maintain strong connections to the units comprising Lewis and Clark NHP. Likewise, local communities have long been engaged in preserving and interpreting the Lewis and Clark story, and are actively involved with the management of these units. More specific information will be presented in a forthcoming Special History Study of the Lower Columbia.

Museum Objects

As of 2005, the Lewis and Clark NHP museum collections contained over 52,000 historical and archeological objects, natural history specimens, ethnographic objects, and archive documents, along with more than 2,000 books and other research materials (National Park Service 2005). These are curated in the Fort Clatsop Visitor Center, a wood frame structure with board and batten siding and shake roofing that is embedded within a heavily forested setting.

PARK OPERATIONS/INTERAGENCY COORDINATION:

Lewis and Clark NHP is comprised of three government entities: National Park Service, Oregon State Parks and Washington State Parks and Recreation. Shared management operations are in place where deemed beneficial to efficiency of planning and operations.

Park operations are focused on interpretation of the period of Lewis and Clark Expedition's (Corps) presence near the mouth of the Columbia River. Park programs are designed to provide a visitor learning experience concerning the Corps activities as well as an appreciation of the natural features prevalent in the area.

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

This section describes the impacts that the proposed alternatives are expected to have on the affected resources under this Fire Management Plan. Three alternatives were evaluated, **No Action** Alternative (Alternative 1) , Agency Preferred **Mechanical and Limited Prescribed Fire Option** (Alternative 2) and **Mechanical Treatments Only** (Alternative 3). This chapter is organized by resource and presents the potential impacts by alternative. This organizational structure was chosen primarily to evaluate in a systematic manner the many resource topics. This structure was also chosen to facilitate interagency consultations and the review of the impact analysis by various stakeholders and other interested parties. Implementing this style of analysis helps to assure that impacts are thoroughly and comprehensively evaluated, but it does lend itself to some overlap and repetition between similar injury types and resource topics.

Three categories of effects, or impacts, are considered and analyzed: (1) direct effects, which occur at the same time and in the same place as the action; (2) indirect effects, which occur later or at a location away from the action; and (3) cumulative effects, which are additive and include those that occur in the past, present, and foreseeable future. Direct, indirect, and cumulative effects are addressed for each affected resource under the proposed alternatives. The following resources described in Chapter 3, Affected Environment, were evaluated for potential effects.

1. Soils
2. Water Resources
3. Wetlands
4. Vegetation
5. Wildlife
6. Threatened, Endangered, and Sensitive Species
7. Soundscape
8. Air Quality
9. Visitor use and Experience
10. Land Use
11. Health and Human Safety
12. Cultural Resources
13. Park Operations/Interagency Cooperation

ANALYSIS APPROACH

The potential direct, indirect, and cumulative impacts of the proposed alternatives were analyzed. The resources expected to be affected by the proposed alternatives are described in Chapter 3. Fire management actions and methods discussed in this environmental assessment are the same as those currently approved and utilized by the Lewis and Clark National Historical Park, the difference being the areas within the park where these actions and methods can be applied

Approach for Evaluating Alternatives

The impact analysis involved the following steps:
• Identifying the resource that could be affected.
• Identifying the cumulative effect, duration of impact (long-term or short-term), and intensity of impact (negligible, minor, moderate, or major).
• Identifying whether effects would be beneficial or adverse.
• Identifying mitigation measures that may be employed to offset or minimize potential adverse impacts.

The impact analyses were based on professional judgment using information provided by project designs, NPS staff, relevant references and technical literature citations, and subject matter experts.

Impacts and Effects

Under Council of Environmental Quality (CEQ) regulations the terms “effects” and “impacts” are used synonymously (40 CFR 1508.8). Impacts or effects of an action can be beneficial or adverse. Impacts, or effects, also consider spatial and temporal components. For this assessment, “place” is defined as the Lewis and Clark NHP park units, but the meaning of “time” varies. When evaluating direct impacts from fire management actions and specific methods, “time” is defined as the period of time when the fire management activity is occurring.

Cumulative Impacts: The CEQ regulations to implement NEPA require an assessment of cumulative impacts. Under CEQ regulations a “cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” For the purposes of this environmental assessment, cumulative impacts include other ongoing or reasonably foreseeable future projects and plans in and around Lewis and Clark National Historical Park and the contribution of the action on cumulative effects to the resource.

Duration of Impacts: Effects can be characterized by the duration of the effect. Short-term effects include actions that temporarily affect, or have the potential to affect, a resource for 12 months or less, such as disturbance during restoration of areas that are later reclaimed. Long-term effects include actions that affect a resource for greater than 12 months, and may or may not be permanent.

Intensity of Impacts

For all adverse impacts, the intensity of the impact on a given impact topic is described as negligible, minor, moderate, or major. For each impact topic, a distinct set of impact thresholds is used to provide definition of what constitutes an impact of a given intensity. The impact thresholds are aligned to relevant standards based on regulations, scientific literature and research, or best professional judgment. The intensity of an impact on a given topic is determined by comparing the effect to the impact threshold definitions for that topic. Impact thresholds are used for adverse impacts only.

Regulations and Policies—The Organic Act of 1916, NPS Management Policies (NPS 2006b), and NPS Reference Manual 77: National Resource Management Guidelines (NPS 1991) direct NPS managers to provide for the protection of Park resources. These regulations and policies require the NPS to protect and preserve geologic resources and processes.

Impairments

According to the 1916 Organic Act, which established the National Park Service, impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment. An impact would be more likely to constitute impairment to the extent that it

- affected a resource or value whose conservation was necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- was key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- was identified in the park's general management plan or other relevant NPS planning documents as being of significance.

Impairment Analysis
In addition to determining the environmental consequences of the alternatives, NPS *Management Policies* (2006) requires the analysis of potential effects to determine if actions would impair park resources. The fundamental purpose of the national park system, established by the *Organic Act* and reaffirmed by the *General Authorities Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or minimize to the greatest degree practicable, adverse impacts on park and monument resources and values. However, the laws do give NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS management discretion to allow certain impacts within parks, that discretion is limited by statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for

the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. However, an impact would more likely constitute impairment to the extent that it affects a resource or value whose conservation is:

Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; identified as a goal in the park's *GMP* or other relevant NPS planning documents. Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. In this "Environmental Consequences" section, a determination on impairment is made in the conclusion statement of the appropriate impact topics for each alternative. The NPS does not analyze recreational values/visitor experience (unless impacts are resource based), land use, or park operations for impairment.

Impact Analysis
SOILS AND VEGETATION

Related Laws, Regulations, and Policies
The NPS *Organic Act* directs the park to conserve the scenery and the natural objects unimpaired for future generations. Soil resources will be protected by preventing or minimizing adverse potentially irreversible impacts on soils, in accordance with NPS *Management Policies*.
NPS-77 specified objectives for each management zone for soil resources management. These management objectives are defined as: (1) natural zone - preserve natural soils and the processes of soil genesis in a condition undisturbed by humans; (2) cultural zone - conserve soil resources to the extent possible consistent with maintenance of the historic and cultural scene and prevent soil erosion wherever possible; (3) park development zone - ensure that developments and their management are consistent with soil limitations and soil conservation practices; and, (4) special use zone - minimize soil loss and disturbance caused by special use activities, and ensure that soils retain their productivity and potential for reclamation.

NPS *Management Policies* defines the general principles for managing biological resources as maintaining all native plants and animals as part of the natural ecosystem. When NPS management actions cause native vegetation to be removed, then the NPS will seek to ensure that such removals will not cause unacceptable impacts to native resources, natural process, or other park resources.

Non-native species, also referred to as non-native or alien, are not a natural component of the ecosystem. They are managed, up to and including eradication, under the criteria specified in *Management Policies* and NPS-77.

Impact Indicators, Criteria, and Methodology

Negligible: Impacts have no measurable or perceptible changes in soil structure and occur in a relatively small area. Impacts have no measurable or perceptible changes in plant community size, integrity, or continuity.
Minor: Impacts are measurable or perceptible but localized in a relatively small area. The overall soil structure would not be affected. Impacts are measurable or perceptible and localized within a relatively small area. The overall viability of the plant community would not be affected and, if left alone, would recover.
Moderate: Impacts would be localized and small in size, but would cause a permanent change in the soil structure in that particular area. Impacts would cause a change in the plant community (e.g. abundance, distribution, quantity, or quality); however, the impact would remain localized.
Major: Impact to the soil structure would be substantial, highly noticeable, and permanent. Impacts to the plant community would be substantial, highly noticeable, and permanent.
Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Duration:
• **Short-Term—**Lasting only during the active work period or no longer than the first growing season thereafter.
• **Long-Term**—A permanent post-construction impact.

Soil Impacts
Soil impacts were quantitatively assessed using soil characteristics, literature reviews, and mitigation measures. Under all alternatives, mechanical treatment (mowing) and manual reduction activities would have no or negligible effects to soil resources.

Soils in pile burn areas may be impacted by the fire if they burn too hot or for a long duration. These burns could result in short-term damage to the soil layers. However, these areas would receive rehabilitation soon after burning by turning under the soils, and adding organic matter from adjacent areas. A maximum of 20 piles per acre could be burned based on an average of 20 piles per acre being constructed. Based on a 20 pile per acre estimate, approximately 0.01 acres of impacted area per acre piled will result. This is calculated using an average pile size of 6 feet by 6 feet (28 sq. ft.) times the average number of piles (20) equals 560 sq. ft. 560 square feet is approximately 0.01 acres. (Acre equals 43,560 sq. ft.) The 0.01 acre of impacted area is distributed across the piled acre; further reducing impacts.

Alternative 1 *No Action*

Impact Analysis: Direct Effects; The No Action Alternative does not entail any changes to the current Fire Management Plan; therefore its impacts would be limited to the 300 acres surrounding Fort Clatsop. Proposed activities of Alternative 1 that have potential to impact soils include building fire lines, and prescribed fire activities such as pile burning as well as mobile chippers, chainsaws, loppers and mowers utilized in mechanical fuels reduction projects . Fire line construction would result in soil disturbance and could lead to increased erosion, especially in areas of steep slopes.

Prescribed Fire - Broadcast Burn
There are two proposed broadcast burn projects under Alternative 1(Reed Canary Grass project 1 and Reed Canary Grass project 2) for a total of 15 acres. Direct effects on the soil from these projects would be the impacts of the burn (15 acres) and the construction of fire containment lines around the perimeter of the burn site. Soil impacts would be minimal due to the location of the burn project. Soil moistures in the burn project areas are high, therefore heat penetration from the burn would be minimal. Maximum containment line construction for the two projects (10 acres and 5 acres each) without natural or existing roads or trails would be 7,619 feet. Actual constructed fireline would be minimal, approximately 500 feet, as existing roads, dikes and waterways would serve as firebreaks. Maximum acreage of constructed fireline for the two projects would be approximately 0.02 acres based on a fireline 1.5 feet wide to mineral soil. Release of nutrients post-burn would be of benefit to areas of burns. Mitigation measures are utilized by fire managers to minimize impacts.

Prescribed Fire – Handpile Burning
Soils in pile burn areas may be impacted by the fire if the piles burn too hot or for a long duration. These burns could result in short-term damage to the soil layers. Piles average 6 feet by 6 feet in size, with an average of 20 piles per acre. The area of direct impact from pile burning would be 28 sq. ft. (per pile area) times 20 (number of piles per acre) divided by 43,560 sq. ft. (area of sq. ft. in an acre) which is approximately 0.01 impacted acres per acre treated. A maximum of 25 acres could be burned for this planning period (Boundary Protection Projects 2-5), making the area impacted by pile burning less than 0.3 acre of the total project area. The actual burned area would be dispersed throughout the planned acreage and mitigation measures are implemented to reduce the impacts further. Therefore, pile burning would result in short-term, negligible to minor impacts on soil resources. A list of projects is found in App E Table 1 page 196.

Wildland Fire Suppression
Fire line construction would result in soil disturbance and could lead to increased erosion, especially in areas of steep slopes. If heavy equipment were used in suppression actions there could be short-term erosion and if allowed off existing trails and roadways potential soil compaction. Wildfires in the park are a rare event, no known wildfires in the last 10 years of record keeping, therefore impacts from wildfire suppression would be minor to moderate, short-term in nature.

Mechanical/manual Fuels Reduction Projects
If mechanized equipment is used off of established trails and roadways there could be minor short-term areas of erosion.

Indirect Effects
There are no known indirect effects due to the minimal direct impacts on soil in this alternative.

Cumulative Impacts: In the past, soils of most of the acreage within Lewis and Clark NHP have received moderate to major, long-term impacts due to logging, diking, agricultural practices, development, and road construction. Current and reasonably foreseeable future activities would cause negligible, short term impacts or, more likely, benefit soil resources, due to management activities and mitigation measures designed to protect and preserve the natural resources within the park.

Conclusion: The No Action alternative would have minor to moderate negative short-term effects on soils. There are benefits to nitrification and soil development in areas of prescribed burns as fire releases nutrients back to the soil.

Impairment: There would be no impairment of soils under this alternative.

Mitigation Measures:
- Whenever consistent with safe, effective suppression techniques, the use of natural or human-made barriers would be used as extensively as possible;
- Fire lines would be located outside of highly erosive areas, steep slopes, and other sensitive areas;

- Heavy earth-moving equipment such as tractors, graders, bulldozers or other tracked vehicles would generally not be used for fire suppression. The superintendent can authorize the use of heavy earth-moving equipment in extreme circumstances in the face of loss of human life and/or property;
- Mechanical equipment, should it be used, would use multiple entry and exit points within a treated area to minimize concentrated soil compaction or soil disturbance impacts resulting from continued use of a single entrance and/or exit;
- When handline construction is required, construction standards would be issued requiring the handlines to be built to Minimum Impact Suppression Tactic (MIST) standards. No handlines exposing mineral soil would be allowed through cultural sites, and all handlines would be rehabilitated. Erosion control methods would be used on slopes exceeding 10% where handline construction takes place;
- All sites where improvements are made or obstructions removed would be rehabilitated to pre-fire conditions, to the extent practicable;
- A rehabilitation plan as required by NPS-18, with the use of a Burned Area Emergency Rehabilitation (BAER) Team, would be formulated and implemented in advance of demobilization from major fire events.
- Following fire suppression and prescribed fire activities, fire lines may be recontoured, water barred, and possibly seeded with native plant species.
- Pile burn areas would receive rehabilitation soon after burning by turning under the soils, and adding organic matter from adjacent areas.
- Use "wetlines" in areas of sparse light fuels to reduce the need for fireline construction.

Alternative 2 ***Agency Preferred Mechanical and Limited Prescribed Fire Option***

Impact Analysis: Direct Effects; The Mechanical and Limited Prescribed Fire alternative expands the current Fire Management Plan management processes to cover all NPS managed units of the park. Proposed activities of Alternative 2 that have potential to impact soils include building fire lines, and prescribed fire activities such as pile burning as well as mobile chippers, chainsaws, loppers and mowers utilized in mechanical fuels reduction projects. Fire line construction would result in soil disturbance and could lead to increased erosion, especially in areas of steep slopes.

Prescribed Fire - Broadcast Burn

There are six proposed broadcast burn projects (Reed Canary Grass Eradication Projects 1, 2 and 3 plus Prairie Restoration Projects 1, 2 and 3), see App E Figures 2-4 and App E Table 2, under Alternative 2 for impacting a total of 35 acres. Direct effects on the soil from these projects would be the impacts of the burn (35 acres) and the construction of fire containment lines around the perimeter of the burn site. Maximum containment line construction for the three Reed Canary Grass Eradication Projects (10 acres, 5 acres and 5 acres each) without natural or existing roads or trails would be 7,619 feet. Actual constructed fireline would be minimal, approximately 500 feet, as existing roads, dikes and waterways would serve as firebreaks. Prairie Restoration Projects 1, 2 and 3 would also utilize natural barriers for minimal control line building. Mitigation measures are utilized by fire managers to minimize impacts.

Prescribed Fire – Handpile Burning
Soils in pile burn areas may be impacted by the fire if the piles burn too hot or for a long duration. These burns could result in short-term damage to the soil layers. Piles average 6 feet by 6 feet in size, with an average of 20 piles per acre. The area of impact from pile burning would be 28 sq. ft. (per pile area) times 20 (number of piles per acre) divided by 43,560 sq. ft. (area of sq. ft. in an acre) which is approximately 0.01 impacted acres per acre treated. A maximum of 71 acres, (see App E Table 2 for projects and App E Fig. 2-4 for locations), could be burned for this planning period, making the area impacted by pile burning less than 0.8 acre total area. The actual burned area would be dispersed throughout the planned project acreage, and mitigation measures are implemented to reduce the impacts further. Therefore, pile burning would result in short-term, negligible to minor impacts on soil resources.

Yeon property (prairie restoration)
There are three proposed prairie research burns in this alternative covering 15 acres: (Prairie Research Burn Projects 1,2 and 3), see App E Table 2 and App E Figures 2-4. The soils on the Yeon property have been altered due to past management activities such as dune stabilization, which affected both the tilth and nutrient content of the soils. Plantings of dune grasses and Scotch broom created a deeper organic layer and added nitrogen to the soils. Native prairie species have evolved to thrive in low-nutrient soils, so this has had a detrimental effect on native plants. Prescribed burns, if applied, would have a negative, short-term effect on soils due to the immediate increase in available nutrients, but a positive, long-term effect by eliminating those species (such as Scotch broom) that would otherwise continually add more nitrogen to the soils.

Pile burning at Fort Clatsop and Yeon units
Pile burning may be utilized at the Yeon property (Projects include: Boundary Protection Projects A, B, C and D, Developed Landscape/Interior Forests Projects 1and 2) for a total activity area of 46 acres. Actual burned area would be approximately 0.5 acres dispersed throughout the activity zones. Due to the dispersal of the burned area and the small impact zones there would be minor short term adverse impacts on soils, but would be beneficial in the long term.

Prescribed fires of low to moderate severity would release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrients for vegetation in the park. In addition to increasing nitrification of the soils and increasing minerals and salt concentrations in the soil, the ash and charcoal residue resulting from incomplete combustion aids in soil buildup and soil enrichment by being added as organic matter to the soil profile. The added material works in combination with dead and dying root systems to make the soil more porous, better able to retain water, and less compact while increasing needed sites and surface areas for essential microorganisms, mycorrhizae, and roots (Wright and Bailey, 1980).

Wildland Fire Suppression
Fire line construction would result in soil disturbance and could lead to increased erosion, especially in areas of steep slopes. If heavy equipment were used in suppression actions there could be short-term erosion and if allowed off existing trails and roadways potential soil compaction. Wildfires in the park are a rare event, no known wildfires in the last 10 years of

record keeping; therefore impacts from wildfire suppression would be moderate, short-term in nature.

Control lines for prescribed fire would be limited to those projects that require the use of broadcast burning. The use of broadcast burning would be for projects designed to eradicate invasive species or enhance native prairie ecosystems. For the planning period the maximum area impacted would be within 6 proposed projects Canary Grass Eradication Projects1, 2 and 3 and Prairie Research Burns 1, 2 and 3, totaling 35 acres: surrounded by natural fuel breaks (streams, rock slides and sand etc), man-made existing fuel breaks (roads, old logging skid roads and trails) and newly constructed fire control lines where needed. (See App E Figures 2-4 and App E table 2. A standard fire line in the brush cut to mineral soil could average a foot and one half wide. Calculating approximately 1600 feet of line to encompass 5 acres, each project could have about .06 acres impacted by newly built fire control lines for a total of approximately 0.36acres, if there were no other control line possibilities. Again project lay-out will minimize the need to construct new control lines limiting the impacts.

Mechanical/manual Fuels Reduction Projects

If mechanized equipment is used off of established trails and roadways there could be minor short-term areas of erosion.

Indirect Effects
There are no known indirect effects due to the minimal direct impacts on soil in this alternative.

Cumulative Impacts: In the past, soils of most of the acreage within Lewis and Clark NHP have received moderate to major, long-term impacts due to logging, diking, agricultural practices, development, and road construction. Current and reasonably foreseeable future activities would cause negligible, short term impacts or, more likely, benefit soil resources, due to management activities and mitigation measures designed to protect and preserve the natural resources within the park.

Conclusion: Alternative 2 *Mechanical and Limited Prescribed Fire Option* would have minor to moderate negative short-term effects on soils. There are benefits to nitrification and soil development in areas of prescribed burns as fire releases nutrients back to the soil.

Impairment: There would be no impairment of soils under this alternative.

Mitigation Measures
Same as Alternative 1

Alternative 3 *Mechanical Treatment Only*

Impact Analysis: Direct Effects; The Mechanical Treatment Only alternative expands the current Fire Management Plan to cover all NPS managed units of the park. Proposed activities of Alternative 3 that have potential to impact soils include building fire lines, and impacts associated with mechanical treatments designed to reduce or manipulate fuels. Fire line

construction would be associated with emergency operations to control a wildfire and would result in soil disturbance and could lead to increased erosion, especially in areas of steep slopes. This alternative also involves other non-wildland fire management operations that are limited to mechanical fuels treatments only.

Proposed activities of Alternative 3 that have a potential to impact soils are: the use of ground based equipment needed to manipulate fuels into a state less likely to create fast spreading fires. The types of equipment used would be mobile chippers, chainsaws, loppers and mowers. Affects to soils in Alternative 3 would be limited to those actions expressly tied to the use of mechanical processes to reduce fuel loadings within the park. There are still effects from wildfire suppression activities common to all alternatives, but there are no effects from prescribed fire actions as prescribed fire is not allowed in this alternative.

This alternative proposes a total of 116 acres of fuels reduction work with negligible impacts to soils due to restrictions on ground disturbing machinery, such as bulldozers and skidders. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations.

Indirect Effects: Due to the minimal direct impacts there are no known indirect effects to soils in this alternative.

Cumulative Impacts: In the past, soils of most of the acreage within Lewis and Clark NHP have received moderate to major, long-term impacts due to logging, diking, agricultural practices, development, and road construction. Current and reasonably foreseeable future activities would cause negligible, short term impacts or, more likely, benefit soil resources, due to management activities and mitigation measures designed to protect and preserve the natural resources within the park.

Conclusion: Alternative 3 *Mechanical Treatment Only* would have minor to moderate negative short-term effects on soils.

Impairment: There would be no impairment of soils under this alternative.
Mitigation: Same as alternative 1

WATER RESOURCES (INCLUDING WETLANDS)

Related Laws, Regulations, and Policies
NPS policies require protection of water resources consistent with the *Clean Water Act*. Increased erosion following a fire event, planned or unplanned, may affect water quality within and outside of the historical park; therefore, it is considered a relevant impact topic. Water supply within the park, or the lack thereof, is also analyzed as an impact topic**.** Included in the analysis is potential flood run-off and the availability of water to suppress a fire event. Further guidance for the protection of water quality is included in *Management Policies* (4.6) which directs the NPS to work with appropriate government bodies to obtain the highest possible standards available under the *Clean Water Act* for the protection for park resources, and to take the necessary actions to maintain or restore the quality of surface and ground waters within the parks consistent with the *Clean Water Act* and all other applicable federal, state, and local laws and regulations.

Methodology
Water resource impacts were qualitatively assessed using presence/absence of surface water resources, literature reviews, and mitigation measures. General discussion of the impacts to water resources is followed by more project specific impacts discussion.

Thresholds for Intensity, Duration, and Type of Effect:

• **Negligible—**Very slight changes in surface water quality. Impacts barely detectable.
• **Minor—**Changes in surface water quality would be measurable, although the changes would likely be small and the effects would be localized. No mitigation measures would be necessary.
• **Moderate—**Changes in surface water quality would be measurable and potentially long-term but would be relatively local. Mitigation measures would be necessary and would be effective.
• **Major—**Changes in surface water quality would be measurable, long-term, and broad-scale. Mitigation measures would be necessary and their success would not be guaranteed.

Duration:
• **Short-Term—**Recovery in less than a year.
• **Long-Term—** Permanent post-construction impact.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Water Resources Impacts

Alternative 1 *No Action Alternative*

Fuel reduction activities (Boundary Protection Projects 1-5), App E, Figure 1and App E Table 1, would not occur in wetland areas and prescribed fire activities proposed in Alternative 1 would be limited to two invasive species (reed canary grass) eradication projects (Canary Grass Eradication Projects 1 and 2) (App E, Figure 1) and would not greatly increase the demand for fresh water. Canary Grass Eradication Project 1(10 acres) could occur in 2014 followed by Canary Grass Eradication Project 2 (5 acres) in 2015. (App E, Table 1) Water used in support of wildland and prescribed fires would result in negligible to minor impacts to local water supplies.

