

OPERATIONAL STRATEGY FOR THE FIRE MANAGEMENT PLAN

Golden Gate National Recreation Area

April 2008



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INTRODUCTION

The Fire Management Plan (FMP) for Golden Gate National Recreation Area (GGNRA) is an operational manual containing the standards, practices and guidelines in use by the Fire Management Branch of the Law Enforcement Division of GGNRA for conducting actions within the 15,700 acres of primary jurisdiction (see Figure 1, GGNRA Lands). The legislative boundary of GGNRA is much larger than the area of primary jurisdiction and covers 74,816 acres in Marin, San Francisco and San Mateo counties. The majority of these lands are administered by agencies other than the National Park Service (NPS) such as the California State Department of Park and Recreation, the San Francisco Public Utilities Commission (San Francisco Watershed Lands), the Presidio Trust¹, the San Mateo County Parks and Recreation Division and the Marin Municipal Water District. An additional 15,400 acres of GGNRA lands on Bolinas Ridge in Marin County are managed by Point Reyes National Seashore (PRNS) under an agreement between PRNS and GGNRA; this area is covered in the PRNS FMP.

For purposes of the FMP, GGNRA will be used to refer to the 15,700 acres directly managed by the NPS through GGNRA and those parcels that will soon pass to the management of GGNRA. The latter category includes Cattle Hill and Pedro Point in the San Mateo County adjacent to the City of Pacifica.

The FMP provides a framework for prioritizing, developing and implementing the fire management group's prevention and fuels reduction programs, conducting prescribed burns with resource benefit objectives and advance planning for response to wildland fires within the jurisdictional area. The FMP was built upon guidance provided by the fire management section of the NPS Management Policies (2006) and current Federal Wildland Fire Management Policy (2001). Federal wildland fire policy stresses the importance of the protection of the lives and safety of firefighters and the public, public and private property, and the protection, restoration and rehabilitation of the natural and cultural resources on federally-managed lands.

The fire management strategy to be implemented by this FMP was the subject of an Environmental Impact Statement (EIS) prepared by the NPS that underwent public review and comment, as required by the National Environmental Policy Act (NEPA). As part of the NEPA process, conformance requirements for the Endangered Species Act, the National Historic Preservation Act (NHPA), the Magnuson-Stevens Fishery Conservation and Management Act and the Coastal Zone Management Act were met.

FMP goals and specific strategies were developed and assessed for potential impact during the NEPA process, which concluded with signature of the Record of Decision

¹ The Presidio Trust manages the interior acres of the Presidio of San Francisco (Area B); the NPS manages the coastal areas (Area A). However, Congress made both management areas a part of GGNRA.

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(ROD) by the NPS Pacific West Regional Director on February 24, 2006. Mitigation measures included in the FMP EIS or recommended by the regulatory agencies for conformance with the Endangered Species Act regulators were adopted by the NPS as part of the ROD and are now incorporated into this operational FMP for GGNRA and included as Appendix D. The mitigation measures will be assigned to FMP projects by the interdisciplinary team review required for each project by NEPA project review and NHPA quintex review, processes that ensure regulatory conformance. Conformance requires that the impacts of implementing the fire management program remain within the levels anticipated during the NEPA process and do not result in impacts on the environment greater than those assumed when the ROD was adopted.

The FMP is organized to present the current strategies and tactics for the range of actions undertaken by the GGNRA Fire Management Branch. Program operations addressed include preparedness, prevention, suppression, fuels management, rehabilitation, fire communication and education, monitoring and fire and fuels research. The FMP is written to be used as a reference by GGNRA staff as they plan and implement fuel reduction, resource protection and rehabilitation projects and strategize for and conduct suppression actions.

1. FOUNDATION OF THE FMP

Federal agencies that manage large tracts of public land having vegetation capable of sustaining wildland fire are required by federal policy to develop FMPs and to ensure that the FMPs be updated to keep current with periodic changes to federal wildland fire management policy and must undergo NEPA and other environmental regulatory requirements. The GGNRA FMP develops the implementation strategy selected by the NPS Pacific West Regional Director at the conclusion of a multi-year EIS process involving public and regulatory agency consultations. The Operational FMP provides a framework for all fire management activities and the management of wildland fire and prescribed fire as a tool to safely accomplish protection and resource management objectives on NPS lands.

The ROD that concluded the NEPA process is Appendix C to this FMP; the Mitigation Measures adopted through the ROD are Appendix D. Together these documents summarize the findings of the EIS regarding the selected strategy, describe the decision taken and the decision-making process and list the specific procedures to protect the environment the NPS will follow when implementing FMP projects. The Operational FMP which provides specific implementation detail is grounded in the goals, objectives and implementation strategy developed in the NEPA process and is circumscribed by the park's commitment to the public and regulators to abide by the mitigation measures adopted through the ROD.

1.2 RELATIONSHIP TO FEDERAL FIRE MANAGEMENT POLICY

NPS fire management actions must conform to adopted plans and policies of the Department of the Interior and the National Park Service. These include the Federal Wildland Management Policy, NPS Management Policies (2006), Director's Order #18 (2005) and Reference Manual #18 (2006b), the guidance documents for wildland fire management in the NPS, as well as the General Management Plan and resource management plans for GGNRA.