Mitigation measures would be in place for suppression actions to protect wetland areas in the case of wildfire or use on prescribed fire projects. The use of fire retardants or foams could potentially cause short and long-term impacts to water resources if misapplied or mishandled. Retardants contain ammonia and phosphate or sulfate ions, which can change the chemistry of surface water, thus making it lethal to fish and other aquatic organisms. Foams contain detergents that can interfere with the ability of fish gills to absorb oxygen. The degree of impact would depend on the volume of retardant/foam dropped into the surface water, the size of the body of water, and the volume of flow in the water.

Cumulative Impacts: Impacts to water resources from past, present, and reasonably foreseeable future activities including agricultural practices, logging, and development in and adjacent to the park are negligible to minor. Past agricultural practices, including grazing and diking, most likely altered natural surface water patterns and/or disturbed wetland areas through trampling and/or the construction of levees. Past, present, and future development adjacent to the park, has and will continue to increase the demand for fresh water, and has the potential to impact ground water resources by making aquifers becoming more susceptible to salt water infiltration. This would have negligible impacts on surface water resources in the park. Minor to moderate, long-term impacts would occur to ground water resources from which the park obtains fresh water.

Conclusion: This alternative would have negligible long-term negative effects on the water quality of Lewis and Clark National Historical Park.

Impairment: There would be no impairment of water quality at Lewis and Clark National Historical Park from this alternative.

Mitigation:

- Fire control strategies would be sensitive to wetland values, and firelines would not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Crews would implement MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources.
- Foams and retardants would not be used within 300 feet of surface waters, except in the event of a life threatening situation;
- Heavy earth-moving equipment would not be used in any “fragile environment;”

- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan.
- Oil and gas containment features will be utilized around water pumping stations to minimize contamination of surface water features.

Alternative 2- Agency Preferred: ***Mechanical and Limited Prescribed Fire Option***
Impact Analysis: Impacts to water resources from Alternative 2 would be the same as those described under Alternative 1, but would be expanded to include all park units. All projects with the exception of the 3 proposed Reed Canary Grass Eradication projects would not occur in wetland areas. See App E, Table 2 for list of projects and Figures 2-4 for locations.
Cumulative Impacts: Cumulative impacts would be the same as those described under Alternative 1.

Conclusion: Fire suppression activities such as foam use and retardant may have impacts on surface water. Water usage for suppression activities may stress local water supplies during the summer season. Manual fuel reduction projects would not impact water resources. Fuels reduction activities would not take place near surface water areas and prescribed fire activities utilized to eliminate invasive species would be limited to reed canary grass burning. Water usage to support prescribed fires would be planned to avoid water use issues. Water used in support of wildland and prescribed fires would result in negligible to minor impacts to local water supplies. The cumulative effects of past, present, and reasonably foreseeable future activities would have minor to moderate, long-term impacts to ground water resources. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from all of the alternatives and cumulative impacts to water resources would be negligible to minor and of short term duration.

Impairment: There would be no impairment of water quality at Lewis and Clark National Historical Park under this alternative.

Mitigation:
- Fire control strategies would be sensitive to wetland values, and firelines would not "tie" into wetland or bog margins except when relying on those areas to naturally retard the fire without constructed line;
- Crews would implement MIST fire suppression guidelines to minimize and/or eliminate adverse impacts to surface water resources.
- Foams and retardants would not be used within 300 feet of surface waters, except in the event of a life threatening situation;
- Heavy earth-moving equipment would not be used in any “fragile environment;”
- Riparian areas, which have been burned, may be seeded with native seed from native genotypes, as specified in a Burned Area Emergency Rehabilitation (BAER) plan.
- Oil and gas containment features will be utilized around water pumping stations to minimize contamination of surface water features.

Alternative 3 Mechanical Treatment Only

Impact Analysis: Impacts to water resources from Alternative 3 would be the same as those described under Alternative 1, but would be expanded to include all park units and would not include the use of prescribed fire. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for locations of proposed projects.

Projects would be located outside of riparian areas, with restrictions on large machinery. Total restrictions on the use of prescribed fire would eliminate any potential impacts associated with prescribed fire operations, specifically no use of foam, retardant or gas and oil near water pumping sites. These types of operations could still occur during a wildfire suppression operation, which historically has been a rare occurrence.

Cumulative Impacts: Cumulative impacts would be the same as those described under Alternative 1.

Conclusion: Fire suppression activities such as foam use and retardant may have impacts on surface water. Water usage for suppression activities may stress local water supplies during the summer season. Manual fuel reduction projects would not impact water resources. Prescribed fire activities would not take place. Water usage to support prescribed fires would not be needed. Water used in support of wildfires would result in negligible to minor impacts to local water supplies.
The cumulative effects of past, present, and reasonably foreseeable future activities would have minor to moderate, long-term impacts to ground water resources. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from all of the alternatives and cumulative impacts to water resources would be negligible to minor and of short term duration.

Impairment: There would be no impairment of water quality at Lewis and Clark National Historical Park under this alternative.

Mitigation: Same as alternatives 1 and 2

VEGETATION

Policy

National Park Service Policy 2006 delivers the standard for managing vegetation in parks. Chapter 4.4 *Biological Resource Management* specifically addresses management principles for: restoration of native plants as well as removal of exotic plant species. In the case of Lewis and Clark NHP enhancement of native plants and removal of exotic plant species is a recommended course of action.

Methodology

The Vascular Plant Inventory Report for Lewis and Clark NHP, completed in December 2010, was used as the primary reference for this analysis. Impacts were qualitatively assesses by acres impacted.

Thresholds for Intensity, Duration and Type of Effect:
• **Negligible –** Direct or indirect impacts would have perceptible but small changes in the size, integrity, or continuity of vegetation at the sites.
• **Minor –** Disturbance of vegetation would be measurable or perceptible but limited in size to less than one acre. The overall viability of plant communities would not be affected and would recover. The introduction of exotic plants would be limited to those species already established at the site.
• **Moderate –** Disturbance of 1 to 5 acres of vegetation would occur. Impacts would cause a change in the plant communities (e.g. abundance, distribution, quantity, or quality), but the impacts would remain localized. May result in the introduction of non-aggressive exotic plant species not previously established in the park.
• **Major –** Disturbance of more than 5 acres of vegetation or any disturbance to federally listed plant species would occur. This alternative would also result in the introduction of aggressive exotic plant species not already established in the park.

Duration:
• **Short-term –** The physical impact from the proposed actions would require less than one growing season for the full recovery of plant communities.
• **Long-term –** The physical impact from the proposed actions would require more than one growing season for the full recovery of plant communities

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Alternative 1- No Action

Impact Analysis: Under this alternative, small diameter trees would continue to be cut, piled, and burned in the 300 acres around the Fort and facilities as part of the ongoing fuels reduction program. Under Alternative 1, *No Action*, the total acres potentially impacted would be 45 acres. The range of actions would be 15 acres of direct impacts associated with 2 broadcast burning projects (Canary Grass Eradication Projects 1 and 2) and 30 acres of vegetative thinning, fuel cutting and piling (Boundary Protection Projects 1-5) with 0.3 acres of direct burning impacts (Boundary Protection Projects 2-5) App E, Figure 1 and App E Table 1. All projects would have mitigation measures implemented during operations. Boundary Protection projects are all projected to be 5 acres in size, with one project implemented per year for 5 years.

This reduces stress from competitive exclusion and has a positive effect on plant growth. Digging fire lines for wildfire suppression would have a moderate short term effect on vegetation, as the coastal rainforest habitat is quick to recover from disturbance.

Cumulative Impacts: Cumulative impacts to vegetation within NPS administered lands would be positive as the use of fire to reduce invasive species and enhance habitat for native species could be realized. Fire management programs promote the use of fire to obtain resource management objectives and could be used to enhance management goals as expressed in the Otter Point Restoration Plan. Otter Point Restoration Plan proposes 15 acres of canary grass eradication. Prescribed fire for invasive species eradication includes the Otter Point canary grass eradication project. For areas outside of the park continued modifications to native vegetation habitat will allow continued habitation by non-native vegetative species.

Conclusion: This alternative would result in moderate short-term impacts by altering existing vegetation communities. In the long term, this would positively benefit the overall health and integrity of forested habitats.

Impairment: There would be no impairment of vegetation from Alternative 1.

Mitigation:

- Park staff would survey for noxious weeds in treatment units prior to ignition of prescribed fires and provide mitigation measures deemed necessary by exotic vegetation management specialists.
- Removal of vegetation will only occur to the level necessary to mitigate fire behavior threats and/or allow fire control.
- Park staff will identify preferred species for removal during project planning and while working as resource advisors on wildfires.
- Cleaning of tools, boots, and equipment would mitigate against possible new weed infestations.

Alternative 2- Agency Preferred: *Mechanical and Limited Prescribed Fire Option*
Impact Analysis: Under Alternative 2, treatments would be expanded to include all other park . Under Alternative 2 there would be 136 acres of impacted sites, of which 35 acres would be directly impacted by broadcast burning. 101 acres of vegetative thinning, fuel cutting and piling

of which pile burning would occur over 71 acres, with 1.4 acres of direct pile burning impacts. See App E, Table 2 for list of projects and Figures 2-4 for locations. Fire breaks would be created by thinning out shore pines and thick stands of western hemlock, and prescribed fire may be used to help combat scotch broom and other invasive species.

Sensitive habitat and species such as remnant prairie and the early blue violet do exist in the Yeon unit. These areas are mapped in GIS and would be carefully protected and avoided during all management activities. In other units, vegetation would be altered if it became necessary to build fire lines to combat wildfires. Due to mitigation, the impact on vegetation would be minor to moderate short term, negligible to minor long term.

Cumulative Impacts: Cumulative impacts to vegetation within NPS administered lands would be positive as the use of fire to reduce invasive species and enhance habitat for native species could be realized. Fire management programs promote the use of fire to obtain resource management objectives and could be used to enhance management goals as expressed in the Otter Point Restoration Plan. Otter Point proposes 15 acres of canary grass eradication, of which the use of prescribed fire would be allowed in this fire management plan. For areas outside of the park continued modifications to native vegetation habitat will allow continued habitation by non-native vegetative species.

Conclusion: Alternative 2 will have major long-term positive effects on Yeon property sites as the removal of scotch broom and other non-native species would assist native vegetation recovery and long-term positive effects would be associated with Boundary Protection Projects as these can be developed to promote native vegetation as a secondary benefit of the project. I**mpairment:** There will be no impairment of vegetation from Alternative 2.

Mitigation: Same as alternative 1

Alternative 3 Mechanical Treatment Only

Impact Analysis: Under Alternative 3, mechanical treatments only would be utilized to manage fuels in the park. Alternative 3 contains 116 acres of impacted sites. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations. The projects include vegetative thinning, fuel cutting, chipping, mowing or scattering of the fuel bed. In the Yeon unit for example: fire breaks would be created by thinning out shore pines and mechanical methods may be used to help combat scotch broom and other invasive species.

Sensitive habitat and species such as remnant prairie and the early blue violet do exist in the Yeon unit. These areas are mapped in GIS and would be carefully protected and avoided during all management activities. In other units, thinning in thick stands of hemlock, Douglas fir and spruce will occur providing fuel breaks in selected areas and if it became necessary building fire lines to combat wildfires. Due to mitigation and the rarity of wildfires, the impact on vegetation would be minor to moderate short term, negligible to minor long term.

Cumulative Impacts: Cumulative impacts to vegetation within NPS administered lands would still be positive as the use of mechanical treatments to reduce invasive species and enhance

habitat for native species could be realized, even though the application of fire as a step towards eradication could be more effective. For areas outside of the park continued modifications to native vegetation habitat will allow continued habitation by non-native vegetative species.

Conclusion: Alternative 3 will have major long-term positive effects on Yeon property sites as the removal of scotch broom and other non-native species would assist native vegetation recovery.

I**mpairment:** There will be no impairment of vegetation from Alternative 2.

Mitigation: Same as Alternative 1 and 2

WILDLIFE

Related Laws, Regulations, and Policies
The NPS *Organic Act*, which directs parks to conserve wildlife unimpaired for future generations, is interpreted by the NPS to mean native animal life should be protected and perpetuated as part of the historical park's natural ecosystem. Natural processes are relied on to control populations of native species to the greatest extent possible. The restoration of native species is a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity and ecological integrity of plants and animals. Further direction is found in NPS Policies 2006 section 4.4 *Biological Resource Management.*

Impact Indicators, Criteria, and Methodology
On-site visits, on-going research, and knowledge and technical expertise by park staff were used to estimate the effects of the proposed actions in the various alternatives. Wildlife Impacts were qualitatively assessed using presence/absence determinations and mitigation measures.

Thresholds for Intensity, Duration, and Type of Impact:
• **Negligible—**Wildlife would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.
• **Minor—**Disturbance of native terrestrial and/or aquatic wildlife habitat would be limited to one acre or less for terrestrial communities and to highly localized areas in rivers and streams.
• **Moderate—**Disturbance of regionally typical native terrestrial and/or aquatic wildlife habitat would occur. The area of disturbance would be from over one to five acres of terrestrial habitat and localized areas in rivers and streams.
• **Major—**Disturbance of more than five acres of regionally typical terrestrial wildlife habitat. Disturbance of major areas of aquatic habitat.

Duration:
• **Short-Term—**Complete disturbance recovery in less than five years.
• **Long-Term**—Disturbance recovery requiring more than five years to return to pre-disturbance levels.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Alternative 1 No Action

Continue with the current program of wildland fire limited to the 300 acres analyzed in the 2004 Fire Management Plan analysis.

Proposed actions that could directly impact wildlife include: building fire control lines, fire retardant use associated with suppression actions, hazard fuel reduction activities, including the use of prescribed fire. The probability of a wildfire impacting the park is quite low as there have not been any reported wildfires in the last 10 years.

Habitat for native species could improve with the restoration of needed habitat conditions. The use of mechanical/manual fuel reduction along with prescribed fire would help restore and enhance the variety of native plants with their associated wildlife habitats. Nutrients, in the form of ash, released to plants through the burning process provide valuable nutrition to herbivores. Snags that are deemed hazardous in project areas may be felled for safety reasons. Fuel reduction projects would include thinning thickets of Douglas-fir and hemlock and converting to Sitka spruce where appropriate. Thinning would open up stands allowing more diverse native vegetation which serves as browse for herbivores.

All fire management activities could result in the temporary displacement of wildlife or even individual mortality of wildlife species. However the loss of individual species would not jeopardize the viability of populations inside or outside of the park.

This alternative proposes 45 acres of activity during this planning cycle. Of the 45 acres 2 projects (Reed Canary Grass Eradication Project 1 and 2), App E Figure 1 and App E table 1, totaling 15 acres would manipulate non-native vegetation (reed canary grass) to promote native vegetation, which is more palatable and better habitat for herbivores. The other 30 acres is impacted by five projects (Boundary Protection Projects 1,2,3,4 and 5), App E, Figure 1and Table 1, of five acres each. Timing for these projects would be 1 project per year if funding allows. These projects are fuels reduction projects which will open up dense stands of timber for more diverse native vegetation on the ground.

Moderate impacts to wildlife are anticipated in the short-term, but positive impacts in the long-term for native species based on improved representation of native vegetation over time.

Cumulative Impacts: Fire management activities associated with this alternative would create areas of enhanced habitat for native wildlife. The park could become an important refuge for native species as manipulation of surrounding habitat continues. Wildlife within the park will be impacted in the short-term, but will benefit in the long-term.

Conclusion: The *No Action* alternative will create opportunities for managers to utilize wildland fire – prescribed fire and mechanical fuel treatments to reduce hazard fuels and at the same time foster native wildlife through improved habitat. This alternative creates moderate disturbance to wildlife in the short-term.

Impairment: Based on professional judgment the activities associated with Alternative 1 will not cause impairment to park wildlife. The activities as proposed are not spatially large, occur over an extended time period and are all completed with a set of mitigation measures in place.

Mitigation

- Known raptor nest trees will be identified and protected during any mechanical treatment or prescribed burning.
- Aircraft should use flight paths that avoid raptor nests, ie one-half mile from active nests and 1,300 feet above the canopy.
- Waterfowl nesting areas will be identified and protected as part of project planning and implementation.
- Snags will be left when determined to be not a safety hazard and occasional patches of untreated trees will be left for wildlife habitat needs

Alternative 2 Agency Preferred: ***Mechanical and Limited Prescribed Fire Option***

Continue with the current wildland fire program but extend all fire management options to the entire park, except for Use of Wildland Fire – wildfire, for resource benefits which is not allowed in the park.

Proposed actions that could directly impact wildlife include: building fire control lines, fire retardant use associated with suppression actions, hazard fuel reduction activities, including the use of prescribed fire. The probability of a wildfire impacting the park is quite low as there have not been any reported wildfires in the last 10 years.

Habitat for native species could improve with the restoration of needed habitat conditions. The use of mechanical/manual fuel reduction along with prescribed fire would help restore and enhance the variety of native plants with their associated wildlife habitats. Nutrients, in the form of ash, released to plants through the burning process provide valuable nutrition to herbivores. Snags that are deemed hazardous in project areas may be felled for safety reasons. Fuel reduction projects would include thinning shore pine, thinning thickets of Douglas-fir and hemlock and converting to Sitka spruce where appropriate. Thinning to break up continuous aerial fuels would open up stands allowing more diverse native vegetation which serves as browse for herbivores.

All fire management activities could result in the temporary displacement of wildlife or even individual mortality of wildlife species. However the loss of individual species would not jeopardize the viability of populations inside or outside of the park.

This alternative proposes 161 acres of activity during this planning cycle. Of the 161 acres 6 projects totaling 35 acres would manipulate non-native vegetation (reed canary grass) and prairie restoration to promote native vegetation, which is more palatable and better habitat for herbivores. The remaining 126 acres is divided into 20 projects of five to 15 acres each. These projects are fuels reduction projects which will reduce the threat of running crown fires, create defensible space around buildings and as an additional benefit, open up dense stands of timber for more diverse native vegetation on the ground. The projects are a mix of handpiling slash,

mowing of vegetation and loping and scattering slash. See App E Table 2 for a list of projects and Figures 2-4 for locations.

Moderate impacts to wildlife are anticipated in the short-term, but positive impacts in the long-term for native species based on improved representation of native vegetation over time.

Cumulative Impacts: Fire management activities associated with this alternative would create areas of enhanced habitat for native wildlife. The park could become an important refuge for native species as manipulation of surrounding habitat continues. Wildlife within the park will be impacted in the short-term, but will benefit in the long-term.

Conclusion: Alternative 2 *Mechanical and Limited Prescribed Fire Option* will create opportunities for managers to utilize wildland fire – prescribed fire and mechanical fuel treatments to reduce hazard fuels and at the same time foster native wildlife through improved habitat. This alternative creates moderate disturbance to wildlife in the short-term and enhanced habitat in the long-term.

Impairment: Based on professional judgment the activities associated with Alternative 2 will not cause impairment to park wildlife. The activities as proposed are not spatially large, occur over an extended time period and are all completed with a set of mitigation measures in place.

Mitigation: Same as alternative 1

Alternative 3 *Mechanical Treatment Only*

Alternative 3 does not allow prescribed fire to be used as a tool for reducing fuels or other resource management projects. Wildfire suppression is still possible, but wildfire events in the park are rare, no wildfires in the last 10 years have been recorded.

Proposed actions that could directly impact wildlife include: building fire control lines, fire retardant use associated with suppression actions, hazard fuel reduction activities without the use of prescribed fire. The probability of a wildfire impacting the park is quite low as there have not been any reported wildfires in the last 10 years.

Habitat for native species could improve with the restoration of needed habitat conditions. The use of mechanical/manual fuel reduction could help restore and enhance the variety of native plants with their associated wildlife habitats. Snags that are deemed hazardous in project areas may be felled for safety reasons. Fuel reduction projects would include thinning shore pine, thinning thickets of Douglas-fir and hemlock and converting to Sitka spruce where appropriate. Thinning to break up continuous aerial fuels would open up stands allowing more diverse native vegetation which serves as browse for herbivores.

All fire management activities could result in the temporary displacement of wildlife or even individual mortality of wildlife species. However the loss of individual species would not jeopardize the viability of populations inside or outside of the park.

This alternative proposes 116 acres of activity during this planning cycle. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations. The projects are fuels reduction projects which will reduce the threat of running crown fires and as an additional benefit; open up dense stands of timber for more diverse native vegetation on the ground. The projects are a mix of handpiling slash, mowing of vegetation and loping and scattering slash.

Moderate impacts to wildlife are anticipated in the short-term, but positive impacts in the long-term for native species based on improved representation of native vegetation over time.

Cumulative Impacts: Fire management activities associated with this alternative would create areas of enhanced habitat for native wildlife. The park could become an important refuge for native species as manipulation of surrounding habitat continues. Wildlife within the park will be impacted in the short-term, but will benefit in the long-term.

Conclusion: Alternative 3 *Mechanical Treatment Only* will create opportunities for managers to utilize mechanical fuel treatments to reduce hazard fuels and at the same time foster native wildlife through improved habitat. This alternative creates moderate disturbance to wildlife in the short-term and enhanced habitat in the long-term.

Impairment: Based on professional judgment the activities associated with Alternative 2 will not cause impairment to park wildlife. The activities as proposed are not spatially large, occur over an extended time period and are all completed with a set of mitigation measures in place.

Mitigation: Same as alternative 1

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Related Laws, Regulations, and Policies

Section 7 of the *Endangered Species Act*, as amended, mandates all federal agencies to determine how to use their existing authorities to further the purposes of the Act to aid in recovering listed species, and to address existing and potential conservation issues. Section 7(a)(2) states that each federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

Management Policies directs the parks to survey for, protect, and strive to recover all species native to National Park System units that are listed under the *Endangered Species Act* (4.4.2.3). It sets the direction to meet the obligations of the Act. *Management Policies* also directs the NPS to inventory, monitor, and manage state and locally listed species, and other native species that are of special management concern to the parks, to maintain their natural distribution and abundance.

Impact Indicators, Criteria, and Methodology

The *Endangered Species Act* defines the terminology used to assess impacts to listed species as follows:

No effect: The appropriate conclusion when the action agency determines that its proposed action would not affect a listed species or designated critical habitat.

Is not likely to adversely affect: The appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Based on the best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Is likely to adversely affect: The appropriate finding if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial. In the effect the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, an “is likely to adversely affect” determination should be made.

Is likely to jeopardize proposed species/adversely modify proposed critical habitat – (Impairment): The appropriate conclusion when the action agency or the U.S. Fish and Wildlife

Service identify situations in which the proposed action is likely to jeopardize the continued existence of a proposed species or adversely modify the proposed critical habitat.

Methodology

Available research on the Columbia River Estuary and information from Oregon Dept. of Fish and Wildlife and the US Fish and Wildlife Service was used to estimate the effects of the proposed actions on threatened and endangered species. No impact to threatened or endangered species is anticipated from implementation activities.

Thresholds for Intensity, Duration, and Type of Impact:

• **Negligible—**Threatened and Endangered species would not be affected or the effects would be at or below the level of detection, would be short-term, and the changes would be so slight that they would not be of any measurable or perceptible consequence to the wildlife species' population.
• **Minor—**Disturbance of native terrestrial and/or aquatic habitat for threatened and endangered species would be limited to one acre or less for terrestrial communities and to highly localized areas along rivers, lakes, and streams.
• **Moderate—**Disturbance of regionally typical native terrestrial and/or aquatic habitat for threatened and endangered species would occur. The area of disturbance would be from over one to five acres of terrestrial habitat and to localized areas along rivers, lakes, and streams.
• **Major—**Disturbance of more than five acres of regionally typical terrestrial habitat for threatened and endangered species. Disturbance of measurable portions of lakes or waterways.

Duration:
• **Short-Term—**Complete disturbance recovery in less than five years.
• **Long-Term**—Disturbance recovery requiring more than five years to return to pre-disturbance levels.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

The only federally threatened species that might be directly impacted by fire management activities being proposed in this planning cycle are the land-based species: Silver Spot Butterfly and the Snowy Plover. Neither of these species is currently present in the park. The last documented sighting of the Oregon Silverspot butterfly was in 1998 near Camp Rilea, previously the population stronghold in the county (Vanbuskirk 1998). Snowy plovers historically nested in the Sunset Beach dunes adjacent to the Yeon site , but have not been documented in the area since 1983. Oregon State Parks is currently engaged in snowy plover habitat restoration efforts at Fort Stevens State Park, to the north. The extent of impacts of proposed activities on water borne

species is negligible due to the minimal size of projects, lack of appreciable impacts to waterways and projects being dispersed over a 5 year planning period. Mitigation measures near waterways will effectively eliminate direct impacts to surface water systems. The probability of a wildfire in the park is minimal, based on historical occurrences; therefore there will not be opportunities for any misapplication of retardant impacting surface water or emergency use of bulldozers to construct fire control lines which may create siltation problems. The following water borne federally threatened/endangered species will not be impacted by any proposed fire management activities: Lower Columbia chum salmon, Lower Columbia, Willamette and Snake River Chinook salmon, Upper Columbia Chinook salmon and Pacific eulachon.

Alternative 1 *No Action Alternative*

Direct Impacts: Under the *No Action* alternative, there are no new activities being proposed that has the potential to change the current status of listed species known to inhabit or frequent the areas in and adjacent to the 300 acres initially analyzed in the 2004 fire management planning process. Proposed actions under this alternative with potential to impact threatened and endangered species include: construction of firelines, fire retardant associated with suppression activities, hazard fuel reduction projects and prescribed fire.

The following types of projects are proposed for this planning period: 8 projects impacting 45 acres: 2 projects (Reed Canary Grass Eradication Project 1 and 2) are broadcast burns for habitat enhancement (15 acres) and 6 fuels reduction projects (Boundary Protection Projects 1-5 and Fuels Break/access point Project 1), pile and burning piles (25 acres) and 1 project (Boundary Protection Project 5) of handpiling w/o burning. (App E, Figure 1 and App E Table 1.

All proposed projects would be of short duration, timed so as not to interfere with breeding and nesting seasons and designed to preserve identified species, sensitive habitats and resources. By following mitigation measures impacts to listed species will be negligible.

The threat of wildfire is minimal, based on historical occurrence; therefore impacts associated with wildfire suppression are also negligible concerning a threat to T&E species.

Hazard fuel reduction projects have a periphery benefit of moving the park's vegetation to a more natural state, not the commercial forest model existing in areas surrounding the park. The change will provide a refuge for species dependent upon the Sitka spruce ecosystem and native prairie system envisioned for the park in the long-term.

Cumulative Impacts: Areas outside of the park are being developed for human commercial and living uses. The forests surrounding the park are vigorous commercial forests managed to provide wood fiber, not necessarily promote T&E species habitat. The park, by policy, will manage native biological resources for long-term viability, which prioritizes T&E species protection and habitat enhancement whenever possible.

Conclusion: The opportunity to utilize hazard fuel reduction projects to mollify any wildfire behavior to a level providing acceptable initial response firefighting outcomes and at the same time assist the park in creating a more natural ecosystem is of benefit to T&E species.

Impairment: Alternative 1 does not impair the park in providing long-term refugia for T&E species.

Mitigation:

- If threatened, endangered, or sensitive plant species are found in a treatment unit, a buffer surrounding the plants would be imposed that prohibits physical damage to the identified population;
- If threatened, endangered, or sensitive wildlife are found in or adjacent to a treatment area, in park biologists would be consulted with respect to designating buffer zones and/or scheduling of the project so as to minimize impacts to the wildland from noise, smoke, or change in habitat structure;

Alternative 2 ***Agency Preferred Mechanical and Limited Prescribed Fire Option***

Direct Impacts: Under the *Mechanical and Limited Prescribed Fire Option* alternative, there are no new types of activities being proposed from the fire management plan assessment of 2004. The difference in this alternative is that the actions approved in 2004 for 300 acres in the park are now extended to all NPS administered lands in the park. None of the proposed activities have the potential to change the current status of listed species known to inhabit or frequent the areas in and adjacent to NPS administered lands. Proposed actions under this alternative with potential to impact threatened and endangered species include: construction of firelines, fire retardant associated with suppression activities, hazard fuel reduction projects and prescribed fire.

This alternative proposes 161 acres of activity during this planning cycle. Of the 161 acres 6 projects totaling 35 acres would manipulate non-native vegetation (reed canary grass) and prairie restoration to promote native vegetation, which is more palatable and better habitat for herbivores. The remaining 126 acres is divided into 20 projects of five to 15 acres each. These projects are fuels reduction projects which will reduce the threat of running crown fires, create defensible space around buildings and as an additional benefit, open up dense stands of timber for more diverse native vegetation on the ground. The projects are a mix of handpiling slash, mowing of vegetation and loping and scattering slash. See App E Table 2 for a list of projects and Figures 2-4 for locations. Handpiling vegetative material occurs across 101 acres with 71 acres of handpiles proposed for burning. Again note that there is an average of 20 piles per acre with an actual burned area of 0.01 acres for a total burn impact area of 0.71 acres distributed across the 101 acres.

All proposed projects would be of short duration, timed so as not to interfere with breeding and nesting seasons and designed to preserve identified species, sensitive habitats and resources. By following mitigation measures impacts to listed species will be negligible.

The threat of wildfire is minimal, based on historical occurrence (zero occurrences over the last 10 years); therefore impacts associated with wildfire suppression are also negligible concerning a threat to threatened species.

Hazard fuel reduction projects have a periphery benefit of moving the park's vegetation to a more natural state, not the commercial forest model existing in areas surrounding the park. The change will provide a refuge for species dependent upon the Sitka spruce ecosystem and native prairie system envisioned for the park in the long-term.

Cumulative Impacts: Areas outside of the park are being developed for human commercial and living uses. The forests surrounding the park are vigorous commercial forests managed to provide wood fiber, not necessarily promote T&E species habitat. The park, by policy, will manage native biological resources for long-term viability, which prioritizes T&E species protection and habitat enhancement whenever possible. The proposed projects have long-term benefits for native habitats and reduce the fire behavior to an acceptable level.

Conclusion: The opportunity to utilize hazard fuel reduction projects to mollify any wildfire behavior to a level providing acceptable initial response firefighting outcomes and at the same time assist the park in creating a more natural ecosystem is of benefit to T&E species.

Impairment: Alternative 2 does not impair the park in providing long-term refugia for T&E species.

Mitigation: Same as alternative 1

Snags and large diameter trees will be preserved where safety is not an issue.

Alternative 3 *Mechanical Treatments Only*

Direct Impacts: Under the *Mechanical Treatments Only* alternative, the use of wildland fire is restricted in the park. This means that prescribed fire and use of wildland fire – wildfire for resource benefits is not allowed. None of the proposed activities have the potential to change the current status of listed species known to inhabit or frequent the areas in and adjacent to NPS administered lands. Proposed actions under this alternative with potential to impact threatened and endangered species include: construction of firelines, fire retardant associated with suppression activities, hazard fuel reduction projects.

The following types of projects are proposed for this planning period: 19 projects impacting 116 acres: broken down proposed projects are fuels reduction projects designed to modify wildfire behavior to a level where initial response firefighters are successful in stopping the spread of the fire 95% of the time. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations.

All proposed projects would be of short duration, timed so as not to interfere with breeding and nesting seasons and designed to preserve identified species, sensitive habitats and resources. By following mitigation measures impacts to listed species will be negligible.

The threat of wildfire is minimal, based on historical occurrence (zero occurrences over the last 10 years); therefore impacts associated with wildfire suppression are negligible concerning a threat to threatened species.

Hazard fuel reduction projects have a periphery benefit of moving the park's vegetation to a more natural state, not the commercial forest model existing in areas surrounding the park. The change will provide a refuge for species dependent upon the Sitka spruce ecosystem and native prairie system envisioned for the park in the long-term.

Cumulative Impacts: Areas outside of the park are being developed for human commercial and living uses. The forests surrounding the park are vigorous commercial forests managed to provide wood fiber, not necessarily promote T&E species habitat. The park, by policy, will manage native biological resources for long-term viability, which prioritizes T&E species protection and habitat enhancement whenever possible. The proposed projects have long-term benefits for native habitats and reduce the fire behavior to an acceptable level.

Conclusion: The opportunity to utilize hazard fuel reduction projects to mollify any wildfire behavior to a level providing acceptable initial response firefighting outcomes and at the same time assist the park in creating a more natural ecosystem is of benefit to T&E species.

Impairment: Alternative 3 does not impair the park in providing long-term refugia for T&E species.

Mitigation: Same as alternative 1

SOUNDSCAPE

Management Policies, section 4.9 directs the parks to preserve, to the greatest extent possible, the natural soundscapes of parks. Where possible the NPS is directed to restore to the natural condition park soundscapes that have become degraded by noise. Noise briefly defined as unwanted sounds. The NPS will also protect natural soundscapes from unnatural impacts.

Noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and enjoyment of natural environments. For wildlife, noise may disrupt activities such as hunting, breeding, and nesting. This is of particular concern with sensitive, threatened and endangered species.
Frequencies, magnitudes, and durations of acceptable noise will vary throughout the park, generally greater in developed areas. Park managers will take action to minimize noise.
Noise impacts were qualitatively assessed using proximity of sensitive receptor sites and presence/absence of resources with potential impacts.

Noise impacts were qualitatively assessed using proximity of sensitive receptor sites and presence/absence of resources with potential impacts. The actions that impact the soundscape are directly associated with the number of proposed acres work will be accomplished for each alternative, therefore the measure of soundscape impacts will be the number of acres of projects proposed for each alternative.

Alternative 1 *No Action* Alternative
Activities proposed in Alternative 1 that have potential to impact the soundscape include vehicular traffic, engines, portable pumps, chainsaws, lawn mowers, and aircraft. All of these management activities can affect the soundscape. An acceptable approach to analyzing the potential for impacts between alternatives is to compare the number of project activity acres being proposed by alternative. Project Acres planned in the NO Action Alternative are summarized in Table 15. It is important to note that Table 15 displays the planned entries into a site. For example a Boundary Protection Project would consist of two entry cycles: 1 piling of vegetative material and 2 burning of constructed handpiles. Each of these entries would have an associated impact on the local soundscape. For a list of projects see App E Table 1 and App E Figure 1.

Table 15 Planned Acres of Projects for Alternative 1 No Action Alternative

Alternative 1 – Soundscape		**Planned Acres**	**Planned Acres**
Planned acres per year*		**Grass Fuel Type** **Broadcast Burning**	**Timber Fuel Type** **Handpile/Burning**
2011	Mechanical/Manual	0	5
	Prescribed Fire	0	0
2012	Mechanical/Manual	0	5

	Prescribed Fire	0	5
2013	Mechanical/Manual	0	10
	Prescribed Fire	0	10
2014	Mechanical/Manual	0	5
	Prescribed Fire	10	5
2015	Mechanical/Manual	0	5
	Prescribed Fire	5	5
*Funding and fire activity levels may dictate shifting projects to different years slightly altering the total yearly acres listed.			

Noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and enjoyment of natural environments. For wildlife, noise may disrupt activities such as hunting, breeding, and nesting. This is of particular concern with sensitive, threatened and endangered species.

To minimize noise impacts, projects that may generate noise would not be scheduled on holidays and may be limited in duration near areas of high visitor use such as popular trails or in areas of known habitat for T&E species. Sensitive receptor sites would have adequate buffer zones in which project work would be limited during designated times. Aircraft use for fire management would be limited to wildland fire suppression fires that require aircraft support to control. This would be a very rare event.

Even with the mitigation measures, there could be minor to moderate, short-term impacts to the natural soundscape from the implementation of this alternative.

Cumulative Impacts: Noise impacts from past, present, and reasonably foreseeable future activities including agricultural practices, logging, development, hunting practices, and fire management in and adjacent to the park are negligible to minor and short term. There are no proposed or designated wilderness areas in or adjacent to the park and there are frequent aircraft over flights. Motorized watercraft on the Columbia River and mechanized equipment also add to ambient noise within the park. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts from noise would be negligible to minor and short term.

Conclusion: The *No Action* alternative will have minor to moderate impacts to the natural soundscape. Scheduling project implementation to periods of lowest visitor use and utilizing buffer zones around high use areas near Fort Clatsop will help minimize the impacts. The impacts will be of short-term, basically the operational period for crews engaged in the activity.

In areas where park units are presently impacted by noise outside the park (roadways, shipping channels and recreational boating areas), proposed projects are even less noise obtrusive.

Impairment: This alternative will not impair the natural soundscape for the park.
Mitigation:

- Use of loud, mechanized equipment in or adjacent to high density visitor use areas will limited to times of low visitation (i.e. early mornings, weekdays);
- Fire management activities resulting in loud noise (excluding fire suppression) would not be conducted on holidays;

Alternative 2 – Agency Preferred: Mechanical and Limited Prescribed Fire Option (Mechanical treatment, Prescribed fire, Herbicide as needed) No Action alternative expanded to all areas.
Activities proposed in Alternative 2 that have potential to impact resources include vehicular traffic, engines, portable pumps, chainsaws, lawn mowers, and aircraft. Acres planned with work proposed are summarized in Table 16. For a list of individual proposed projects see App E Table 2 and App E Figures 2-4 for locations.

Table 16 Planned Acres of Projects for Alternative 2

Alternative 2 – Soundscape		**Planned Acres**	**Planned Acres**	**Planned Acres**
Planned acres per year*		**Grass Fuel Type** **Broadcast Burning and Mowing**	**Timber Fuel Type** **Handpile/Loping and Scattering**	**Timber Fuel Type** **Handpile/Burning**
2011	Mechanical/Manual	7	5	
	Prescribed Fire	0	0	15
2012	Mechanical/Manual	5	5	
	Prescribed Fire	5	0	15
2013	Mechanical/Manual	5	9	
	Prescribed Fire	5	0	20
2014	Mechanical/Manual	5	0	
	Prescribed Fire	15	0	10
2015	Mechanical/Manual	5	10	
	Prescribed Fire	10	0	11
*Funding and fire activity levels may dictate shifting projects to different years				

slightly altering the total yearly acres listed.	

Noise has the potential to impact both humans and wildlife. For humans, noise can affect recreational experiences and enjoyment of natural environments. For wildlife, noise may disrupt activities such as hunting, breeding, and nesting. This is of particular concern with sensitive, threatened and endangered species.

To minimize noise impacts, projects that may generate noise would not be scheduled on holidays and may be limited in duration near areas of high visitor use such as popular trails. Sensitive receptor sites would have adequate buffer zones in which project work would be limited during designated times. Aircraft use for fire management would be limited to wildland fire suppression fires that require aircraft support to control. This would be a very rare event.

Even with the mitigation measures, there could be minor to moderate, short-term impacts to the natural soundscape from the implementation of this alternative.

Cumulative Impacts
Noise impacts from past, present, and reasonably foreseeable future activities including agricultural practices, logging, development, hunting practices, and fire management in and adjacent to the park are negligible to minor and short term. There are no proposed or designated wilderness areas in or adjacent to the and there are frequent aircraft over flights. Motorized watercraft on the Columbia River and mechanized equipment also add to ambient noise within the park. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts from noise would be negligible to minor and short term.

Impairment: This alternative will not impair the natural soundscape for the park.
Mitigation: Same as alternative 1

Alternative 3 – Mechanical treatments only
Noise impacts would be the similar to those listed under Alternative 2 with the exception of no prescribed fire. This would lead to more chainsaw use to reduce fuels in and around developed areas thus increasing potential impacts from minor to moderate. Acres planned with work proposed are summarized in Table 17. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations.

Table 17 Planned Acres of Projects for Alternative 3

Alternative 3 – Soundscape		**Planned Acres**	**Planned Acres**
Planned acres per year*		**Grass Fuel Type**	**Timber Fuel Type**
2011	Mechanical/Manual	7	15
2012	Mechanical/Manual	5	20

2013	Mechanical/Manual	5	24
2014	Mechanical/Manual	5	10
2015	Mechanical/Manual	5	20
*Funding and fire activity levels may dictate shifting projects to different years slightly altering the total yearly acres listed.			

Cumulative Impacts
Cumulative impacts from this alternative would be the same as described under Alternative 2.

Conclusion
Impacts to the natural soundscape would be minor to moderate, localized, and short-term during project activities. Manual fuel reduction and prescribed fire activities would generate noise from chainsaws, pumps and vehicles. Past, present, and reasonably foreseeable future management activities are being designed as to restore and maintain the natural and historical conditions within the park. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from all of the alternatives and cumulative impacts from noise to human and wildlife would be negligible to minor, localized, and short term.

Impairment: This alternative will not impair the natural soundscape for the park.
Mitigation: Same as alternative 1

AIR QUALITY

Related Laws, Regulations, and Policies

Lewis and Clark NHP is designated as a Class II Air Quality area under the *Clean Air Act (1997)*. The main purpose of this act is to protect and enhance the nation's air quality to promote the public health and welfare. The act establishes specific programs to provide protection for air resources and values, including the program to prevent significant deterioration of air quality in clean air regions of the country. Although Lewis and Clark NHP is designated as a Class II airshed area, the park strives to maintain the highest air quality standards, and project work within the historical park is completed in accordance with regional standards. However, the historical park does not possess sufficient autonomous authority to address issues of air quality improvements when air pollution originates outside the boundaries. NPS *Management Policies* direct parks to seek to perpetuate the best possible air quality to preserve natural and cultural resources, sustain visitor enjoyment, human health, and preserve scenic vistas (4.7). Parks are directed to comply with all federal, state, and local air quality regulations and permitting requirements.

Impact Indicators, Criteria, and Methodology

The impact categories are relevant to air quality issues related to fire management activities. Each category is discussed below relative to potential airborne pollution impacts from the alternatives on park resources and human health.

Negligible impacts: There is no visible smoke.

Minor impacts: Smoke is visible during brief periods of time. Dust from the use of dirt roads is visible during brief periods. Mitigation is able to alleviate the impacts.

Moderate impacts: Smoke is visible during extended periods. Dust from the use of dirt roads is visible for an extended area. Mitigation is able to alleviate the impacts.

Major impacts: Smoke is easily detectable for extended periods of time in a large area. Dust from the use of dirt roads and equipment is visible for an extended period for an extended amount of time, and mitigation is unable to alleviate the conditions.

Impairment: Air emissions contribute to continued violation of national standards. In addition, impacts have a major effect on park resources and values; contribute to the deterioration to the extent that the park's purpose cannot be fulfilled as established in its enabling legislation; affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or affect the resource whose conservation is identified as a goal in the park's general management plan or other park planning document.

Air quality impacts were qualitatively assessed after review of NPS best management practices to reduce air emissions and the extent of proposed prescribed fire activities and wildland fire potential in each alternative.

Alternative 1 No Action Alternative

Activities proposed under Alternative 1 with potential to impact air quality, both beneficially and negatively, include prescribed fire, hazard fuel reduction and fire suppression. The use of vehicles and mechanized equipment such as chainsaws, could affect air quality in a localized area.

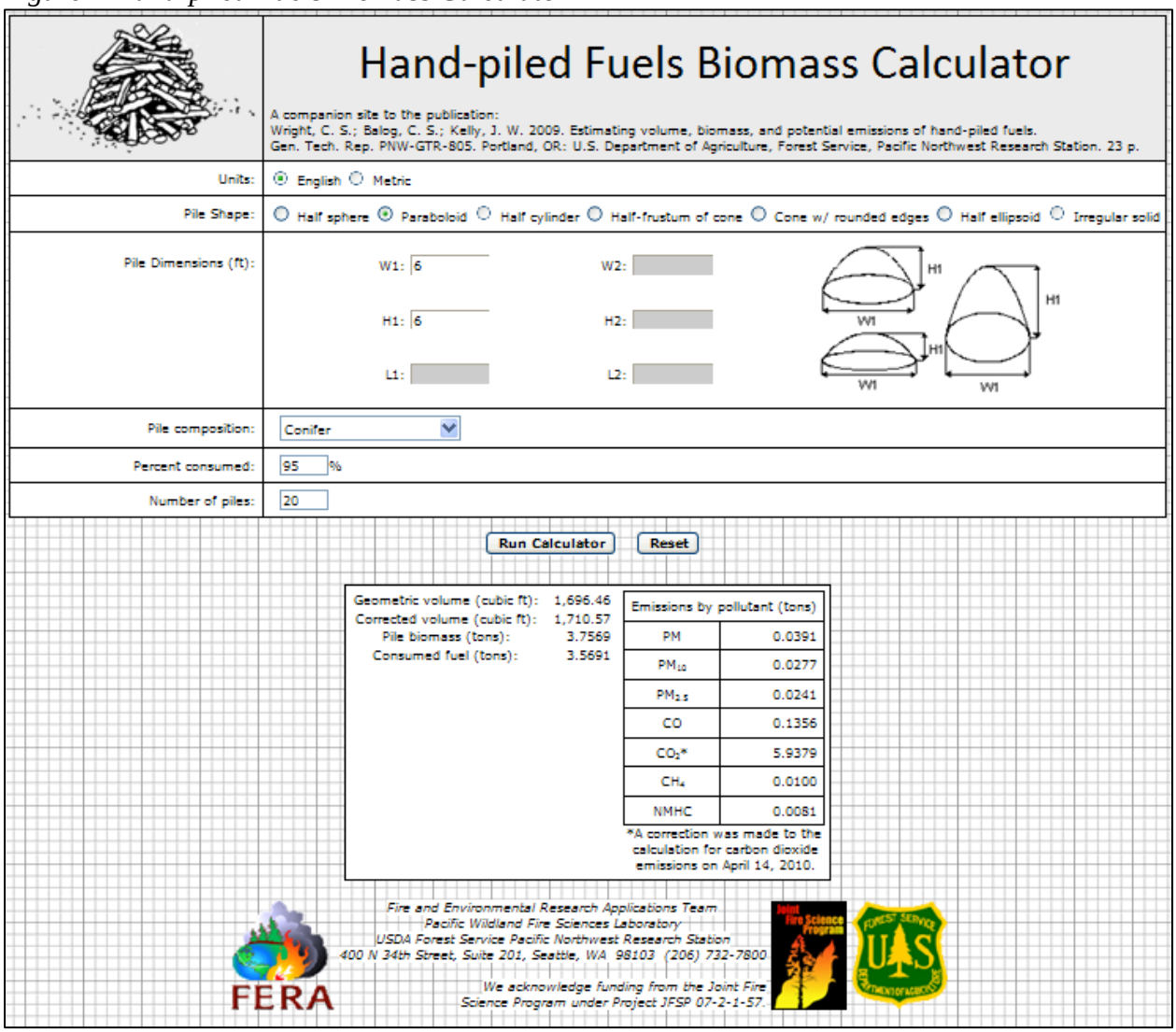
Fuels reduction projects under Alternative 1 would entail handpiling the debris and burning during state mandated allowable burn days. Handpiles approximately 6' in diameter and 6' tall would be used as necessary to dispose of vegetative debris. Approximately 20 piles per acre would be built with 20-40 piles burned per day. A summary of proposed emissions in pounds per acre, by project, is shown in Table 18. The hand-piled Fuels Biomass Calculator was used to illustrate estimated consumption from hand piles and is shown in Figure 7.

Table 18 Air Quality: Handpile consumption Alternative 1

Timber Fuel Types (Piles)*– Modeled using W. Hemlock – Sitka Spruce defaults, typical loading, dry conditions			
Emissions - lbs/acre			
	Flaming	Smoldering	Total
PM 10	183	2536	2709
PM 2.5	155	2141	2296
CH 4	47	1300	1347
CO	387	28524	28911
CO 2	105648	116101	221749
NOX	190	0	190
SO 2	59	95	154
Consumption = 76.96 tons/ac Duration = 02:56:00 (hr/min/sec)* Ave. Combustion Efficiency = 0.79			

Year	Planned Acres in Timber Fuel Types	Total tons/year
2011	5 (0.05 acre total burned area) Boundary Protection Project 1	3.85
2012	5 (0.05 acre total burned area) Boundary Protection Project 2	3.85
2013	5 (0.05 acre total burned area) Boundary Protection Project 3	3.85
	5 (0.05 acre total burned area) Fuels Break/Access Points Project 1	3.85
2014	5 (0.05 acre total burned area) Boundary Protection Project 4	3.85
2015	5 (0.05 acre total burned area) Boundary Protection Project 5	3.85

Figure 7 Hand-piled Fuels Biomass Calculator



Hand-piled Fuels Biomass Calculator

A companion site to the publication:
Wright, C. S.; Balog, C. S.; Kelly, J. W. 2009. Estimating volume, biomass, and potential emissions of hand-piled fuels. Gen. Tech. Rep. PNW-GTR-805. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 23 p.

Units: (•) English ( ) Metric

Pile Shape: ( ) Half sphere (•) Paraboloid ( ) Half cylinder ( ) Half-frustum of cone ( ) Cone w/ rounded edges ( ) Half ellipsoid ( ) Irregular solid

Pile Dimensions (ft):

W1:	6	W2:	
H1:	6	H2:	
L1:		L2:	

Pile composition: Conifer

Percent consumed: 95 %

Number of piles: 20

Run Calculator | Reset

Geometric volume (cubic ft):	1,696.46
Corrected volume (cubic ft):	1,710.57
Pile biomass (tons):	3.7569
Consumed fuel (tons):	3.5691

Emissions by pollutant (tons)	
PM	0.0391
PM_{10}	0.0277
$PM_{2.5}$	0.0241
CO	0.1356
CO_2*	5.9379
CH_4	0.0100
NMHC	0.0081

*A correction was made to the calculation for carbon dioxide emissions on April 14, 2010.

FERA

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We acknowledge funding from the Joint Fire Science Program under Project JFSP 07-2-1-57.

Burning of reed canary grass as part of an eradification program would occur under Alternative 1. Estimated consumption is shown in Table 19

Table 19 Air Quality: Reed Canary Grass Burning consumption modeling

FOFEM Smoke Emission Modeling – Alternative 1			
Grass Fuel Types - Modeled using Fescue and Freshwater Marsh defaults with typical loading, dry conditions			
Emissions - lbs/acre			
	Flaming	Smoldering	Total
PM 10	6-8	0	6-8
PM 2.5	5-7	0	5-7
CH 4	2-2	0	2-2
CO	12-16	0	12-16
CO 2	3375-4446	0	3375-4446
NOX	6-8	0	6-8
SO 2	2-3	0	2-3
Consumption = 1.25 tons/ac Duration = 00:01:00 (hr/min/sec) Ave. Combustion Efficiency = 0.97			

Year	Planned Acres in Grass Fuel Types	Total consumption in tons/year
2011	0	0
2012	0	0
2013	0	0
2014	10 Reed Canary Eradication Project 1	12.5
2015	5 Reed Canary Project Eradication 2	6.25

Smoke consists of dispersed airborne solids and liquid particles (particulates) that could remain suspended in the atmosphere for a few days to several months. Particulates can reduce visibility and contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can sometimes result from multiple burn days and/or multiple owners burning within an airshed over too short a period of time to allow for dispersion.

The Oregon State Department of Forestry (ODF) and Washington Department of Natural Resources (DNR) provide smoke management guidance for the park. Smoke permits and reporting is required for all fire related activities on federal lands. Most prescribed fires (including handpile burning) potentially planned in the park are of small scale and short duration. However, coordination with ODF/DNR and local fire jurisdictions is crucial to minimizing impacts to air quality.

Strategies to manage smoke and reduce air quality impacts, as discussed in the mitigation section of this document*, would be utilized for all fire activities. Thus, management-ignited fires would result in minor to moderate, short-term adverse impacts to air quality during burning activities.

The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Cumulative Impacts: Air quality impacts from past, present, and reasonably foreseeable future activities including agricultural practices, development, and fire management in and adjacent to the park are negligible to minor and short term. There are no major emission sources within the park. Regional haze contributions originate from communities and traffic along the SW Washington Interstate 5 corridor (Longview, WA to Vancouver WA) and the Portland OR metropolitan area, which produces smog emissions as a dense urban area. Occasional, small scale and short duration prescribed fires may cause negligible to minor, localized, short term air quality impacts. Accepting short term impacts would reduce the potential of moderate to major impacts that can occur during significant wildland fire events. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts from noise would be negligible to minor and short term.

Conclusion: Projects generating particulate material that could impact air quality are tightly regulated by state smoke implementation plans. The NPS manages projects to be in compliance with both Oregon and Washington smoke implementation plans. All smoke generating projects will need to have authorization from the respective state regulatory agency prior to ignition. The intent of the smoke management program in both states is to minimize impacts to air quality. There will be short-term impacts to air quality from the use of prescribed fire.

Impairment: The implementation of this alternative would not impair air quality or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other Park Service planning documents.

Mitigation: For prescribed fires, there are three principle strategies to manage smoke and reduce air quality impacts. They include:

- Avoidance – This strategy relies on monitoring meteorological conditions when scheduling prescribed fires to prevent smoke from drifting into sensitive receptors, or suspending burning until favorable weather conditions.
- Dilution – This strategy ensures proper smoke dispersion in smoke-sensitive areas by controlling the rate of smoke emissions or scheduling prescribed fires when weather systems are unstable, not under conditions when a stable high-pressure area is forming with an associated subsidence inversion. An inversion would trap smoke near the ground.
- Emission Reduction – This strategy utilizes techniques to minimize the smoke output per unit area treated. Smoke emission is affected by the number of acres burned at one time, pre-burn fuel loadings, fuel consumption, and the emission factor. Reducing the number of acres that are burned at one time would reduce the amount of emissions generated by that burn. Reducing fuel beforehand, i.e. removing wood for utilization purposes reduces the amount of fuel available. Emission factors can be reduced by pile burning or by using certain firing techniques. If weather conditions changed unexpectedly during a prescribed fire, and there was a potential for violating air quality standards or for adverse smoke impacts on sensitive receptors, the park would cease burn operations at an appropriate and safe location to avoid further smoke impacts.

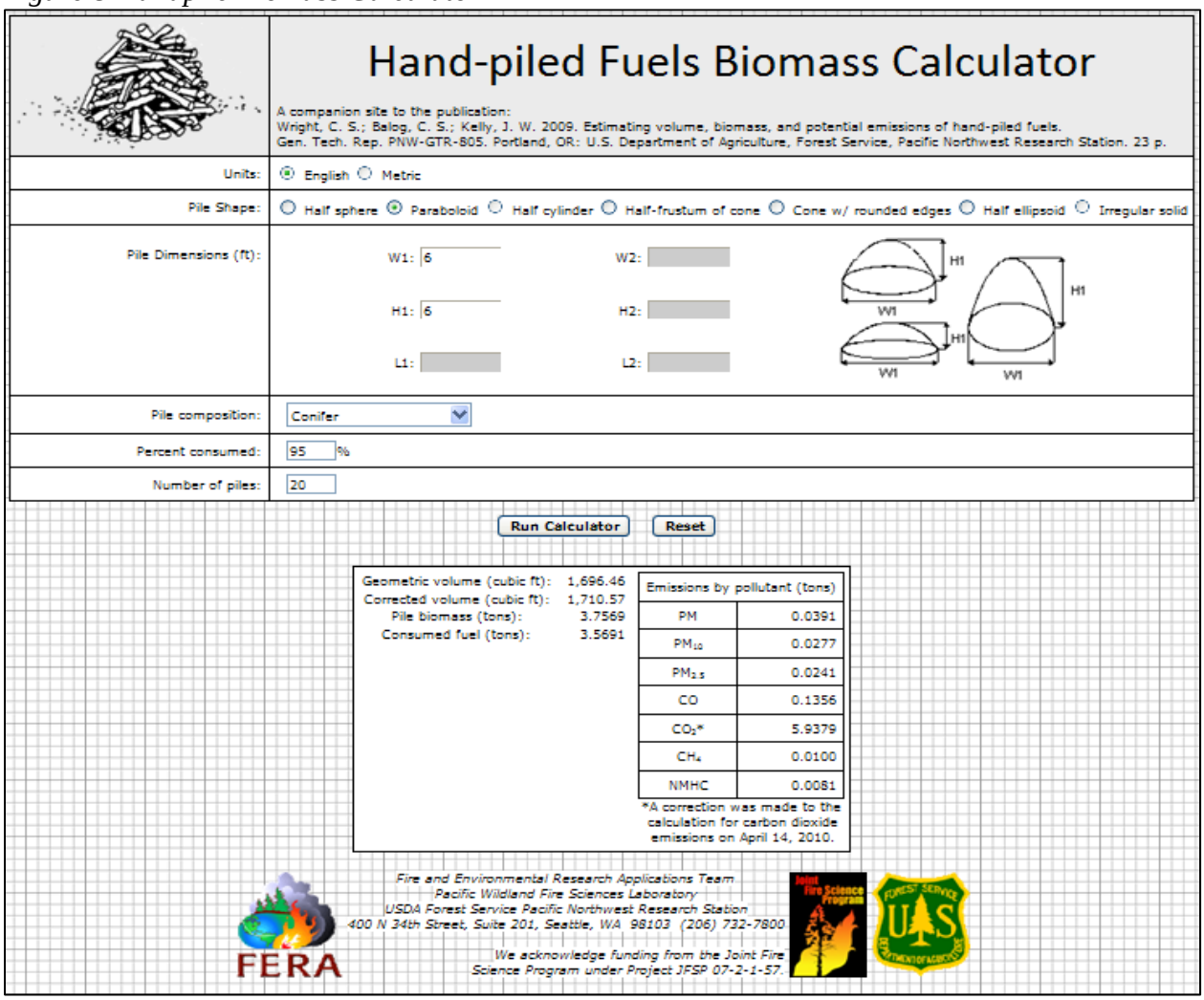
Alternative 2 – Mechanical and Limited Prescribed Fire Option (Mechanical, Prescribed fire, Herbicide as needed) No Action alternative expanded to all areas Activities proposed under Alternative 2 with potential to impact air quality, both beneficially and negatively, include prescribed fire, hazard fuel reduction, and fire suppression. See App E Table 2 for a list of proposed projects and Figures 2-4 for project locations. The use of vehicles and mechanized equipment such as chainsaws, could affect air quality in a localized area. Handpiles approximately 6’ in diameter and 6’ tall would be used as necessary to dispose of vegetative debris. Approximately 20 piles per acre would be built with 20-40 piles burned per day. The hand-piled Fuels Biomass Calculator was used to illustrate estimated consumption from hand piles. Alternative 2 Fuel Consumption is shown in Table 20. Summary calculations of emissions are determined by utilizing the Handpile Biomass Calculator - Figure 8

Tale 20 Air Quality: Alternative 2: Emissions (pounds per acre) generated from handpile burning

Timber Fuel Types (Piles)*– Modeled using W. Hemlock – Sitka Spruce defaults, typical loading, dry conditions			
Emissions - lbs/acre			
	Flaming	Smoldering	Total
PM 10	183	2536	2709
PM 2.5	155	2141	2296
CH 4	47	1300	1347
CO	387	28524	28911
CO 2	105648	116101	221749
NOX	190	0	190
SO 2	59	95	154
Consumption = 76.96 tons/ac Duration = 02:56:00 (hr/min/sec)* Ave. Combustion Efficiency = 0.79			

Year	Planned Acres in Timber Fuel Types	Total tons/year
2011	10 (0.1 acres total burned)	7.69
2012	15 (0.15 acre total area burned)	11.54
2013	15 (0.15 acre total area burned)	11.54
2014	10 (.1 acre total area burned)	7.69
2015	16 (.16 acre total area burned)	12.31

Figure 8 Handpile Biomass Calculator



Hand-piled Fuels Biomass Calculator

A companion site to the publication:
Wright, C. S.; Balog, C. S.; Kelly, J. W. 2009. Estimating volume, biomass, and potential emissions of hand-piled fuels. Gen. Tech. Rep. PNW-GTR-805. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 23 p.

Units: (•) English ( ) Metric

Pile Shape: ( ) Half sphere (•) Paraboloid ( ) Half cylinder ( ) Half-frustum of cone ( ) Cone w/ rounded edges ( ) Half ellipsoid ( ) Irregular solid

Pile Dimensions (ft):

W1:	6	W2:	
H1:	6	H2:	
L1:		L2:	

Pile composition: Conifer

Percent consumed: 95 %

Number of piles: 20

Run Calculator | Reset

Geometric volume (cubic ft):	1,696.46
Corrected volume (cubic ft):	1,710.57
Pile biomass (tons):	3.7569
Consumed fuel (tons):	3.5691

Emissions by pollutant (tons)	
PM	0.0391
PM_{10}	0.0277
$PM_{2.5}$	0.0241
CO	0.1356
CO_2*	5.9379
CH_4	0.0100
NMHC	0.0081

*A correction was made to the calculation for carbon dioxide emissions on April 14, 2010.

FERA

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We acknowledge funding from the Joint Fire Science Program under Project JFSP 07-2-1-57.

Burning of reed canary grass as part of an eradification program would occur under Alternative 2. Estimated consumption is shown in Table 21

Table 21 Air Quality: Reed Canary Grass burning emissions per acre

FOFEM Smoke Emission Modeling – Alternative 2			
Grass Fuel Types - Modeled using Fescue and Freshwater Marsh defaults with typical loading, dry conditions			
Emissions - lbs/acre			
	Flaming	Smoldering	Total
PM 10	6-8	0	6-8
PM 2.5	5-7	0	5-7
CH 4	2-2	0	2-2
CO	12-16	0	12-16
CO 2	3375-4446	0	3375-4446
NOX	6-8	0	6-8
SO 2	2-3	0	2-3
Consumption = 1.25 tons/ac Duration = 00:01:00 (hr/min/sec) Ave. Combustion Efficiency = 0.97			

Year	Planned Acres in Grass Fuel Types	Total consumption in tons/year
2011	0	0
2012	5	6.25
2013	5	6.25
2014	15	18.75
2015	10	12.5

Smoke consists of dispersed airborne solids and liquid particles (particulates) that could remain suspended in the atmosphere for a few days to several months. Particulates can reduce visibility and contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can sometimes result from multiple burn days and/or multiple owners burning within an airshed over too short a period of time to allow for dispersion.

The Oregon State Department of Forestry (ODF) and Washington Department of Natural Resources (DNR) provide smoke management guidance for the park. Smoke permits and

reporting is required for all fire related activities on federal lands. Most prescribed fires (including handpile burning) potentially planned in the park are of small scale and short duration. However, coordination with ODF/DNR and local fire jurisdictions is crucial to minimizing impacts to air quality.

Strategies to manage smoke and reduce air quality impacts, as discussed in the mitigation section of this document*, would be utilized for all fire activities. Thus, management-ignited fires would result in minor to moderate, short-term adverse impacts to air quality during burning activities.

The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Cumulative Impacts:
Air quality impacts from past, present, and reasonably foreseeable future activities including agricultural practices, development, and fire management in and adjacent to the park are negligible to minor and short term. There are no major emission sources within the park. Regional haze contributions originate from communities and traffic along the SW Washington Interstate 5 corridor (Longview, WA to Vancouver WA) and the Portland OR metropolitan area, which produces smog emissions as a dense urban area. Occasional, small scale and short duration prescribed fires may cause negligible to minor, localized, short term air quality impacts. Accepting short term impacts would reduce the potential of moderate to major impacts that can occur during significant wildland fire events. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts from noise would be negligible to minor and short term.

The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Conclusion: Projects generating particulate material that could impact air quality are tightly regulated by state smoke implementation plans. The NPS manages projects to be in compliance with both Oregon and Washington smoke implementation plans. All smoke generating projects will need to have authorization from the respective state regulatory agency prior to ignition. The intent of the smoke management program in both states is to minimize impacts to air quality. However, impacts from prescribed fires would occur under this alternative, thus resulting in minor to moderate, short-term adverse impacts to area air quality during the duration of the burn.

The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Impairment: The implementation of this alternative would not impair air quality or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other Park Service planning documents.

Mitigation: Same as alternative 1

Alternative 3 – Mechanical Only

In the short term, Alternative 3 would have less potential for air quality impacts than Alternative 1or 2 due to the absence of prescribed fire. The potential for wildfires to cause impacts to air quality would increase over time as fuel accumulations that would have been reduced by prescribed fire continue to increase and become available during a wildland fire. No smoke emission modeling was completed since no prescribed fire is included in this alternative. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations.

The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from use of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around the suppression activities on a short-term basis, creating minor temporary impacts.

Cumulative Impacts: Cumulative impacts from this alternative would generally be the same as described under Alternative 1and 2, with the notable exception that the fire management program would not contribute prescribed fire smoke to regional air airsheds.

Conclusion
The lowest impacts to air quality would be under Alternative 3 due to the lack of prescribed fire. The use of vehicles and mechanized equipment could generate fumes in the form of smoke and exhaust from burning of fossil fuels, and generate dust and particulate matter. This would affect air quality in the immediate area around project activities on a short-term basis, creating minor temporary impacts.

When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative air quality impacts would be negligible to minor, localized, and short term.

Impairment: The implementation of this alternative would not impair air quality or values that are (1) necessary to fulfill specific purposes identified in the enabling legislation of the park, (2) key to the natural or cultural integrity of the park or opportunities for enjoyment of the park, and (3) identified as a goal in the park's general management plan or other Park Service planning documents.
Mitigation: Same as alternative 1

VISITOR USE AND EXPERIENCE (RECREATIONAL AND VISUAL RESOURCES)

Related Laws, Regulations, and Policies

Visitor use in parks is authorized in the NPS *Organic Act* and managed under the NPS *Management Policies* under Chapter 8, "Use of Parks" that includes commercial as well as public use.

The enabling legislation of Lewis and Clark NHP specifically addresses the preservation of the scenic features of the area. The NPS manages the natural resources of the park, including highly valued associated characteristics such as scenic views, to maintain them in an unimpaired condition for future generations (*Management Policies* 4).
Since impacts on scenic quality are difficult to assess, best professional judgment prevailed in the evaluation of impacts.

Impact Indicators, Criteria, and Methodology
Negligible—Visitors would not likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources.
• **Minor—**Visitors would likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources; however the changes in visitor use and experience would be slight and likely short term.
• **Moderate—** Visitors would be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and likely long term.
• **Major—** Visitors would be highly aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and long term. The change in visitor use and experience proposed in the alternative would preclude future generations of some visitors from enjoying park resources and values. Some visitors who desire to continue their chosen activity would be required to pursue other available local or regional areas.

Duration:
• **Short-Term —** During the project
• **Long-Term** — Past project completion and 10 years into future.
Recreation impacts were qualitatively assessed in light of the intensity and duration of fuels treatment activities as they relate to visitor use and experience. Visual resource impacts were assessed in terms of scenic integrity, visual wholeness, and unity of the landscape.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Alternative 1: *No Action*
The No Action alternative restricts fire management activities, except wildfire suppression, to the 300 acres analyzed in the 2004 environmental analysis for the park's fire management plan.

Projects that could impact visitor use and scenic integrity are: thinning of forest timber stands, prescribed fire and wildland fire suppression activities involving fire engines and wildland firefighting crews. There will be short-term impacts associated during and immediately after these activities (project). Impacts would be restrictions to entry in project areas during activity periods. In alternative 1 there is a potential for a total of 13 projects over 5 years that may impact visitor experiences or scenic vistas. The maximum number of projects could be 4 in 1 year. A summary of the number of projects for Alternative 1 is shown in Table 22. The presence of wildfire is a rare unplanned event and is not depicted in the table.

Table 22 Visitor Use and Experience: Total Proposed Projects for Alternative 1

Year	Fuels Manipulation (Lop and scatter, handpile)	Handpile Burning	Broadcast Burning
2011	1(Boundary Protection Proj. 1)		0
2012	1(Boundary Protection Proj. 2)	1(Boundary Protection Proj. 2)	0
2013	1(Boundary Protection Proj. 3)	1(Boundary Protection Proj. 3)	0
	1 Fuels Break/Access Points Project 1	1 Fuels Break/Access Points Project 1	
2014	1(Boundary Protection Proj. 4)	1(Boundary Protection Proj. 4)	1 (Canary Reed Grass Eradication Proj. 1)
2015	1(Boundary Protection Proj. 5)	1(Boundary Protection Proj. 5)	1 (Canary Reed Grass Eradication Proj. 2)

Impacts to scenic integrity would be minor because fire management activities involve a short-term presence of vehicles and personnel, tactics employed by crews are designed to cause minimum impact and smoke accumulations associated with prescribed fire would be of short-term duration due to the permitting process regulating projects that generate smoke.

Prescribed fires will produce smoke accumulations that impact local visual quality. These impacts would be minor as the impacts would not be long-term. Fire managers' design prescribed burns to minimize smoke emissions through best management practices and they limit implementation of the project to periods of low visitor use, further limiting impacts.

Visitor access to areas of fire management activity would be restricted for the duration of the activity. Thinning, prescribed fire and wildland fire suppression activities are very dangerous requiring restrictions for the safety of the visitor.
The impact from restricted access could be minor to major, depending on the visitor's plans and flexibility and the availability and amount of non-impacted areas offering similar expectations/experiences.

Cumulative Impacts: Impacts to visitor use and experience from fire management activities in and adjacent to the park, through past, present and reasonably foreseeable future activities are negligible to minor and short-term, especially with inclusion of agricultural practices, commercial logging, and development outside the park. Prescribed burn projects will require short-term restrictions to access for safety reasons. The impacts from all fire management activities are short-term and will create negligible to minor impacts to visitor use, experience and scenic values.

Conclusion: Fire management activities are inherently unsafe; therefore restrictions of access to ongoing fire management projects are necessary to protect visitors. Restrictions to areas of the park placed upon visitors will be negligible to minor and short-term. Prescribed fires will impact visual values, again projects are designed to minimize these impacts, creating negligible minor short-term impacts.

Mitigation:

- Fire management activities (excluding fire suppression) would not be conducted on holidays;
- Public information in the form of pamphlets, signs, and/or information stations would be used to inform park visitors of project activities and purpose;
- Educational/informational materials would be developed and distributed to park visitors on what to expect during fire management activities including potential noise from chainsaws during line construction, smoke dispersion, safety, and information on where and when these activities would occur;
- Area closures due to safety concerns would be implemented for the least amount of time possible.
- All smoke generating projects will minimize emissions using best management practices.

Alternative 2 ***Agency Preferred Mechanical and Limited Prescribed Fire Option***

The *Mechanical and Limited Prescribed Fire Option* alternative expands all fire management activities beyond the 300 acres analyzed in the 2004 park's fire management plan environmental analysis to all of the NPS administered sites at Lewis and Clark NHP. Use of Wildland Fire – wildfire, for resource benefits is not allowed in this alternative.

Projects that could impact visitor use and scenic integrity are: thinning of forest timber stands, prescribed fire and wildland fire suppression activities involving fire engines and wildland firefighting crews. There will be short-term impacts associated during and immediately after these activities (project). In alternative 2 there is a potential for a total of 37 projects over 5 years that may impact visitor experiences or scenic vistas. See App E Table 2 for a list of proposed projects and App E Figures 2-4 for project locations. The maximum number of projects could be 9 in 1 year. A summary of the number of activities for Alternative 2 is shown in Table 23. The presence of wildfire is a rare event and is not depicted in the table.

Table 23 Visitor Use and Experience: Total Proposed Projects for Alternative 2

Year	Total Projects	Fuels Manipulation (Lop and scatter, handpile, mowing)	Handpile Burning	Broadcast Burning
2011	4	2	2	0
2012	5	2	2	1
2013	6	1	4	1
2014	5	1	2	2
2015	6	1	3	2

Impacts to scenic integrity would be minor because fire management activities involve a short-term presence of vehicles and personnel, tactics employed by crews are designed to cause minimum impact and smoke accumulations associated with prescribed fire would be of short-term duration due to the permitting process regulating projects that generate smoke.

Prescribed fires will produce smoke accumulations that impact local visual quality. As shown in Table 23 a total of 19 prescribed fire events could occur over the 5 year planning period. These impacts would be minor as the impacts would not be long-term. Fire managers' design prescribed burns to minimize smoke emissions through best management practices and they limit implementation of the project to periods of low visitor use, further limiting impacts.

Visitor access to areas of fire management activity would be restricted for the duration of the activity. Thinning, prescribed fire and wildland fire suppression activities are very dangerous requiring restrictions for the safety of the visitor.

The impact from restricted access could be minor to major, depending on the visitor's plans and flexibility and the availability and amount of non-impacted areas offering similar expectations/experiences.

Cumulative Impacts: Impacts to visitor use and experience from fire management activities in and adjacent to the park. , through regulation of smoke by state regulatory agencies impacts to scenic integrity would be negligible to minor and short-term, especially with inclusion of agricultural practices, commercial logging, and development outside the park. Prescribed burn projects will require short-term restrictions to access for safety reasons. The impacts from all fire management activities are short-term and will create negligible to minor impacts to visitor use, experience and scenic values.

Conclusion: Fire management activities are inherently unsafe; therefore restrictions of access to ongoing fire management projects are necessary to protect visitors. Restrictions to areas of the park placed upon visitors will be negligible to minor and short-term. Prescribed fires will impact

visual values; again projects are designed to minimize these impacts, creating negligible minor short-term impacts.

Mitigation: Same as alternative 1

Alternative 3 *Mechanical Treatment Only*

The *Mechanical Treatment Only* alternative expands all fire management activities beyond the 300 acres analyzed in the 2004 park's fire management plan environmental analysis to all of the NPS administered sites at Lewis and Clark NHP. Use of Wildland Fire – wildfire, for resource benefits is not allowed in this alternative. Prescribed fire is a not allowed under this alternative.

Projects that could impact visitor use and scenic integrity are: thinning of forest timber stands, and wildland fire suppression activities involving fire engines and wildland firefighting crews. There will be short-term impacts associated during and immediately after these activities. In alternative 3 there is a potential for a total of 19 projects over 5 years that may impact visitor experiences or scenic vistas. The maximum number of projects could be 4 in 1 year. A summary of the number of activities for Alternative 3 is shown in Table 24. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations. The presence of wildfire is a rare unplanned event and is not depicted in the table.

Table 24 Visitor Use and Experience: Total Proposed Projects for Alternative 3

Year	Fuels Manipulation (Lop and scatter, chipping)
2011	4
2012	4
2013	4
2014	3
2015	4

Impacts to scenic integrity would be minor because fire management wildfire suppression activities involve a short-term presence of vehicles and personnel, tactics employed by crews are designed to cause minimum impact and smoke accumulations associated with wildfire would be of short-term duration.

Visitor access to areas of fire management activity would be restricted for the duration of the activity. Thinning and wildfire suppression activities are very dangerous requiring restrictions for the safety of the visitor.

The impact from restricted access could be minor to major, depending on the visitor's plans and flexibility and the availability and amount of non-impacted areas offering similar expectations/experiences.

Cumulative Impacts: Impacts to visitor use and experience from fire management activities in and adjacent to the park would be negligible to minor and short-term, especially with inclusion of agricultural practices, commercial logging, and development outside the park. Fire management projects will require short-term restrictions to access for safety reasons. The impacts from all fire management activities are short-term and will create negligible to minor impacts to visitor use, experience and scenic values.

Conclusion: Fire management activities are inherently unsafe; therefore restrictions of access to ongoing fire management projects are necessary to protect visitors. Restrictions to areas of the park placed upon visitors will be negligible to minor and short-term.

Mitigation:
Same as alternative 1

LAND USE

Land use impacts were qualitatively assessed by evaluating park boundary issues and potential effects to neighboring land owners.

Regulations and Policy

NPS Policies 2006 provides guidance directing the need to assess impacts to adjacent landowners when proposing activities in the park. Director's Order 12 lists Land Use as a required impact topic to be considered in any NEPA analysis.

Impact Indicators, Criteria, and Methodology

Negligible Impacts: There is not a measurable impact to neighboring land owners.
Minor Impacts: The impact to neighboring land owners is slight and temporary; neighbors would be able to hear or see fire management activities and be restricted in access to project sites, but not for extended periods of time.
Moderate Impacts: The impact to neighboring landowners is noticeable, requiring changes to their regular routines over an extended period of time.
Major Impacts: The impact to neighboring landowners is long-lasting requiring permanent changes to their use of their land over time.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Alternative 1 *No Action*

Alternative 1 limits fire management activities to the area analyzed in the 2004 fire management planning effort. Fire management activities that could impact neighboring landowner's land use are wildland fire suppression actions; includes wildfire and prescribed fire and fuels reduction projects. Wildfire suppression activities are unplanned and in the case of Lewis and Clark NHP – rare events. Therefore wildfire suppression actions are negligible in their impact to adjacent landowners. None of the proposed fire management activities will affect any local zoning rules or ordinances.

Prescribed fire activities have the potential to limit normal access to impacted areas, produce smoke intrusions and provide periods of disruption to adjacent landowners. A summary of prescribed fire events is shown in Table 25. The proposal for prescribed fire events (handpile burning and broadcast burning) would be 7 events (Boundary Protection Projects 2-5, Fuel Breaks/Access Points Project 1 and Reed Canary Grass Eradication Projects 1and 2), App E, Figure 1 and App E Table 1, during the 5 year planning cycle, which will equate to 7 area closures for the planning period, with a maximum of 2 area closures in any one year. Boundary Protection Project 5 would entail access restrictions during the fuels manipulation phase, this project would not have a burning phase. Access to these project sites would also be restricted during the preparation phase bringing the total potential closures during the 5 year period to 13. It is important to note that each of the prescribed fire projects is designed for safe

implementation during environmental conditions that facilitate a safe outcome. A summary of fire management activities is shown in Table 25.

Table 25 Land Use: Total Proposed Projects for Alternative 1

Year	Fuels Reduction Projects	Handpile Burning	Broadcast Burning
2011	Boundary Protection Project 1		0
2012	Boundary Protection Project 2	Boundary Protection Project 2	0
2013	Boundary Protection Project 3	Boundary Protection Project 3	0
	Fuel Breaks/Access Points Project 1	Fuel Breaks/Access Points Project 1	
2014	Boundary Protection Project 4	Boundary Protection Project 4	Reed Canary Grass Eradication Project 1
2015	Boundary Protection Project 5	Boundary Protection Project 5	Reed Canary Grass Eradication Project 2

Cumulative Impacts: Cumulative impacts of the fire management activities would be negligible when considering the impacts to land use overall. Local zoning regulation impacts would be negligible and would not be impacted. Any impacts to local land use adjacent to and during periods of activity would be short-term

Conclusion: Fire management activities as proposed under alternative 1 would have minor to negligible impacts on adjacent landowners' use of their land. Any impacts to use would be disruption of normal access during periods of fire management activity. Impacts from wildfire suppression would be negligible due to the rare nature of occurrence.

Mitigation:

- Landowners will be notified prior to the implementation of fire management projects which might impact them. Notifications will be prior to the field season and immediately before implementation.
- Park trails and recreation areas may be closed temporarily during fuels projects and/or wildfires for the safety of park visitors. All efforts will be made to minimize the amount of time an area is closed to visitor use.

Alternative 2 ***Agency Preferred Mechanical and Limited Prescribed Fire Option***

Alternative 2 expands fire management activities to the all areas of the park. Fire management activities that could impact neighboring landowner's land use are wildland fire suppression actions; includes wildfire and prescribed fire and fuels reduction projects. Wildfire suppression activities are unplanned and in the case of Lewis and Clark NHP – rare events. Therefore wildfire suppression actions are negligible in their impact to adjacent landowners. None of the proposed fire management activities will affect any local zoning rules or ordinances.

Prescribed fire activities have the potential to limit normal access to impacted areas, produce smoke intrusions and provide periods of disruption to adjacent landowners. A summary of prescribed fire events is shown in Table 26. See App E Table 2 for a list of proposed projects and App E Figures 2-4 for proposed project locations. The proposal for prescribed fire events (handpile burning and broadcast burning) would be 18 events during the 5 year planning cycle, which will equate to 18 area closures for the planning period, with a maximum of 9 area closures in any one year. Associated with the prescribed fire events are the 20 fuels reduction projects, 13 of which are the first phase of a specific handpile burning project. Access to these sites would also be restricted during the preparation phase bringing the total potential closures during the 5 year period to 38. It is important to note that each of the prescribed fire projects is designed for safe implementation during environmental conditions that facilitate a safe outcome. A summary of fire management activities is shown in Table 26.

Table 26 Land Use: Total Proposed Projects for Alternative 2

Year	Fuels Reduction Projects	Handpile Burning	Broadcast Burning
2011	4	2	0
2012	5	3	0
2013	4	3	1
2014	3	2	2
2015	4	3	2

Cumulative Impacts: Cumulative impacts of the fire management activities would be negligible when considering the impacts to land use overall. Local zoning regulation impacts would be negligible and would not be impacted. Any impacts to local land use adjacent to and during periods of activity would be minor in impact and short-term in duration

Conclusion: Fire management activities as proposed under alternative 2 would have minor to negligible impacts on adjacent landowners' use of their land. Any impacts to use would be short-term disruption of normal access during periods of fire management activity. Impacts from wildfire suppression would be negligible due to the rare nature of occurrence.

Mitigation: Same as alternative 1

Alternative 3 ***Mechanical Treatment Only***

Alternative 3 expands fire management activities to the all areas of the park. Fire management activities proposed in alternative 3 that could impact neighboring landowner's land use are wildfire suppression actions and fuels reduction projects. Wildfire suppression activities are unplanned and in the case of Lewis and Clark NHP – rare events. Therefore wildfire suppression actions are negligible in their impact to adjacent landowners. None of the proposed fire management activities will affect any local zoning rules or ordinances.

Fuels reduction activities could provide periods of disruption to adjacent landowners, due to the noise and restriction in access to project areas, possibly limiting their use of their lands during periods of operations. A summary of fuels reduction events is shown in Table 27. The proposal for fuels reduction events (handpile. Lop and scatter or chip fuels) would be 19 events during the 5 year planning cycle, which will equate to 19 area closures for the planning period, with a maximum of 4 area closures in any one year. A summary of fire management activities is shown in Table 27. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations.

Table 27 Land Use: Total Proposed Projects for Alternative 3

Year	Fuels Reduction Projects
2011	4
2012	4
2013	4
2014	3
2015	4

Cumulative Impacts: Cumulative impacts of the fire management activities would be negligible when considering the impacts to land use overall. Local zoning regulation impacts would be negligible and would not be impacted. Any impacts to local land use adjacent to and during

Conclusion: Fire management activities as proposed under alternative 3 would have minor to negligible impacts on adjacent landowners' use of their land. Any impacts to use would be short-term disruption of normal access during periods of fire management activity. Impacts from wildfire suppression would be negligible due to the rare nature of occurrence.

Mitigation: Same as alternative 1

HUMAN HEALTH AND SAFETY

Related Laws, Regulations, and Policies

The Federal Wildland Fire Management Policy Review, 2009, provides fire policies related to safety. The guiding principles are fundamental and establish firefighter and public safety as the first priority in every fire management activity. Public safety and the safety of all personnel engaged in a fire event is the primary concern of park managers.

Impact Indicators, Criteria, and Methodology

Negligible Impacts: The impact to personnel and visitor safety is not measurable or perceptible.
Minor Impacts: The impact to personnel and visitor safety is slight and temporary, but not sufficient to cause a permanent change in accident rates and can be immediately controlled by management actions in a timely manner.
Moderate Impacts: The impact to personnel and visitor is slight and temporary, but could create a slight permanent increase in accident rates. The safety of park personnel and visitors can not be controlled immediately by park management, but control would occur within 24 hours.
Major Impacts: The impact to personnel and visitor safety is sufficient to cause a permanent change in accident rates at existing low accident locations.
When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Human health and safety impacts were qualitatively assessed through determination of activities, equipment and conditions that could result in injury, literature review of type and extent of injury caused by equipment and conditions, and in light of mitigation measures and best management practices.

Alternative 1 – *No Action*

Factors most likely to adversely impact firefighter health and safety include activities associated with wildland fire suppression efforts (accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, injuries from wildland fires). Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Accidental spills of fire retardants and foams are the most likely to adversely impact human health and safety. Fire retardants used in controlling or extinguishing fires contain about 85% water, 10% fertilizer, and 5% minor ingredients such as corrosion inhibitors and bactericides. Fire suppressant foams are more than 99% water. The remaining 1% contains surfactants, foaming agents, corrosion inhibitors, and dispersants. These qualified and approved wildland fire chemicals have been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests (USDA, 2001). However, they are strong detergents, and can be extremely drying to skin. All currently approved foam concentrates are irritating to the eyes as well. Application of a topical cream or lotion can alleviate the effects of a retardant, and protective goggles can prevent any injury to the eyes when using foams.

Fuel break construction can pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for firefighting efforts during suppression efforts. While each of the crew is trained in the use of firefighting equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning firefighter accreditation, and equipment and procedural safety guidelines would minimize accidents.

Smoke inhalation can also pose a threat to human health and safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. The chief inhalation hazard appears to be carbon monoxide (CO), aldehydes, respirable particulate matter with a median diameter of 2.5 micrometers (PM2.5), and total suspended particulate (TSP). Adverse health effects of smoke exposure begin with acute, instantaneous eye and respiratory irritation and shortness of breath, but can develop into headaches, dizziness, and nausea lasting up to several hours. Based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous, but a small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA, 2000b).

Use restrictions applied to areas of wildfires or prescribed fires would minimize or eliminate public human health and safety concerns resulting from smoke exposure and fire injuries. When using prescribed fire, mitigation measures, such as construction of fire lines, the presence of engines, and strict adherence to prescribed fire plans, would minimize the potential for an out-of-prescription burn or escape. Elements of the prescribed fire plan that relate to ensuring a safe burn include such measures as fuel moisture, wind speed, rate of fire spread, and estimated flame lengths. While the potential for a fire escape will always exist when conducting prescribed fires, that potential is extremely small. Recent statistics summarized by the Boise Interagency Fire Center report that approximately 1% of prescribed fires on federal lands required suppression activities of some kind. In most cases these prescribed fires jumped a control line and suppression tactics were successfully used to control them. Out of the 1% of prescribed fires that required suppression, 90% were controlled without incident. Statistically, this result leaves about 0.1% of prescribed fires that required major suppression actions.

As a result of the potential risks associated with the implementation of Alternative 1, impacts to human health and safety would be adverse, minor to moderate, short to long-term.

Cumulative Impacts

Impacts to human health and safety from past, present, and reasonably foreseeable future activities including development and park management activities are negligible to minor and short term. Potential impacts are easily mitigated through proper planning and by following established safety guidelines while engaged with fire operations or other park maintenance activities. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to visitor use and experience would be negligible to minor and short term.

Conclusion: Fuels treatment operations and wildland fire operations are inherently dangerous. Safety mitigation is practiced by firefighting personnel to help counter balance thepotential for

burns, chemical contamination (foams and retardant), injuries to the body and smoke inhalation impacts. Impacts to personnel and others in the vicinity of any fire management operation could be minor to major, short-term or long lasting.

Mitigation:

- Public and personnel safety will be the first priority in all fire management activities. All fire management activities will follow safety standards as specified in RM 18 and the Interagency Standards for Fire and Fire Aviation Operations.

Alternative 2 – *Agency Preferred Mechanical and Limited Prescribed Fire Option*

Factors most likely to adversely impact firefighter health and safety include activities associated with wildland fire suppression efforts (accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, injuries from wildland fires). Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Accidental spills of fire retardants and foams are the most likely to adversely impact human health and safety. Fire retardants used in controlling or extinguishing fires contain about 85% water, 10% fertilizer, and 5% minor ingredients such as corrosion inhibitors and bactericides. Fire suppressant foams are more than 99% water. The remaining 1% contains surfactants, foaming agents, corrosion inhibitors, and dispersants. These qualified and approved wildland fire chemicals have been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests (USDA, 2001). However, they are strong detergents, and can be extremely drying to skin. All currently approved foam concentrates are irritating to the eyes as well. Application of a topical cream or lotion can alleviate the effects of a retardant, and protective goggles can prevent any injury to the eyes when using foams.

Fuel break construction can pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for firefighting efforts during suppression efforts. While each of the crew is trained in the use of firefighting equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning firefighter accreditation, and equipment and procedural safety guidelines would minimize accidents.

Smoke inhalation can also pose a threat to human health and safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. The chief inhalation hazard appears to be carbon monoxide (CO), aldehydes, respirable particulate matter with a median diameter of 2.5 micrometers (PM2.5), and total suspended particulate (TSP). Adverse health effects of smoke exposure begin with acute, instantaneous eye and respiratory irritation and shortness of breath, but can develop into headaches, dizziness, and nausea lasting up to several hours. Based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous, but a small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA, 2000b).

Use restrictions applied to areas of wildfires or prescribed fires would minimize or eliminate public human health and safety concerns resulting from smoke exposure and fire injuries. When using prescribed fire, mitigation measures, such as construction of fire lines, the presence of engines, and strict adherence to prescribed fire plans, would minimize the potential for an out-of-prescription burn or escape. Elements of the prescribed fire plan that relate to ensuring a safe burn include such measures as fuel moisture, wind speed, rate of fire spread, and estimated flame lengths. While the potential for a fire escape will always exist when conducting prescribed fires, that potential is extremely small. Recent statistics summarized by the Boise Interagency Fire Center report that approximately 1% of prescribed fires on federal lands required suppression activities of some kind. In most cases these prescribed fires jumped a control line and suppression tactics were successfully used to control them. Out of the 1% of prescribed fires that required suppression, 90% were controlled without incident. Statistically, this result leaves about 0.1% of prescribed fires that required major suppression actions.

As a result of the potential risks associated with the implementation of Alternative 1, impacts to human health and safety would be adverse, minor to moderate, short to long-term.

Cumulative Impacts
Same as alternative 1.

Conclusion: Same as alternative 1.

Mitigation: Same as Alternative 1

Alternative 3 – *Mechanical Treatment Only*
Factors most likely to adversely impact firefighter health and safety include activities associated with wildland fire suppression efforts (accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, injuries from wildland fires). Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires. Alternative 3 does not allow the use of prescribed fire. Therefore the impacts from wildland fire are limited to wildland fire – wildfire. As noted throughout the environmental assessment wildfire rarely occurs in the park. Therefore fire impacts to the public and personnel are negligible.

Associated with fuels treatment operations are other hazards. The use of chainsaws and chippers create their own hazards, mainly minor to severe cuts.

Fuel break construction can pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for fuel reduction work. While each of the crew is trained in the use of firefighting equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning firefighter accreditation, and equipment and procedural safety guidelines would minimize accidents.

As a result of the potential risks associated with the implementation of Alternative 3, impacts to human health and safety could be adverse, minor to moderate, short to long-term.

Cumulative Impacts: Fuels treatment operations are inherently dangerous. Safety mitigation is practiced by firefighting personnel to help counter balance the potential injuries to the body. Impacts to personnel and others in the vicinity of any fire management operation could be minor to major, short-term or long lasting.
Conclusion: Same as alternative 1.

Mitigation: Same as Alternative 1

CULTURAL RESOURCES

National Park Service guidance for the management of cultural resources is found in the Cultural Resource Management Guideline (1997) and 2006 Management Policies and references therein. With regard to fire management actions, archeological resources, structures, cultural landscapes and ethnographic resources are regulated principally by the National Historic Preservation Act (NHPA, 1966, as amended), and Section 106 in particular under the terms of the 2008 Programmatic Agreement among the National Park Service, Advisory Council on Historic Preservation (ACHP), and National Conference of State Historic Preservation Officers (http://www.achp.gov/2008%20NATIONWIDE%20PA%20-%20SIGNED.pdf). Other major legislation with pertinence includes the Archeological Resources Protection Act (ARPA, 1978, as amended) and Native American Graves Protection and Repatriation Act (NAGPRA, 1990). Proper management of museum objects is dictated through 36 CFR 79.

NEPA recognizes three types of impacts—direct, indirect, and cumulative. Direct impacts are those that are caused at the same time and place as the action, indirect impacts occur later in time and at a distance, while cumulative impacts are additive. In regard to cultural resources, direct, operational and indirect impact categories are utilized. Direct impacts are those where the fire itself is the cause of the impacts, operational impacts occur as a result of associated operations like line construction or staging, while indirect impacts are ones where fire and/or associated operations result in changes to local context such that cultural resources will be impacted. As such, direct and operational impacts for cultural resources are the equivalent of direct impacts under NEPA, while indirect fire management impacts on cultural resources correspond to indirect and cumulative impacts.

Under NEPA, impacts also vary in terms of intensity and duration, and can be adverse or beneficial, which stands in contrast to the NHPA. For the purpose of this analysis, negligible impacts are the equivalent of a *No Historic Properties Affected* determination; minor impacts to *No Adverse Affect*; and moderate and major impacts equate to *Adverse Affect* (as defined in 36 CFR 800.5). With some exceptions, the duration of impacts to cultural resources from fires and fire management activities will be permanent or long-term. The NHPA takes only adverse impacts into account, although fire management actions such as reducing fuels around historic structures can have beneficial long-term impacts.

Under the NHPA, historic properties, those listed or determined eligible for listing in the NRHP, are the cultural resources against which assessment of impacts are made. Lewis and Clark NHP will consider all cultural resources lacking formal evaluation for NRHP eligibility to be historic properties. It may also be the case, however, that certain cultural resources which do not qualify as historic properties are desirable to protect from potentially adverse impacts. This might include remnants of resources in park post-dated the Lewis and Clark expedition, but contribute important interpretive information on the lifeways of early visitors and residents. As such, the goal is to minimize the effects of fire and fire management activities on those resources as well.

Direct Impacts

Cultural resources vary in terms of their susceptibility to direct fire impacts. Predicting whether a particular cultural resource or its attributes will be impacted by a given fire event, however, can be difficult. Buenger (2003) suggested the following variables are important in relation to direct impacts on cultural resources:

- Fuel model and load
- Fire behavior
- Peak temperature and duration of heating
- Proximity of resources to fuels
- Class of resource

The first three can be classified as fire variables, and the last two as cultural resource variables.

Fire Variables

Broadly speaking, fuels in Lewis and Clark NHP include timber, shrubs and grasses. Timber is represented by standing and fallen trees, such as those characteristic of the Sitka spruce forest. Brush includes both native and non-native species, such as salal and Scot's broom, that are either embedded as understory within forested areas or are mixed with other early successional species on recently disturbed sites. Native and non-native grasses occur as understory components of forested areas and in areas prone to periodic disturbance such as sand dunes, unstable slopes and the margins of water bodies.

Wildland fires in Sitka spruce forest tend to burn actively only under very dry conditions characteristic of late summer/fall and when pushed by offshore winds. The typical fire behavior in these fuels will be a surface fire carried largely by understory vegetation and dead and downed materials. Under extreme conditions, however, passive or active crown fires can be anticipated, along with high overstory mortality. Sitka spruce forest also tends to contain very heavy surface fuels (e.g., fallen logs) and deep duff layers. With sufficient drying (<50% moisture content), these fuels will be partially or fully consumed through smoldering combustion, usually following the passage of the flaming front (whether a surface and/or crown fire).

Very high temperatures (700-1500+°C) are likely to be achieved during the flaming combustion phase of surface or crown fires. However, the majority of that heat will tend to be directed toward the atmosphere rather than the ground surface (the exception being very wind conditions that create a low flame angle). Furthermore, high temperatures tend to be maintained only as long as actively flaming combustion occurs (<1 hour). Very large flame lengths (30 m.) may be achieved under extreme conditions, as well as high potential for long-range spotting.

Following the passage of the flaming front, sufficiently dry surface fuels will begin to smolder. Peak temperatures reached during this phase are dependent on fuel moistures, but are generally lower than those achieved during flaming combustion (300-700°C). The duration of that heating, however, can be hours or even days. Further, unlike flaming combustion, heating during this phase is projected towards the ground. Generally speaking, the excellent insulation properties of soil tend restrict heating to the upper 10 or 15 cm. of the mineral soil profile, with

highest temperatures and longest duration occurring beneath and around heavy fuels like stumps, logs and roots.

Shrub fuels will tend to burn as crown fires. Temperatures reached during flaming combustion are likely to be somewhat lower than those in timber (500-1000°C), and duration of that heating should be shorter as well. If sufficient fuel remains following the passage of the flaming front, it may be consumed through smoldering combustion.

Grasses exhibit surface fire behavior. Fire spread tends to be rapid, temperatures are lower than timber or shrubs (<500°C), and the duration of that heating tends to be very short (minutes to seconds). Because most fuel is consumed during the flaming combustion phase, long duration soil heating generally does not occur.

Cultural Resource Variables

The vulnerability of a given cultural resource to direct impacts is influenced by the material characteristics of that resource, as well as the spatial relationship between it and burning fuels. In regard to the former, materials comprising the cultural resources at Lewis and Clark NHP vary in terms of vulnerability to direct fire impacts (see Appendix C *Vulnerability of Common Cultural Materials at Lewis and Clark NHP to Direct Fire Impacts*). Given the data on fire variables presented above, the damage thresholds for many of these materials, if sufficiently exposed, would likely be exceeded during fires under present fuel loads and arrangements. Further, it is important to note that temperature and duration are inversely related; in other words, the longer a material is exposed to heating, the lower the temperature required to reach any damage threshold(s), and the opposite is also true. Although the complexities of this relationship are still poorly understood, the results of controlled experiments are informative. For example, hydration rinds on obsidian artifacts cease to be visible when exposed to temperature of 400-500°C for 1 hour or less, whereas it requires up to 12 hours of exposure to obtain the same outcome at temperatures of 200°C (Skinner et al. 1997; Solomon 2002). This is of particular interest because smoldering combustion—during which fairly low temperatures are maintained for very long durations—will be a common occurrence in heavy ground and surface fuels characteristic of many forested areas of Lewis and Clark NHP.

With respect to spatial relationships, surface and crown fires, where the majority of energy is released into the atmosphere, pose the greatest threat to cultural resources located on and above the surface of the ground like standing structures and vegetation. Materials that are in direct contact with the flaming zone are most prone to impacts, although during flaming combustion, objects within several meters of the flaming zone can be affected. Further, flammable resources like structures can be ignited by embers lofted over long distances. Smoldering combustion poses the greatest threat to resources located below and within surface and ground fuels (e.g., logs, litter, duff) and at and just below the mineral soil interface. Resources deeply buried (>20 cm.) within mineral soils, like subsurface archeological sites, are unlikely to experience direct impacts except on an extremely localized scale (e.g., burned out roots). Archeological data from Lewis and Clark NHP appear to indicate that a vast majority of the documented resources are located below the mineral soil surface, whether buried by natural or artificial processes. That, combined with the extremely dense ground cover, makes subsurface survey techniques like

shovel probes and remote sensing an important accompaniment to traditional pedestrian inventories.

In the case of common archeological resource, a distinction should be drawn between the direct impacts of fire on the physical integrity of a specimen (e.g., complete or partial destruction) and the loss of associated attribute data. For example, a chert projectile point might not break as a result of exposure to a grass fire, but other potentially important data such as artifact color or protein residues might be compromised. Direct effects to common cultural resource materials are briefly summarized in Appendix B.

The following generalizations can be made about direct impacts to cultural resources at Lewis and Clark NHP:

- Wildland fires in grass and, to a lesser extent, shrub fuels pose the least threat of direct impacts to cultural resources. The most vulnerable resource types would include those with a low heat tolerance (e.g., flammable materials) and/or those located directly on or above the ground surface.
- Wildland fires in timber threaten most cultural resources on or above the ground surface during the flaming combustion phase. Extreme burning conditions that promote crown fire behavior will result in extreme vegetation mortality. During smoldering combustion, cultural resources embedded within and located beneath heavy surface and ground fuels will be very susceptible to direct impacts, especially when fuel and duff moisture levels are low.
- Cultural resources located within mineral soil have low potential to experience direct impacts. These resources could, however, be altered by subsequent indirect impacts.
- Of above-ground cultural resources, wooden structures and vegetation are the most vulnerable to direct impacts. Concrete, rock and metallic features are less susceptible, although heavy fuel accumulations (e.g., logs) can result in long duration heating and significant impacts.

Even in areas with little or no vegetation, artificial fuel accumulations like burn piles and windrows along trails and roads may result in localized, long duration heating that could impact surface and shallowly buried cultural resources.

Operational Impacts

Operational impacts can be separated into those that cause physical impacts to cultural resources, and those that result in visual, auditory and ethereal intrusions.

<u>Physical</u>

Ground disturbance is perhaps the most common form of physical impact, and a host of fire management activities can result in ground disturbance within and adjacent to cultural resources. Common examples include the construction, improvement and use of firelines (removing vegetation and exposing mineral soil with hand tools, heavy machinery and explosives), safety zones, helispots and drop points, staging areas, and camps. Post-fire activities like mop-up, the

repair of suppression damages, and implementation of emergency stabilization treatments can have similar impacts.

Ground disturbance associated with planned undertakings, such as vegetation thinning and piling and constructing firelines for prescribed burns, can usually be implemented to avoid or minimize impacts to cultural resources. The same cannot always be said of unplanned ignitions, particularly if fire behavior is extreme and the values at risk are high. Alterations to cultural resources that are directly or indirectly related to ground disturbance include resource displacement and breakage, vegetation loss and soil compaction. Archeological resources are particularly prone to the effects of ground disturbance, but other cultural resource types can be altered as well.

Heavy surface and ground fuels characteristic of many areas of Lewis and Clark NHP dictate that large amounts of material must be moved to reach mineral soil. Any cultural resources in these areas would be subject to significant disturbances. Likewise, mop-up in these fuels is an extremely laborious process, requiring a great deal of digging and mixing of soils. Wettstaed (1993) described heavy damage to an archeological site resulting from mop-up, including extensive subsurface disturbance and artifact breakage from tool blows.

A large amount of vegetation can be manually or mechanically removed during fire management operations, both planned and unplanned. As noted, this can result in ground disturbance. Another aspect of vegetation removal related to cultural resources is the loss or alteration of significant vegetation associated with cultural landscapes. For example, a wildfire in proximity to structures might dictate rapid removal of a substantial amount of vegetation if adequate defensible space is not already present. Fire management operations can also introduce non-native invasive species, and/or promote the spread of exotics through disturbances (Brooks 2008).

Fire retardants, such as water and chemical derivatives, can physically impact cultural resources in variety of ways (Reed et al. 2007). For example, large amounts of water or chemicals can be delivered by aircraft, and the impact of these falling on a cultural resource could result in substantial damage. Likewise, high pressure deliveries through hoses and other means have damaged delicate historic fabrics, and liquid retardants applied to super-heated cultural resources could result in thermal shock.

The effects of chemical retardants on certain material types are well documented. For example, highly porous woods and stones are vulnerable to fertilizer salts (which attract water) and iron oxide dyes (which cause staining) in long-term retardants. Likewise foams and gels can promote water absorption that causes structural damage as a result of excess weight load as well as shrinking and swelling. Foams can also remove the protective coating on metals, resulting in hastened oxidation. In many cases, chemical retardants can only be partially removed, and then using extremely laborious methods.

Chemical retardants are extremely toxic in aquatic environments, but much less so in terrestrial settings, although ingestion in high concentrations is a concern for humans and wildlife.

Chemical retardants do not kill terrestrial vegetation, but the high fertility of long-term retardants could promote the growth of efficient nutrient users like exotic annual grasses.

Looting and vandalism of cultural resources by fire management personnel has been documented, mostly commonly during the suppression of wildfires (Traylor 1990). Generally speaking, archeological resources are the most susceptible to such impacts.

Visual, Auditory and Ethereal

Fire management operations can impact cultural resources in more subtle ways. Disturbances like noise, smoke, aircraft and people, whether associated with planned activities or unplanned ignitions, may intrude on important places. The temporary nature of these impacts may or may not negate their significance. For example, Native American tribes in northwestern California strongly objected to the presence of firefighting personnel on an important spiritual area (Barnard 2008).

Indirect Impacts

Indirect impacts can occur during an incident or project or at later point in time. Indirect impacts of greatest concern at Lewis and Clark NHP include erosion, tree mortality, carbon contamination, and looting.

It is well known that burned areas can exhibit amplified watershed response (Neary and Ffolliot 2005). The drivers behind this increase involve a combination of physical soil changes that reduce water infiltration and vegetation loss that limits water interception. Cultural resources in these areas are prone to impacts. For example,

- Sheet erosion mobilizes surface and shallowly buried artifacts.
- Rill and gully erosion downcuts through archeological deposits and linear features such as roads and trails.
- Sedimentation on toeslopes and footslopes can bury archeological sites and features.
- Increased flow on higher order streams may cause flooding and channel alteration such as undercutting and bank collapse, thus impacting any cultural resources in those areas.
- Cultural resources found in the path of debris flows and mud flows can be severely affected.

As described poorly-drained soils of sedimentary origin at Lewis and Clark NHP are prone to erosion. Further, mass wasting is a concern in the Fort Clatsop and Station Camp units.

Wildland fires can kill standing live trees and weaken snags and these will eventually topple. Any cultural resources located beneath or in the path of these falling trees can be severely impacted. For example, Hamm and Burge (2003) documented the loss of a historic cabin that was crushed by a fire-killed snag. Trees species at Lewis and Clark NHP tend to be very susceptible to fire mortality, and with the high winds in the region, post-fire treefall could be common.

Wildland fires can produce a lot of carbonized plant material. Gravity, wind, water, burrowing animals and other mechanisms may act to incorporate modern charcoal into archeological contexts. Among the implications are erroneous radiocarbon (C14) dates and misleading

paleoenvironmental reconstructions. Given the large amount of woody material, carbon production during fires at Lewis and Clark NHP will likely be substantial.

Wildland fires and thinning projects remove vegetation such that cultural resources become more exposed and/or accessible to the public. This can lead to looting and vandalism (Siefkin 2007). Evidence of looting has been previously documented at the units comprising Lewis and Clark NHP (Smith and Fagan 2003).

Mitigation:

- Prior to all fire management activities, cultural resources in treatment areas would be surveyed, identified and avoided;
- Fire retardant use would be prohibited within 100 feet of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park cultural resources manager or a designated representative would conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.
- In the event that archeological or historic materials are discovered during project activities, work in the immediate vicinity will be discontinued, the area secured, and the State Historic Preservation Office (SHPO) the Historic Preservation Officer (THPO) notified as appropriate.

Alternative 1 - *No ActionAlternative*

Under the *No Action Alternative* planned fire management activities would only occur in the area originally analyzed in the 2004 FMP EA. Under this alternative there would be 15 acres (2 projects – Reed Canary Grass Eradication Projects 1 and 2) broadcast burned in the grass fuel types. Impacts to subsurface artifacts from broadcast burning would be directly related to the duration of the burn. These types of burns are designed to burn out quickly as the fuels are flashy and the soil moisture below them is in many cases saturated. First Order Fire Effects modeling (FOFEM) indicates that under normal prescriptions the surface temperature will not exceed 21 degrees Celsius and the duration of heat is so short that minimal soil heating is expected.

Pile burning in this area would be minimal with proposed 6 activity centers (Boundary Protection Projects 1-4: with burning and Boundary Protection Project 5: without burning and Fuel Breaks/Access Points Project 1) see Appendix E, Figure 1 and App E Table 1 covering 30 acres. Disturbance in these areas would be focused on the areas where forest fuels are concentrated with crews utilizing cutting, loping, piling or scattering techniques to modify the fuel bed. These activities have the potential to expose artifacts covered by vegetation. In addition where the fuels propose a recognized hazard, further modification through burning of piles may be warranted. If pile burning is required the actual impacted burned area has been calculated to be 0.01acres/acre piled (28 square feet per pile with an average of 20 piles per acre). Pile burning could occur on 5 of the 6 activity centers (Boundary Protection Projects 2-5); cover a maximum of 20 acres and Fuel Breaks/Access Points Project 1 – 5 acres, or a burned impact area of 0.25 acres. Pile burning results in long duration burns generally consuming most fuels within the perimeter of the pile edge. The lack of large impact areas helps mitigate the actual impact to an

artifact, especially given the mitigation measures in place, pre-ignition. (See general mitigation measures)

Cumulative Impacts
Impacts to cultural resources from past, present, and reasonably foreseeable future activities including agriculture, development, and park management activities are negligible to major, short to long term. Past agricultural and logging practices had major, long term impacts on surface or near surface cultural resources due to ground disturbance from diking, plowing, crop planting, and grazing as well as skid road construction and subsequent yarding of timber.

Present and reasonably foreseeable activities have negligible and short term impacts on these resources. Mitigation measures are in place to avoid further impacts to cultural resources. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to cultural resources would be negligible to minor and short term.

Mitigation:

- Prior to all fire management activities, cultural resources in treatment areas would be surveyed, identified and avoided;
- Fire retardant use would be prohibited within 100 feet of any historic structure, unless there is imminent threat from wildfire to the historic structure;
- The park cultural resources manager or a designated representative would conduct an inspection and develop a plan to protect any existing or new cultural resources identified before and after prescribed fires.
- In the event that archeological or historic materials are discovered during project activities, work in the immediate vicinity will be discontinued, the area secured, and the State Historic Preservation Office (SHPO) the Historic Preservation Officer (THPO) notified as appropriate.

Alternative 2 – *Mechanical and Limited Prescribed Fire* (Agency Preferred Alternative)

Under the *Mechanical and Limited Prescribed Fire Alternative* planned fire management activities would occur throughout the park. Under this alternative there would be 35 acres (6 projects) broadcast burned in the grass fuel types. Impacts to subsurface artifacts from broadcast burning would be directly related to the duration of the burn. These types of burns are designed to burn out quickly as the fuels are flashy and the soil moisture below them is in many cases saturated. First Order Fire Effects modeling (FOFEM) indicates that under normal prescriptions the surface temperature will not exceed 21 degrees Celsius and the duration of heat is so short that minimal soil heating is expected.

Proposed mechanical treatment of vegetative fuels in this area encompassing 26 activity centers covering 161 acres are possible in this alternative, see Appendix E Table 2 for a list of proposed proposed projects and App E Figures 2-4 for proposed project locations. Projects range from mowing grass near structures to broadcast burning prairies for research. Disturbance in these areas would be concentrated on the areas where vegetative fuels are concentrated with crews utilizing cutting, loping, piling, mowing or scattering techniques to modify the fuel bed. These

activities have the potential to expose artifacts covered by vegetation. In addition where the fuels exhibit a recognized hazard, further modification through burning of piles may be warranted. If pile burning is required the actual impacted burned area has been calculated to be 0.01acres/acre piled (28 square feet per pile with an average of 20 piles per acre). Pile burning could occur on 12 of the 26 activity centers; cover a maximum of 71 acres, or a burned impact area of 0.71 acres. Pile burning results in long duration burns generally consuming most fuels within the perimeter of the pile edge. The lack of large impact areas helps mitigate the actual impact to an artifact, especially given the mitigation measures in place, pre-ignition. (See general mitigation measures)

Cumulative Impacts
Impacts to cultural resources from past, present, and reasonably foreseeable future activities including agriculture, development, and park management activities are negligible to major, short to long term. Past land development agricultural and logging practices had major, long term impacts on surface or near surface cultural resources due to ground disturbance from diking, plowing, crop planting, and grazing as well as skid road construction and subsequent yarding of timber. Modifications by private landowners prior to NPS management have also had impacts on cultural resources.

Present and reasonably foreseeable activities have negligible and short term impacts on these resources. Mitigation measures are in place to avoid further impacts to cultural resources. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to cultural resources would be negligible to minor and short term.

Mitigation: Mitigation is the same as Alternative 1.

Alternative 3 – *Mechanical Treatments Only*
Under the *Mechanical Treatments Only* Alternative planned fire management activities would occur throughout the park. Under this alternative there would no prescribed fire activities in the park. Therefore impacts from planned burning projects will not occur.

Proposed mechanical treatment of vegetative fuels in this area encompassing 19 activity centers covering 116 acres are possible in this alternative. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations. Disturbance in these areas would focus on areas where vegetative fuels are concentrated with crews utilizing cutting, loping, piling or scattering techniques to modify the fuel bed. These activities have the potential to expose artifacts covered by vegetation. Given the mitigation measures enacted prior to and during activities there is minimal chance of disturbance of known sites and procedures will be enacted to minimize impacts to newly uncovered sites. (See general mitigation measures)

Cumulative Impacts
Impacts to cultural resources from past, present, and reasonably foreseeable future activities including agriculture, development, and park management activities are negligible to major,

short to long term. Past private, public, agricultural and logging practices had major, long term impacts on surface or near surface cultural resources due to ground disturbance from plowing, crop planting, and grazing and yarding of timber.

Present and reasonably foreseeable activities have negligible and short term impacts on these resources. Mitigation measures are in place to avoid further impacts to cultural resources. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to cultural resources would be negligible to minor and short term.

Mitigation: Mitigation is the same as Alternative 1.

Conclusion:
There would be no new impacts to cultural resources from Alternatives 1, 2, or 3. Sites would be avoided and/or protected during project activities. The alternatives would allow for a proactive program that could plan manual fuel reduction and prescribed fire treatments in and around cultural resource sites to reduce the potential for wildland fire, thus protecting the sites during suppression activities. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from all of the alternatives and cumulative cultural resource impacts would be negligible to minor, localized, and short term.

PARK OPERATIONS/INTERAGENCY COOPERATION

Fire management requires skilled personnel respond quickly to evolving wildland fire incidents. Lack of highly qualified fire management staff based on site requires the park to work closely with other wildland firefighting agencies, in this case Oregon Department of Forestry, Washington Department of Natural Resources and local rural and city fire departments to act as initial responders to emerging wildfire incidents. Non-emergency fire management operations can also impact park operations, either through area closures, smoke impacts or safety concerns.

Related Laws, Regulations, and Policies

Implementation of Federal Wildland Fire Policy, 2006, requires park fire management embrace interagency cooperation. Director's Order 18, 2008 requires fire management planning be interagency in scope wherever possible. NPS Management Policies 2006 promotes interagency cooperation and supports park operations as a priority in decision-making processes.
In response to the above requirements the park as entered into the following agreement: COOPERATIVE AGREEMENT #H9420040011 between The United State Department of Interior, National Park Service, Lewis & Clark National Historical Park (formerly known as Ft. Clatsop National Memorial) and The Lewis and Clark Rural Fire Protection District

Impact Indicators, Criteria, and Methodology

Negligible: No impact to park operations and no requests for assistance from local firefighting organizations.

Minor Impacts: Park operations continue without a large commitment of staff to the fire management operation. Interagency contacts are aware of the fire management operations and are prepared to respond as a contingency force if needed.

Moderate impacts: Park operations modify their normal routine during the period of fire management activity and interagency firefighting organizations are committed to the activity for the short term.

Major Impacts: Park operations are impacted by the fire management activity as a priority, utilizing staff from all disciplines to assist during the period of operation. Interagency firefighting organizations are fully committed to the fire management activity as an emergency responder.

Impairment: For this analysis, impairment is considered a permanent change in a large portion of the overall acreage of the park, affecting the resource to the point that the park's purpose could not be fulfilled and the resource would be degraded precluding the enjoyment of future generations.

When these criteria were not applicable, and in the absence of quantitative data, best professional judgment prevailed.

Impacts to park operations and interagency cooperation were qualitatively assessed through determination of activities under each alternative that may affect park operations and the amount of support required from an interagency level. It is important to note that wildfires in the park are a rare occurrence, no wildfires detected in the last 10 years.

Alternative 1 – *No Action*

Proposed activities that have potential to impact park operations and interagency cooperation includes wildland fire suppression and prescribed fires. Hazard fuel reduction projects have minimal potential to impact park operations. Wildfires are an unplanned event, and in the case of Lewis and Clark NHP also a rare event. Therefore the impacts from a wildfire suppression action are negligible.

Prescribed fires (broadcast burns) are a planned event and can have impacts to park operations and require support from local firefighting agencies. Table 28 shows the potential number of prescribed fire events proposed for Alternative1. During this planning cycle there could be a total of 2 broadcast burns (Reed Canary Grass Eradication Projects 1and 2), see App E Figure 1 and App E Table 1, which will require help outside of park personnel to accomplish. Area closures and use of park staff for interpretation, road control and other assigned duties will occur. This will be a minor to moderate impact on park operations for the duration of the project. Interagency impacts can be negligible to moderate depending on the actual commitment of the cooperator to the project.

It is important to note that handpile burning will impact park operations during the burning operation. Impacts require short-term closures around the area being burned, possible traffic control and interpretation staff, but unlike broadcast burns, handpile burning generally does not require support from local fire fighting organizations. During this planning period there is a potential for 5 handpile burning projects (Boundary Protection Projects 2-5 and Fuel Breaks/Access Point Project 1). A summary of fire management activities is shown in Table 28.

Table 28: Park Operations/Interagency Cooperation: Total Proposed Prescribed Fire Projects for Alternative 1

Year	Handpile Burning	Broadcast Burning
2011	Boundary Protection Project 1	0
2012	Boundary Protection Project 2	0
2013	Boundary Protection Project 3	0
	Fuel Breaks/Access Points Project 1	

2014	Boundary Protection Project 4	Reed Canary Grass Eradication Proj 1
2015	0	Reed Canary Grass Eradication Proj 1

The park has a limited number of permanent and seasonal personnel with which to operate. The fire management support is provided as a collateral duty by Olympic National Park's fire management staff. There will be a Memorandum of Understanding with the local fire districts, ODF, and Washington DNR to provide fire suppression support for wildland fires within the park. Assistance from the county fire department may be provided for prescribed fire support.

In the event of a significant wildland fire, fire personnel from Olympic National Park as well as personnel from the interagency community would travel to the park to relieve or assist the county firefighting resources with suppression actions. Mitigation measures to reduce impacts to park operation would include proactive public education and information programs to provide park visitors information with information about fire management activities.

Cumulative Impacts: Impacts to park operations and interagency cooperation from past, present, and reasonably foreseeable future activities including are negligible and short term. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to park operations or interagency cooperation would be negligible to minor and short term.

Conclusion: Alternative 1 *No Action* activities have the potential to affect park operations and interagency cooperation. Park operations may be affected through short-term area closures and commitment of staff time, although the periods of commitment and closures are directly tied to the projects. Commitments by interagency cooperators to projects are based on contingency plans for prescribed broadcast burns. There are few burns being proposed so the commitment is minor to moderate. Wildfire is rare in the park so should have negligible impacts on park operations as well as interagency cooperators.

Mitigation:

- Good communication and coordination with park staff and interagency cooperators will increase knowledge, understanding, and implementation of fire management activities.
- Meetings to discuss high profile projects and/or wildfires may be used to increase awareness of fire management activities.

Alternative 2 – *Agency Preferred Mechanical and Limited Prescribed Fire Option*

Proposed activities that have potential to impact park operations and interagency cooperation includes wildland fire suppression and prescribed fires. Hazard fuel reduction projects have minimal potential to impact park operations. Wildfires are an unplanned event, and in the case

of Lewis and Clark NHP also a rare event. Therefore the impacts from a wildfire suppression action are negligible.

Prescribed fires (broadcast burns) are a planned event and can have impacts to park operations and require support from local firefighting agencies. Table 29 shows the potential number of prescribed fire events proposed for Alternative 2. See App E Table 2 for a list of proposed projects and App E Figures 2-4 for proposed project locations. During this planning cycle there could be a total of 6 broadcast burns which will require help outside of park personnel to accomplish. Area closures and use of park staff for interpretation, road control and other assigned duties will occur. This will be a minor to moderate impact on park operations for the duration of the project. Interagency impacts can be negligible to moderate depending on the actual commitment of the cooperator to the project.

It is important to note that handpile burning will impact park operations during the burning operation. Impacts require short-term closures around the area being burned, possible traffic control and interpretation staff, but unlike broadcast burns, handpile burning generally does not require support from local fire fighting organizations. During this planning period there is a potential for 12 handpile burning projects. A summary of fire management activities is shown in Table 29.

Table 29: Park Operations/Interagency Cooperation: Total Proposed Prescribed Fire Projects for Alternative 2

Year	Handpile Burning	Broadcast Burning
2011	1	0
2012	2	1
2013	4	1
2014	2	2
2015	3	2

The park has a limited number of permanent and seasonal personnel with which to operate. The fire management support is provided as a collateral duty by Olympic National Park's fire management staff. There will be a Memorandum of Understanding with the local fire districts, ODF, and Washington DNR to provide fire suppression support for wildland fires within the park. Assistance from the county fire department may be provided for prescribed fire support.

In the event of a significant wildland fire, fire personnel from Olympic National Park as well as personnel from the interagency community would travel to the park to relieve or assist the county firefighting resources with suppression actions. Mitigation measures to reduce impacts to park operation would include proactive public education and information programs to provide park visitors information with information about fire management activities.

Cumulative Impacts: Impacts to park operations and interagency cooperation from past, present, and reasonably foreseeable future activities including are negligible and short term. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from this alternative and cumulative impacts to park operations or interagency cooperation would be negligible to minor and short term.

Conclusion: Alternative 2 *Mechanical and Limited Prescribed Fire Option* activities have the potential to affect park operations and interagency cooperation. Park operations may be affected through short-term area closures and commitment of staff time, although the periods of commitment and closures are directly tied to the projects, the result being short-term minor to moderate impacts to park operations. Commitments by interagency cooperators to projects are based on contingency plans for prescribed broadcast burns. There are 6 broadcast burns over 5 years being proposed so the commitment is minor to moderate. Wildfire is rare in the park so should have negligible impacts on park operations as well as interagency cooperators.

Mitigation: Same as alternative 1

Alternative 3 – Mechanical Treatments Only
Impacts to park operations would be less than those in Alternative 1 and 2. The reason for this is that in Alternative 3 there is no prescribed fire allowed. The commitment for park staff support is less as there would not be a need to deal with the direct effects of burning, smoke, traffic control and monitoring. Therefore this alternative would have negligible to moderate impacts on park staff. Closures associated with work zones would have similar impacts to park operations as alternatives 1 and 2. The difference is that there will not be a follow-up period at the same site to reinstitute closures during a burning operation. In alternative 3 there are proposed to have 19 projects distributed across the park. See App E Table 3 for a list of proposed projects and App E Figures 5-7 for proposed project locations. A summary of fire management activities is shown in Table 30.

Table 30: Park Operations/Interagency Cooperation: Total Proposed Prescribed Fire Projects for Alternative 3

Year	Manual Fuel Treatments
2011	4
2012	4
2013	4
2014	3
2015	4

Impacts to interagency cooperators are negligible in this alternative. Without burning there is not a need for contingency forces to respond to escaped prescribed burns, therefore the impact is negligible to interagency cooperators.

Cumulative Impacts
Cumulative impacts from this alternative would be the same as described under Alternative 1.

Conclusion
There would be less impact to park operations or interagency cooperation from Alternative 1 or 2. When viewed with past, present, and reasonably foreseeable future actions, there would be negligible cumulative contributions from all of the alternatives and cumulative park operations or interagency cooperation impacts would be negligible and short term.

Mitigation: Same as alternative 1

CHAPTER 5 - COORDINATION AND CONSULTATION

Scoping occurred between October 1st and November 15th. Notification of the FMP planning process was posted through the park's normal notification process, local newspapers and public notices. A total of 19 scoping letters were sent to individuals, organizations, and agencies requesting feedback on the fire management program. Along with letters, an attachment outlining the general park management direction and the fire management plan process was provided. A public meeting was held at park headquarters the evening of November 3rd with a turnout of approximately 25 individuals. A total of 23 comments were recorded and are on file in the Resources Office at Lewis and Clark National Historical Park. Six comments were concerned with coordination between the park and neighboring agencies. Five comments addressed concerns regarding the potential for fire to spread to neighboring properties, especially where there is a lot of "blowdown". Other comments were related to logistical issues, the ecological role of fire, and the difference between this plan and the previous fire plan.

Agencies that were contacted for information that assisted in identifying issues, or that will be given the opportunity to review and comment on this environmental assessment include:

Federal Agencies:

Department of Interior: U.S. Fish and Wildlife Service – Western Washington Office and Western Oregon Office

State Agencies:

Washington State Department of Natural Resources: Pacific Cascade Region
Washington State Department of Fish and Wildlife: Coastal Region 6
Washington State Department of Parks and Recreation
WA State Historic Preservation Office

Oregon Department of Ecology
Oregon Department of Forestry
OR State Historic Preservation Office

Other Groups and Individuals
Outreach to all other groups or individuals on the park's mailing list.

Regulatory Compliance

U.S. Fish and Wildlife Service
Section 7 of the ESA, Interagency Cooperation, is the process used to ensure that the actions taken by federal agencies do not jeopardize the existence of any listed species. This process is intended to involve the identification and resolution of species conflicts in the early stages of project planning. The USFWS was sent a letter to inform them of the initial scoping period in

the fall of 2010. NPS will continue to consult with the western Oregon and Washington USFWS offices as part of its ongoing compliance with Section 7 consultation. NPS will undertake consultation through its established communication channels and practices.

State and Tribal Historic Preservation Officers
The NPS initiated the Section 106 consultation on March 15, 2011, when the park sent a letter and proposed design of an archeological survey of Trail A to the Oregon SHPO, Clatsop-Nehalem Confederated Tribes, Confederated Tribes of Siletz Indians, Confederated Tribes of the Grand Ronde and the Chinook Indian Nation. NPS will continue to consult with the Oregon SHPO, tribes, and interested parties, if appropriate, as part of its ongoing compliance with Section 106 consultation. NPS will undertake consultation through its established communication channels and practices.

Oregon Department of Environmental Quality
Because the Preferred Alternative includes some prescribed burning of piles and research burns, the Oregon DEQ has requested notification concerning such activities, to ensure compliance with their regulations. The NPS will send them a letter notifying them of the upcoming comment period.

Review and Comment Period

There will be a 30-day comment period on the EA. The plan will be available at http://parkplanning.nps.gov/fova and http://www.nps.gov/lewi and at the following libraries:

Astoria Public Library
450 Tenth ST
Astoria, OR 97103-4699
503-325-7323

Warrenton Community Library
861 Pacific Drive
OR 97121
(503) 861-3919

Comments may be submitted online at: http://parkplanning.nps.gov/lewi, or in writing to the following address:

Lewis and Clark National Historical Park
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APPENDICES

APPENDIX A: LIST OF ACRONYMS

ACHP	Advisory Council on Historic Preservation
ARPA	Archeological Resources Protection Act
BAER	Burned Area Emergency Rehabilitation
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CREST	Columbia River Estuary Study Taskforce
DEQ	Oregon Department of Environmental Quality
DNR	Washington Department of Natural Resources
DO	National Park Service Director's Order
DOI	Department of Interior
EA	Environmental Assessment
EDRR	Early detection, rapid response
EO	Executive Order
ESA	Endangered Species Act
FMP	Fire Management Plan
FY	Fiscal Year
GMA	Growth Management Act
GMP	General Management Plan
GS	General Schedule (Federal Salary descriptor)
IAC	Interagency Committee
IDT	Interdisciplinary Team
LEWI	Lewis and Clark National Historic Park
MIST	Minimum Impact Suppression Techniques
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act of 1969
NHL	National Historic Landmark
NHP	National Historical Park
NHPA	National Historic Preservation Act
NIFC	National Interagency Fire Center
NPS	National Park Service
OAR	Oregon Administrative Rules
ODF	Oregon Department of Forestry
PM	Particulate matter
RCW	Revised Code of Washington
RM	National Park Service Reference Manual
T&E	Threatened and Endangered

TSP	Total Suspended Particulates
USC	United States Code
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

APPENDIX B: GLOSSARY OF FIRE MANAGEMENT TERMS

Appropriate Management Response Specific actions taken in response to a wildland fire to implement protection and wildland fire use objectives.

Broadcast Burn Prescribed fire applied to wildland fuels scattered over an area (in contrast to "pile burns", where the fuels are placed into piles.)

Confinement Confinement is the strategy employed in appropriate management responses where a fire perimeter is managed by a combination of direct and indirect actions and use of natural topographic features, fuel, and weather factors.

Crown Fire A fire spreading through the crowns of trees.

Cultural Resources These resources include archeological sites, ethnographic information, cultural landscapes and historic structures.

Debris Disposal Debris disposal is burning of wildland fuels deemed infeasible or impractical to mechanically remove, and must be in a non-wildland fuel environment (parking lot, boneyard, gravel pit, etc.) Any material being burned for debris disposal must be classified as permissible to burn under applicable Federal, State, and Local regulations.

Designated Areas are critical areas in Washington State designated by the Department of Ecology that are otherwise subject to air pollution from other sources. These currently are Port Angeles, Spokane, Grays Harbor, Raymond, and the I-5 corridor from Bellingham south to Vancouver.

Emergency Fire Rehabilitation/Burned Area Emergency Rehabilitation (EFR/BAER) These are planned actions taken during and after a wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire.

Emergency Spill Response This is the response to any amount of a regulated waste or hazardous material that is spilled to the environment (air, land, surface waters, ground waters) that may detrimentally affect health, the environment, or property.

Fire Resources Fire resources are the people and equipment needed to manage or suppress wildland fires. These resources include, but are not limited to: overhead teams, firefighters, resource advisors, engines, helicopters, and retardant aircraft.

Fire Regime A generalized description of the role fire plays in an ecosystem. It is characterized by fire frequency, predictability, seasonality, intensity, duration, scale (patch size), as well as regularity or variability.

Fire Return Interval The number of years between two successive fire events in a given area.

Fire Suppression Activity Damage Emergency actions taken to repair or rehabilitate damage to lands, resources, and facilities directly attributable to the wildland fire suppression effort or activities.

Fireline Intensity This is the amount of heat released per unit time per unit length of fire line.

Hazard Fuels Excessive live and/or dead wildland fuel accumulations (either natural or created) having the potential to for the occurrence of uncharacteristically intense wildland fire.

Hazard Fuel Reduction Hazard fuel reduction projects remove excessive live or dead fuel to protect life and property, including communities at risk and municipal watersheds; natural resources, including critical native plant communities and their processes, and threatened and endangered species; and important cultural resources. These treatments, a variety of fire and non-fire techniques, include, but are not limited to, prescribed fire and wildland fire use, mechanical, chemical, biological, and manual methods.

Historic Value Structures Structures that are on the list of classified structures.

Holding Actions Planned actions required to achieve wildland and prescribed fire management objectives. For prescribed fires, these actions are developed to restrict the fire inside the planned burn unit. For fire suppression actions, holding actions may be implemented to prohibit the fire from crossing containment boundaries.

Initial Response An aggressive fire suppression action consistent with firefighter and public safety and values to be protected.

List of Classified Structures (LCS) The LCS is a computerized, evaluated inventory of all historic and prehistoric structures with historical, architectural, or engineering significance in which NPS has or plans to acquire any legal interest. Included are structures that individually meet the criteria of the National Register or are contributing elements of sites and districts that meet the National Register criteria. Also included are other structures - moved, reconstructed, and commemorative structures and structures achieving significance within the last 50 years - that are managed as cultural resources because of decisions reached through the planning process. The LCS assists park managers in planning, programming, and recording decisions of appropriate treatment.

Mechanical/Manual Treatment Manual treatment is the use of hand-operated power tools and handtools to cut, clear or prune herbaceous and woody species. It is a method of reducing hazardous accumulations of wildland fuels, and is often used to create defensible space near structures. In the park, manual treatment would be used to remove excess woody debris from the ground; remove “ladder” fuels, such as low limbs and brush (which could carry fire from the

forest floor into the crowns of trees); and thin dense stands of trees to reduce the horizontal continuity of fuels. Occasionally, larger mechanized equipment (a boom truck and front end loader, mower, or brush cutter) would be used to move large boles, maintain developed landscapes, or cut large areas of brush. Material cut or gathered through manual/ mechanical

treatment would usually be disposed of by piling and burning on site, or burning at an established burn pit. Other methods of disposal would include chipping and broadcast burning.

Minimum Impact Suppression Techniques (MIST) Minimum Impact Suppression Tactics (also referred to as Minimum Impact Techniques) are guidelines that assist fire personnel in the choice of procedures, tools, and equipment used in fire suppression and post-fire rehabilitation. These techniques reduce soil disturbance, impact to water quality, noise disturbance, intrusions in the wilderness, and cutting or trampling of vegetation.

Minimum Impact Tactics (MIT) An alternative term for Minimum Impact Suppression Tactics.

Natural Resources These resources include vegetation and wildlife (both terrestrial and aquatic), plus atmospheric, geologic and hydrologic features. The wilderness character of the park can be considered a natural resource or a social resource.

Pile Burning Burning of vegetative material that has been concentrated by manual or mechanical methods in a wildland fuels environment where fire may spread beyond the pile perimeter. A prescribed fire plan shall be written and approved prior to ignition for all pile burning.

Preparedness Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and resource management objectives through appropriate planning and coordination.

Prescribed Fire Any fire ignited by management actions to meet specific objectives. The fuels to be burned are in either their natural or modified state under specified environmental conditions (e.g. weather and fuel moisture), confined to a predetermined area, and within a range of fire intensity and rate of spread that permits attainment of planned management objectives and is conducted in conformance with an approved prescribed fire plan meeting National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) requirements prior to ignition.

Prescribed Fire Plan A plan required for each fire application ignited by managers. It must be prepared by qualified personnel and approved by the appropriate agency administrator prior to implementation. Each plan will follow specific agency direction and must include critical elements described in agency manuals.

Prescription Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Silvicultural Burning Under the Washington Clean Air Act, silvicultural burning means burning of wood fiber on forest land consistent with the provisions of RCW 70.94.660.

Smoke Sensitive Areas are special areas in and near the park where elevated concentrations of pollutants from smoke may cause human health or environmental impacts. They include areas of heavy recreational use and population centers outside designated areas.

Unplanned and Unwanted Wildland Fires: An unplanned and unwanted fire is one burning outside the parameters as defined in land use plans and fire management plans for that location (including areas where the fire can be expected to spread) under current and expected conditions. Unplanned and unwanted fires includes fires burning in areas where fire is specifically excluded; fires that exhibit burning characteristics (intensity, frequency, and seasonality) that are outside prescribed ranges, specifically including fires expected to produce severe fire effects; unauthorized human caused fires (arson, escaped camp fires, equipment fires, etc.); and fires that occur during high fire dangers, or resource shortage, where the resources needed to manage the fire are needed for more critical fire management needs.

Wildland Fire Any non-structure fire that occurs in the wildland.

Wildland Fire Decision Support System (WFDSS) A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire use action.

Wildland Fire Management Program The full range of activities and functions necessary for planning, preparedness, emergency fire suppression operations, and emergency rehabilitation of wildland fires, and prescribed fire operations, including non-activity fuels management to reduce risks to public safety and to restore and sustain ecosystem health.

Wildland Fire Suppression An response to wildland fire that results in curtailment of fire spread and eliminates all identified threats from a particular fire. All wildland fire suppression activities provide for firefighter and public safety as the highest consideration, but minimize loss of resource values, economic expenditures, and/or the use of critical firefighting resources.

Use of Wildland Fire The management of wildland fires to accomplish specific pre-stated resource management objectives in predefined geographic areas outlined in Fire Management Plans. Operational management is described in the Wildland Fire Decision Support System documentation.

Wildland Fuels Combustible material that can be consumed by fire which includes naturally occurring live and dead vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees, and excessive buildups of these materials resulting from resource management and other land use activities, as well as from natural plant growth and succession.

Wildland-Urban Interface The Wildland-Urban Interface is the area where homes and structures meet the natural environment of forests and wildlands.

APPENDIX C: VULNERABILITY OF COMMON CULTURAL MATERIALS AT LEWIS AND CLARK NHP TO DIRECT FIRE IMPACTS

This appendix briefly summarizes the vulnerability of materials comprising the cultural resources of the Native American and historical occupations at Lewis and Clark to direct fire impacts.

Native American Materials

Archeological materials comprising the Native American occupation of Lewis and Clark NHP include flaked and ground stone artifacts (cryptocrystalline silicates, fine to coarse-grain volcanic and metamorphic rock, obsidian) and midden constituents (ashy soil, bone, fire-cracked rock).

Cryptocrystalline silicates and fine to coarse-grain volcanic and metamorphic rocks are vulnerable to mineral oxidation and thermal fracturing at temperatures exceeding 300-500°C (Buenger 2003; Deal 2001). Prehistoric peoples frequently pre-heated cryptocrystalline silicates to improve flaking qualities, which often resulted in color and minor structural alterations that could be potentially masked by subsequent exposure to fire. Fine to coarse-grain volcanic and metamorphic rocks exhibit spalling, fracturing and oxidation when exposed to temperatures exceeding 300-500°C (Deal 2001). At 400-500°C, obsidian hydration rinds can be compromised (Loyd et al. 2002). Organic residues on flaked and groundstone artifacts can be compromised at temperatures ranging from 100-500°C (Deal 2001).

Midden constituents are variably affected by direct fire impacts. At temperatures above 200°C bone and antler combusts while calcination occurs at 700-1000°C (Buenger 2003). The impacts of fire on archeobotanical remains such as pollen and carbonized seeds are equivocal, while midden soils may undergo some chemical and physical alterations. Theoretically, the ability to age fire hearths with thermoluminesence dating (TL) could be compromised with exposure to high-intensity, long duration heating (Buenger 2003).

Historical Materials

Historical archeological materials occurring in Lewis and Clark NHP include primarily metals, glass, and ceramics. Common metals exhibit a wide range of melting points (Table 1), although damage (e.g., hastened oxidation) can occur when a given metal is exposed to temperatures below its melting point. Soda lime glass, commonly used for containers, windows, pressed and brown-ware and lighting products, has a melting temperature of about 695°C, while lead glasses melt at 380°C (Haecker 2000). Buenger (2003) documented thermal fracturing and spalling in glass exposed to temperatures in excess of 200°C. Potential direct impacts to ceramics are dictated by the characteristics of the paste, glaze, painted decorations, as well as the temperature

to which the artifact is exposed (Haecker 2000). Refined (i.e., glazed) earthenwares (e.g., ironstone, hotel wares) will crack and become discolored at even relatively low temperatures. Porcelains have a melting temperature of about 1,550°C, although overglaze paint decorations and makers marks can become discolored and/or eliminated at much lower temperatures.

Table 1. Melting Points of Metal Materials Commonly Found on Historical Archeological Sites

Material	*Temperature (°C)*	*Artifacts*
Aluminum	660	Kitchenwares
Brass (yellow)	932	Cartridge cases, military buttons and insignia
Cast iron	1,350 to 1,400	Kettles, Dutch ovens, wood stoves
Copper	1,082	Kitchenwares, building materials, coins
Gold	1,063	Coins, jewelry
Iron	1,540	Tools, nails, horseshoes, cans, corrugated roofing
Lead	327	Bullets
Nickel	1,455	Plating
Pot metal	300 to 400	Flatware, pots, faucets
Silver	960	Coins, jewelry
Solder (tin)	135 to 177	Patch repair on brass and iron objects
Steel (stainless)	1,427	Eating utensils, kitchenwares
Steel (carbon)	1,516	Heavy machinery parts
Tin	232	Kitchenwares, toys, building materials
White pot metal	300 to 400	Kitchenwares
Zinc	375	Plating for iron objects

Data from Haecker (2000).

Wood ignites at various temperatures depending on condition; exposed dimensional lumber typically ignites at 350°C (Haecker 2000). Concrete are vulnerable when exposed to high fire temperatures, with spalling, cracking, breakage and discoloration being the most common impacts. Native vegetation at Lewis and Clark NHP is poorly adapted to fire and will likely experience high mortality.

APPENDIX D: FIRST ORDER FIRE EFFECTS MODEL PRESCRIBED FIRE CULTURAL ARTIFACTS IMPACTS

TITLE: Results of FOFEM model execution on date: 4/20/2011

FUEL CONSUMPTION CALCULATIONS

Region: Pacific_West
Cover Type: FCC - 169-G-Grass-Mature-High-(None)-(none)
Fuel Type: Natural

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture (%)
Litter	0.23	0.23	0.00	100.0	999	
Wood (0-1/4 inch)	0.04	0.04	0.00	95.9	999	
Wood (1/4-1 inch)	0.20	0.04	0.16	17.8	999	22.0
Wood (1-3 inch)	0.00	0.00	0.00	0.0	999	
Wood (3+ inch) Sound	0.00	0.00	0.00	0.0	999	40.0
Wood (3+ inch) Rotten	0.00	0.00	0.00	0.0	999	40.0
Duff	0.53	0.15	0.38	28.3	2	130.0
Herbaceous	0.30	0.27	0.03	90.0	221	
Shrubs	0.00	0.00	0.00	0.0	23	
Crown foliage	0.00	0.00	0.00	0.0	37	
Crown branchwood	0.00	0.00	0.00	0.0	38	
Total Fuels	1.30	0.72	0.58	55.7		

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Duff Depth Consumed (in) 0.0 Equation: 6
Mineral Soil Exposed (%) 13.6 Equation: 10

Soil Heat Report

Cover Type.....: FCC - 169-G-Grass-Mature-High-(None)-(none)
Duff Depth.....: Pre-Fire: 0.25 cm., Post-Fire: 0.25 cm.

Soil Layer Maximum Temperature
(measurements are in centimeters and Celsius)

Depth	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Temp.	23	22	22	22	21	21	21	21	21	21	21	21	21	21
Time	490	509	523	537	550	561	570	578	585	590	594	598	599	1

Max Depth Having 60 degrees: - None -
Max Depth Having 275 degrees: - None -

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APPENDIX E: PROJECT DESCRIPTIONS/LOCATIONS BY ALTERNATIVE

No Action Alternative
Project Level Detail

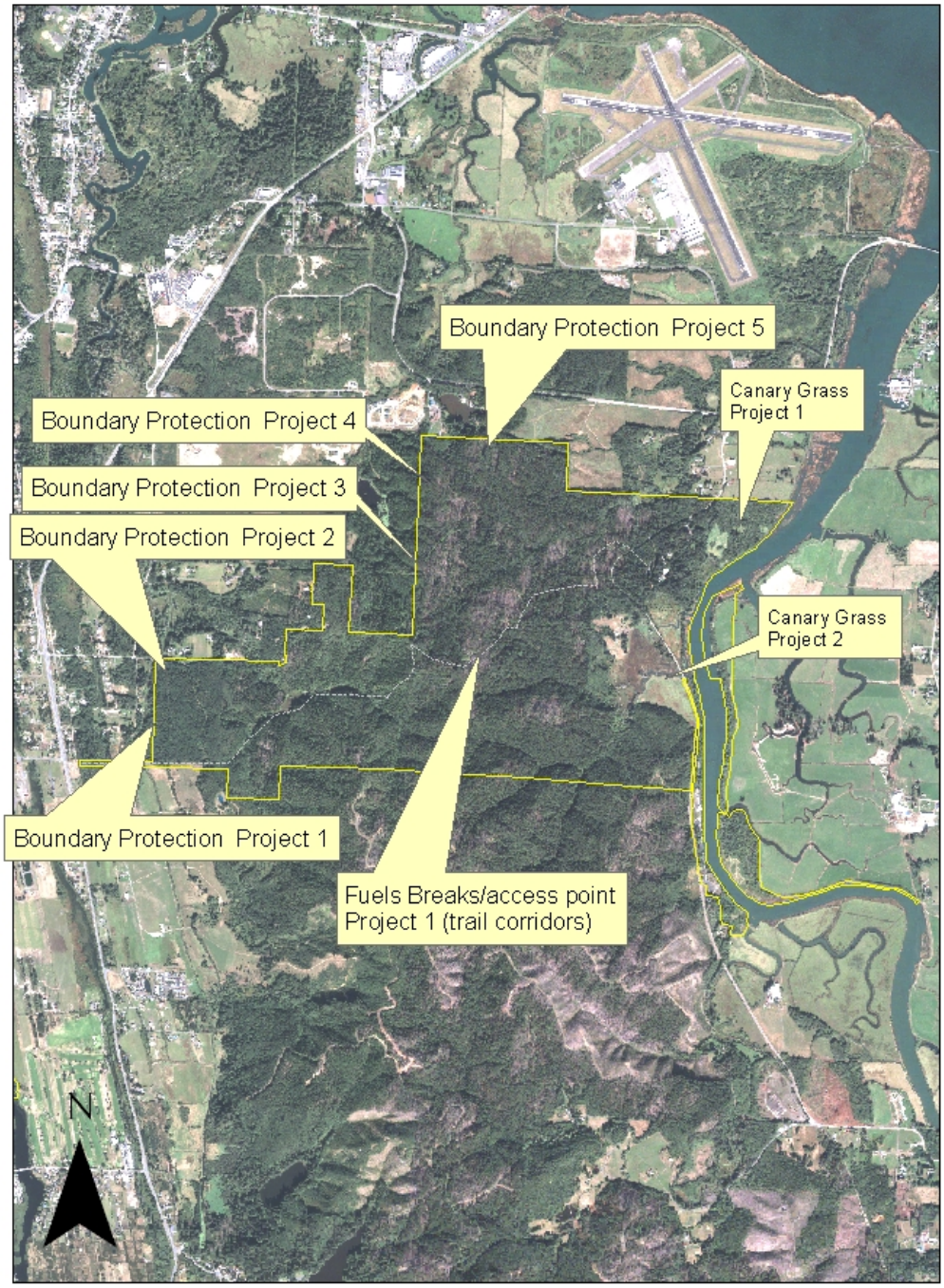
The *No Action Alternative* proposes 30 acres of mechanical/manual fuels reduction projects, 40 acres of prescribed burning, (25 acres of pile burning and 15 acres of broadcast burning). The 15 acres of broadcast burning involves invasive species eradication projects utilizing prescribed fire.

Table 1: No Action Alternative Project List

Year and Unit	Project Name	Type of Treatment	Acres	Notes
Fiscal Year 2011				
Clatsop	Boundary Protection Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Fiscal Year 2012				
Clatsop	Boundary Protection Project 2	Manual/ Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Fiscal Year 2013				
Clatsop	Fuel Breaks/Access Points Project 1	Manual/ Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later.
Clatsop	Boundary Protection Project 3	Manual/ Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later.
Fiscal Year 2014				
Clatsop	Boundary Protection Project 4	Manual/ Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Clatsop	Canary Grass Eradication Project 1	Rx Fire	10	Broadcast burn for canary grass control

Fiscal Year 2015				
Clatsop	Boundary Protection Project 5	Manual/ Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be removed where feasible, lopped and scattered, or handpile for burning later.
Clatsop	Canary Grass Eradication Project 2	Rx Fire	5	Broadcast burn for canary grass control

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations.



Legend

LEWI_parkbndy20081117

0 700 1,400 2,800 4,200 5,600 Feet

Agency Preferred: Mechanical and Limited Prescribed Fire Option
Project Level Detail

The Mechanical and Limited Prescribed Fire Alternative proposes 121 acres of mechanical/manual fuels reduction projects, 106 acres of prescribed burning, (71 acres of pile burning and 35 acres of broadcast burning). Broadcast burns include 20 acres of invasive species eradication utilizing prescribed fire, and 15 acres of research burns promoting prairie restoration.

Table 2 Agency Preferred Mechanical and Limited Prescribed Fire Option Proposed Five –Year Project Plan

Year	Project Name	Type of Treatment	Acres	Notes
Fiscal Year 2011				
Yeon	Boundary Protection Project A	Manual/Pile Burning	15	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning planned for 10 acres of area treated.
Yeon	Developed Landscape Project 1	Manual	2	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 1	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 1	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2012				
Yeon	Boundary Protection Project B	Manual/Pile Burning	10	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning planned for 10 acres of area treated.
Yeon	Developed Landscape Project 2	Manual	5	Developed landscape maintenance and defensible space preparation around Yeon house.

Clatsop	Boundary Protection Project 2	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later,
Clatsop	Canary Grass Eradication Project 1	Rx Fire	5	Prescribed burn in willow stand on the east bank of the Lewis and Clark River, in combination with herbicide treatment, to eradicate reed canary grass and Canada thistle, and prepare the land for revegetation with native plant species.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 2	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2013				
Yeon	Boundary Protection Project C	Manual/Pile Burning	9	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed. Pile burning may be planned for up to 5 acres of area treated.
Yeon	Developed Landscape/Interior Forests Project 1	Manual/Pile Burning	10	Thinning of Shore pine within interior forests to reduce canopy continuity and meet resource objectives. Material will be cut and/or piled, chipped, or removed. Pile burning may be planned for up to 5 acres of area treated.
Yeon	Research Burn Project 1	Rx Fire	5	Coastal prairie research burn.
Clatsop	Fuel Breaks/Access Points Project 1	Manual/Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later. Up to 5 acres of pile burning may occur.
Clatsop	Boundary Protection Project 3	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later,

Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 3	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2014				
Yeon	Research Burn Project 2	Rx Fire	5	Coastal prairie research burn
Yeon	Developed Landscape/Interior Forests Project 2	Manual/Pile Burning	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 4	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later,
Clatsop	Canary Grass Eradication Project 2	Rx Fire	10	Broadcast burn for canary grass control
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 4	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2015				
Yeon	Boundary Protection Project D	Manual/Pile Burning	5	Manual thinning project along strategic fuel breaks (roads, trails). Material will be removed where feasible, lopped and scattered, or handpiled for burning later. Up to 5 acres of pile burning may occur.
Yeon	Developed Landscape/Interior Forests Project 3	Manual/Pile Burning	10	Developed landscape maintenance and defensible space preparation around Yeon house. Up to 6 acres of pile burning may occur.
Yeon	Research Burn Project 3	Rx Fire	5	Coastal prairie research burn

Clatsop	Boundary Protection Project 5	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be lopped and scattered or where deemed necessary removed or handpiled for burning later. Up to 5 acres of treated area may occur.
Clatsop	Canary Grass Eradication Project 3	Rx Fire	5	Broadcast burn for canary grass control
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 5	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations.

Figure 2: Project Locations: Agency Preferred: Mechanical and Limited Prescribed Fire Option Proposed Projects: Clatsop Unit Projects

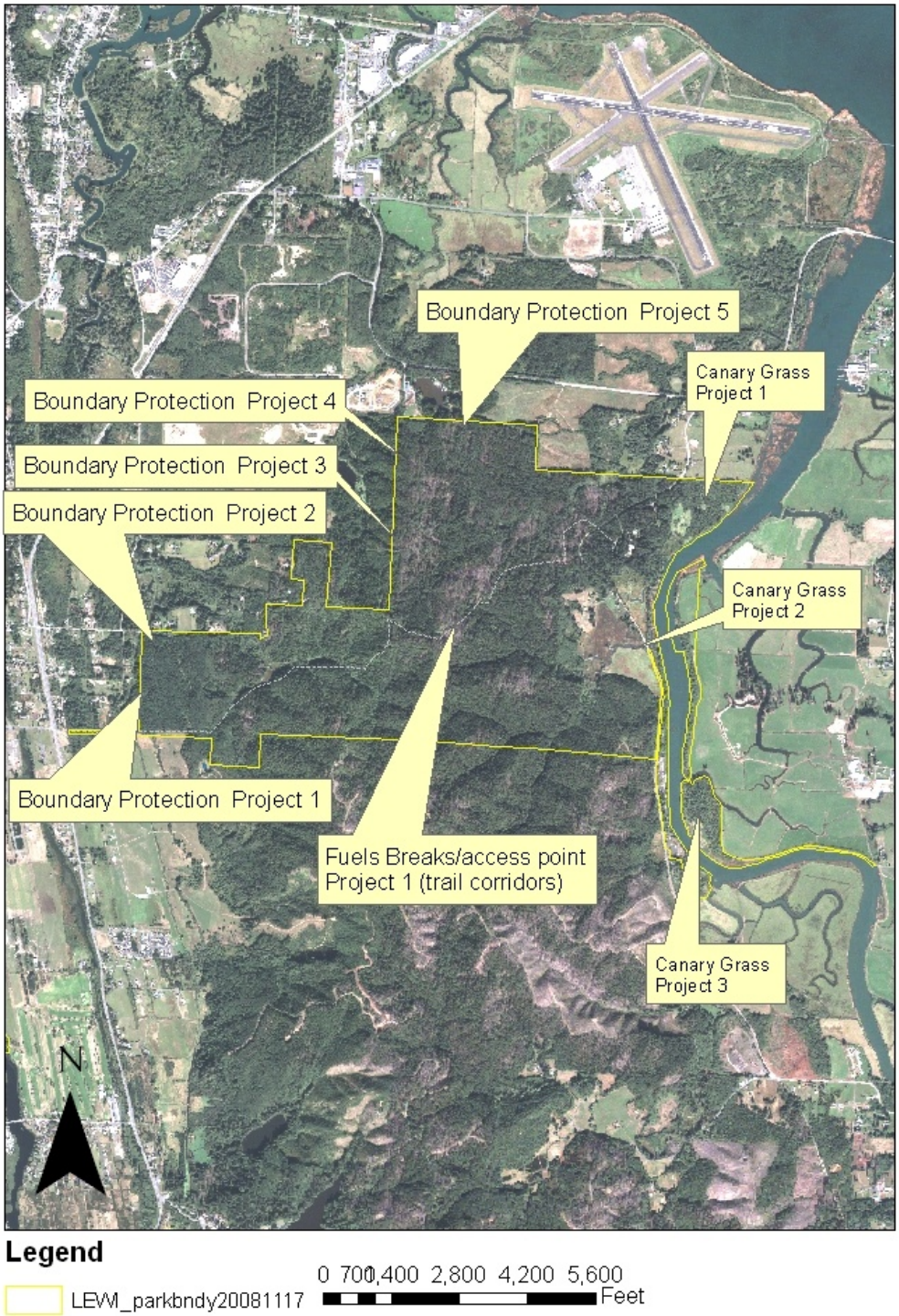


Figure 3: Project Locations: Mechanical and Limited Prescribed Fire Option Proposed Projects Yeon Unit Projects

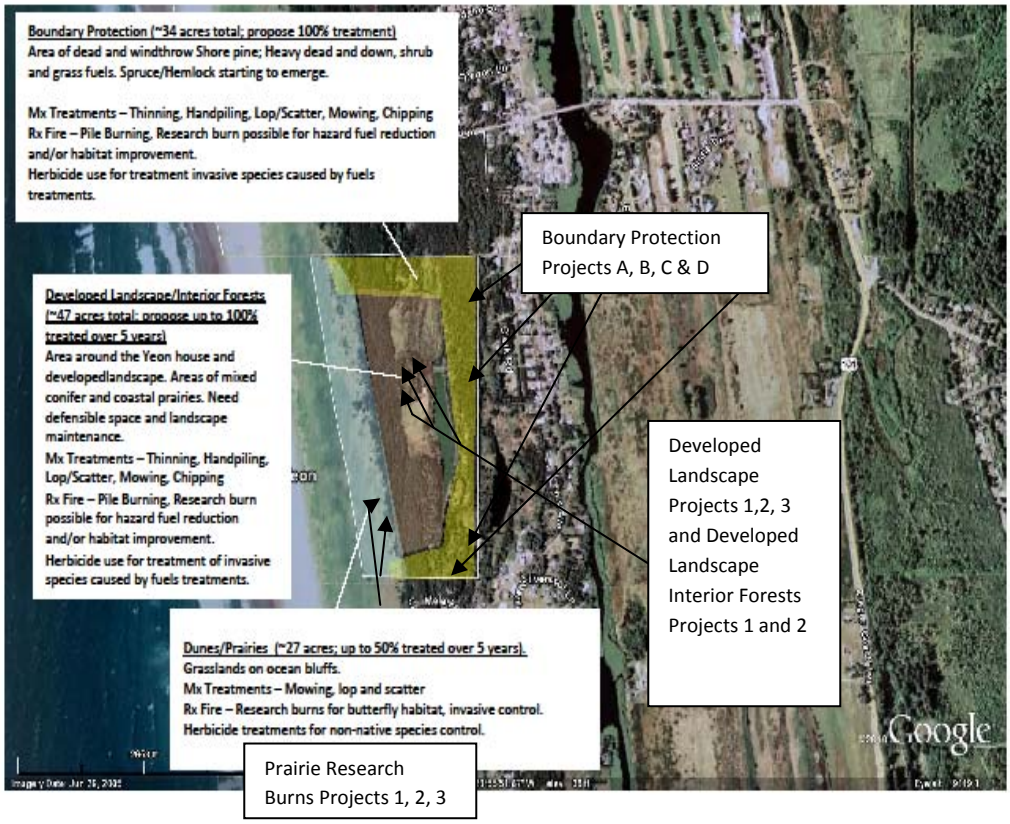
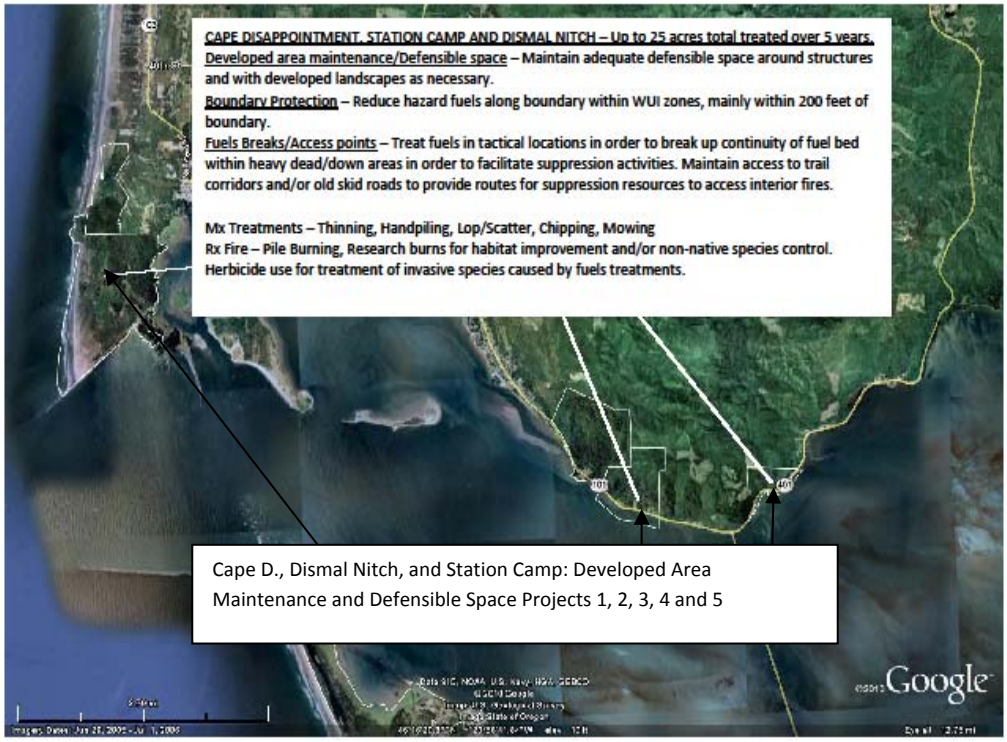


Figure 4: Project Locations: Mechanical and Limited Prescribed Fire Option Proposed Projects

Cape D., Station Camp and Dismal Nitch Projects



The Mechanical Treatments Only Alternative
Project Level Detail

The Mechanical Treatments Only Alternative proposes 116 acres of mechanical/manual fuels reduction projects, of which 57 acres of invasive species eradication/forest restoration projects are included.

Table 3: Mechanical Treatments Only Proposed Five – Year Plan

Year	Project Name	Type of Treatment	Acres	Notes
Fiscal Year 2011				
Yeon	Boundary Protection Project A3	Manual	10	Manual thinning project on the east side of the property. Material will be cut, lopped/scattered, chipped, and/or removed.
Yeon	Developed Landscape Project 1	Manual	2	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 1	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2012				
Yeon	Boundary Protection Project B3	Manual	10	Manual thinning project on the east side of the property. Material will be cut, lopped/scattered, chipped, and/or removed.
Yeon	Developed Landscape Project 2	Manual	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 2	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.

Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 2	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2013				
Yeon	Boundary Protection Project C3	Manual	9	Manual thinning project on the east side of the property. Material will be cut and/or piled, chipped, or removed.
Yeon	Developed Landscape/Interior Forests Project 1	Manual	10	Thinning of Shore pine within interior forests to reduce canopy continuity and meet resource objectives.
Clatsop	Fuel Breaks/Access Points Project 1	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 3	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2014				
Yeon	Developed Landscape/Interior Forests Project 2	Manual	5	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 3	Manual/Pile Burning	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 4	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.
Fiscal Year 2015				
Yeon	Boundary Protection Project D3	Manual	5	Boundary fuel reduction maintenance.

Yeon	Developed Landscape/Interior Forests Project 3	Manual	10	Developed landscape maintenance and defensible space preparation around Yeon house.
Clatsop	Boundary Protection Project 4	Manual	5	Manual thinning project along park boundary adjacent to west boundary to provide fuel break. Material will be cut, lopped/scattered, chipped, and if deemed necessary removed.
Cape D. Station Camp Dismal Nitch	Developed area maintenance and defensible space Project 5	Manual	5	General developed area landscape maintenance consisting of mowing, roadside clearing, and cord trimming.

NOTE: Projects listed are prioritized by potential risk of unplanned fire to life and property with highest priorities listed for FY11. Project scheduling is subject to change due to project funding and park management considerations.

Figure 5: Project Locations. Alternative 3: Mechanical Treatments Only, Clatsop Unit

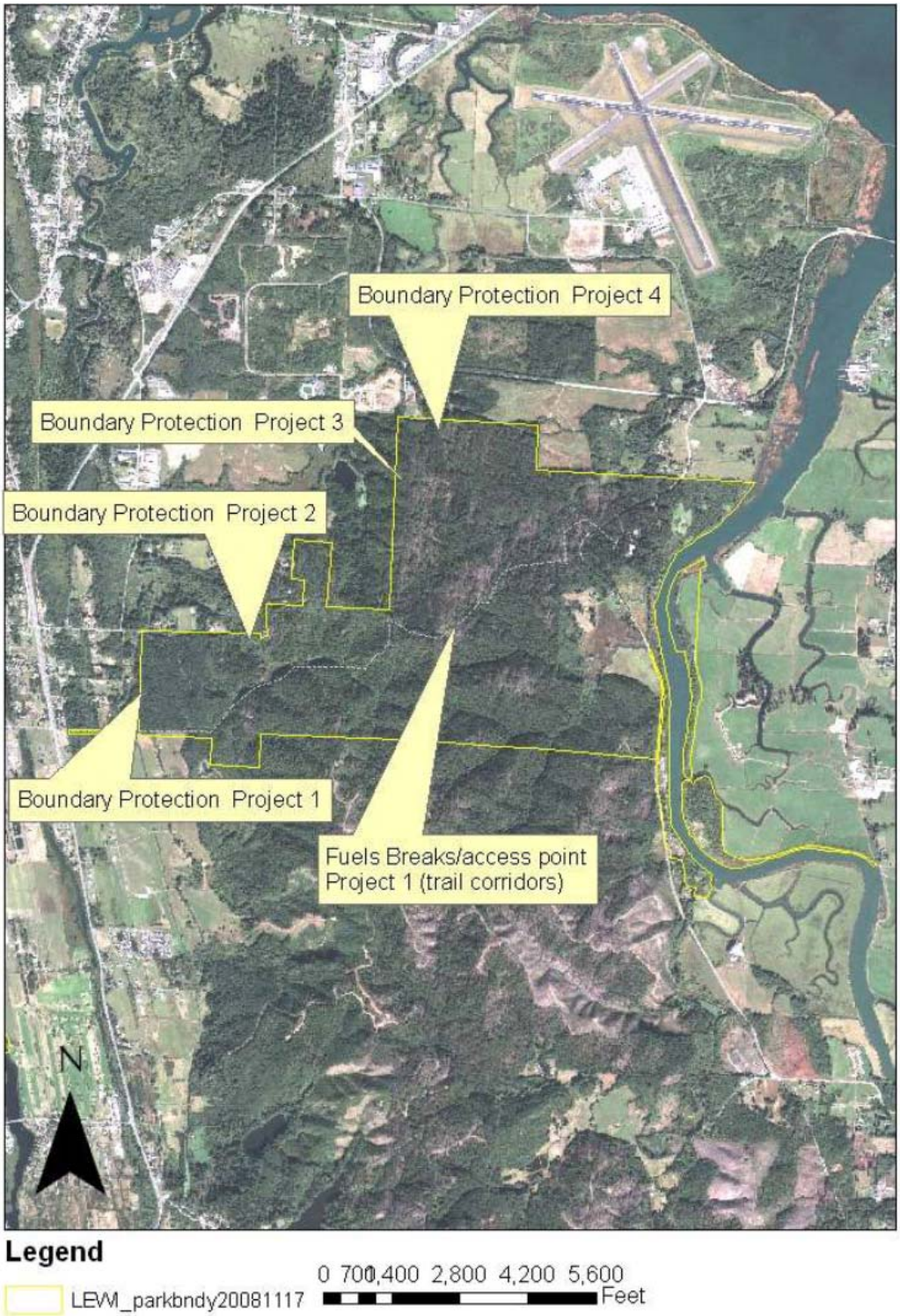


Figure 6: Project Locations. Alternative 3: Mechanical Treatments Only, Yeon Unit

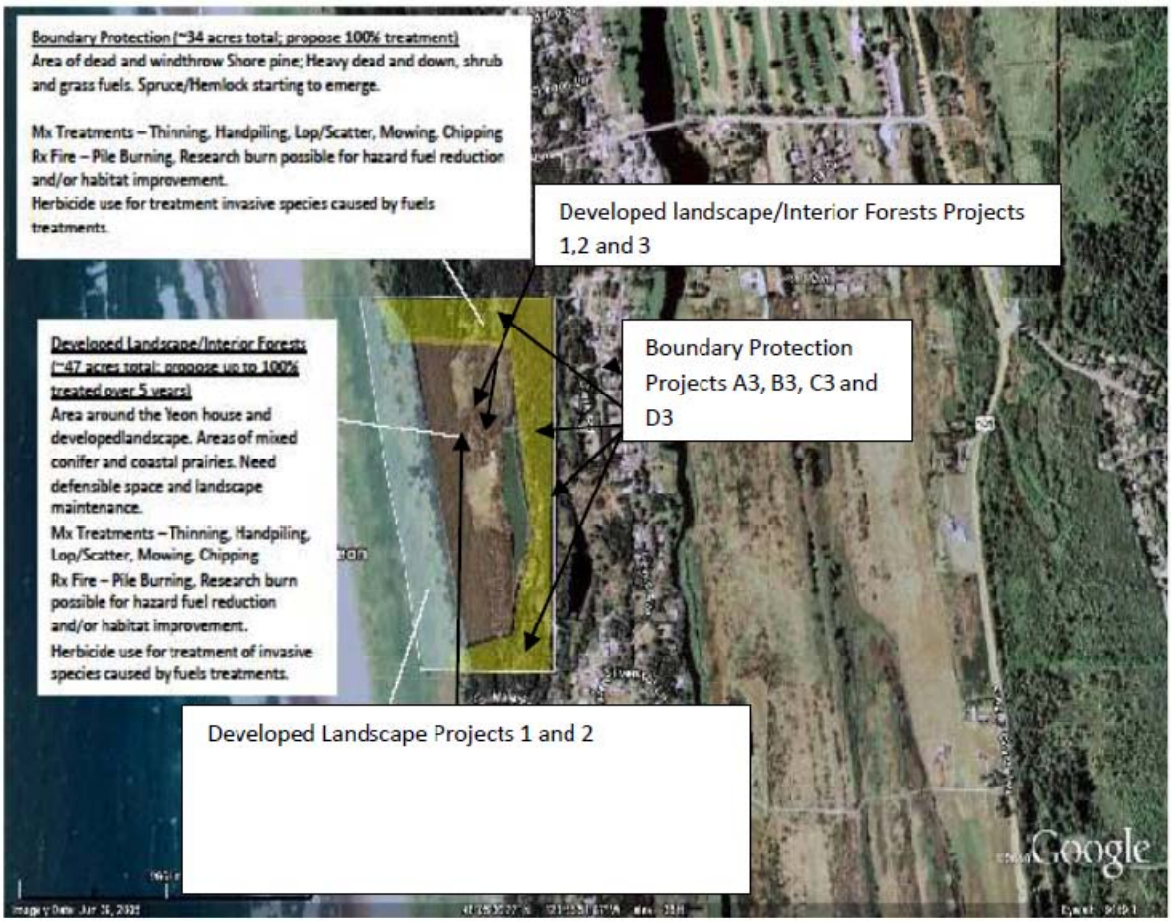
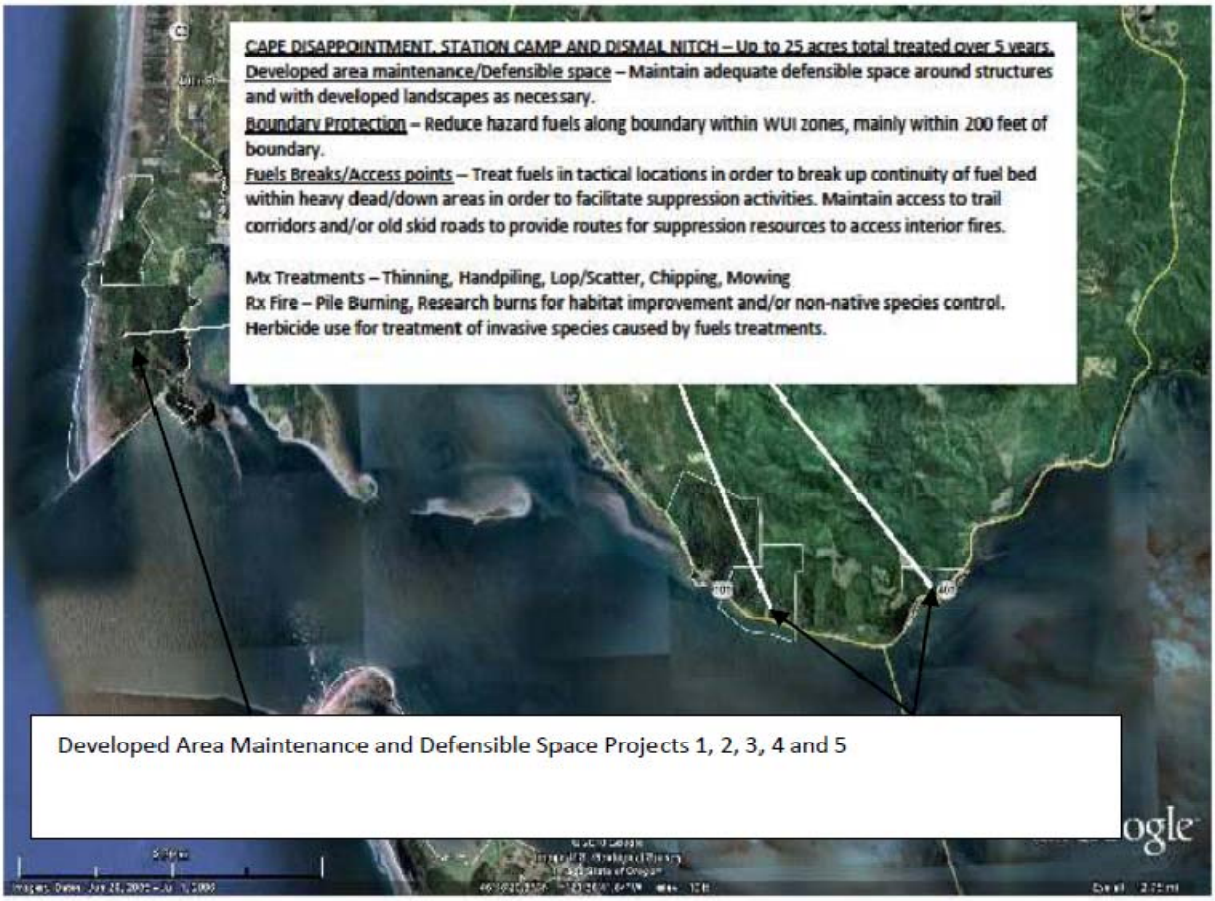



Figure 7: Project Locations. Alternative 3: Mechanical Treatments Only, Cape D, Station Camp, and Dismal Nitch Units