1.2.1 Federal Wildland Fire Management Policy (2001)

In 2001, the Interagency Federal Wildland Fire Policy Review Working Group revised and updated the Federal Wildland Fire Management Policy (NIFC 2001), which applies to all federal land management agencies. The key element of the policy is that firefighter and public safety is the first priority. In addition, the policy states that fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. The policy also directs that fire management plans and programs will be based on a foundation of sound science. Research will support ongoing efforts to increase our scientific knowledge of biological, physical, and sociological factors.

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1.2.2 National Park Service Management Policies (2006)

NPS adopted revised Management Policies on August 31, 2006 which update the 2001 Management Policies under which the FMP NEPA process was conducted. In Section 4.5, the 2006 Management Policies expand the scope of issues that specifically need to be addressed in FMPs to include:

- “determining in which situations natural regeneration of a burned ecosystem is appropriate and when management actions are needed to restore, stabilize, or rehabilitate an area following wildland fire”,
- “addressing the need for adequate funding and staffing to support the planned fire management program”,
- address[ing] strategies for preventing the accumulation of hazardous fuels *in specific areas* and for eliminating hazardous conditions that may have developed over time due to past fire suppression programs or ongoing development activities. These strategies will entail strategic planning, interdisciplinary coordination, and inter-organizational collaboration as needed to provide appropriate treatment using adaptive management practices that range from site specific to landscape level. “
- Measures to protect or rescue cultural resources in the event of an emergency, disaster, or fire will be developed as part of a park’s emergency operations and fire management planning processes (Section 5.3.1.1.)

The Management Policies direct each park to carefully consider the option of wildland fire use based on the specific environmental, safety and logistical conditions of each wildland fire. GGNRA carefully considered the option of wildland fire use in developing the FMP EIS and concluded that GGNRA will be a full suppression park employing Minimum Impact Suppression Tactics (MIST) to the extent possible and a flexible suppression strategy that permits the appropriate approach to be used to suppress a fire (confine, contain or control) based on input from park staff, suppression forces, and adjacent landowners.

All fire management plan requirements in the revised Management Policies that are not currently addressed in the FMP will be developed and adopted in subsequent FMP Annual Review processes. It is conceivable that the development of new park procedures may require additional NEPA and/or Endangered Species Act (ESA) compliance. More details on wildland fire management, including interagency and Department of the Interior policies and requirements, are contained in Director’s Order #18: Wildland Fire Management. These documents provide the detail necessary to develop the components of Fire Management Plans and other companion plans, such as monitoring or communication plans.

Excerpts from 2006 Management Policies, Section 4.5, Fire Management

Regarding Fire Management Plans: “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. The plan will be designed to guide a program that:

- responds to the park's natural and cultural resource objectives;
- provides for safety considerations for park visitors, employees, and developed facilities;
- addresses potential impacts on public and private neighbors and their property adjacent to the park; and
- protects public health and safety.

Regarding Overall Strategy: "All fires burning in natural or landscaped vegetation in parks will be classified as either wildland fires or prescribed fires. All wildland fires will be effectively managed through application of the appropriate strategic and tactical management options. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, and costs."

Regarding Wildland Fire Suppression: "All wildland fires will be effectively managed through application of the appropriate strategic and tactical management options as guided by the park's fire management plan. These options will be selected after comprehensive consideration of the resource values to be protected, firefighter and public safety, costs, availability of firefighting resources, weather, and fuel conditions. "

"All parks will use a systematic decision-making process identified in their fire management plans or other documents to determine the most appropriate management strategies for all unplanned ignitions and for any naturally or management-ignited fires that are no longer meeting resource management objectives."

1.2.3 Director's Order #18, Wildland Fire Management (2005)

Director's Order #18, Section 5(2)(a), builds on the requirement from the Federal Wildland Fire Management Policy and reiterated in the NPS Management Policies that, "Every park area with burnable vegetation must have a fire management plan approved by the Superintendent." Director's Order #18 (NPS 2005) specifically addresses the direction and content expected in the FMPs prepared for NPS units.

The FMPs will:

1. Reinforce the commitment that firefighter and public safety is the first priority.
2. Describe wildland fire management objectives that are derived from land, natural, and cultural resource management plans and address public health issues and values to be protected.
3. Address all potential wildland fire occurrences and consider the full range of wildland fire management actions.

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4. Promote an interagency approach to managing fires on an ecosystem basis across agency boundaries and in conformance with the natural ecological processes and conditions characteristic of the ecosystem.
5. Include a description of rehabilitation techniques and standards that comply with resource management plan objectives and mitigate immediate safety threats.
6. Be developed with internal and external interdisciplinary input and reviewed by appropriate subject matter experts and all pertinent interested parties, and approved by the park superintendent.
7. Comply with the NEPA and any other applicable regulatory requirements.
8. Include a wildland fire prevention analysis and plan.
9. Include a fuels management analysis and plan.
10. Include procedures for short and long term monitoring to document that overall programmatic objectives are being met and undesired effects are not occurring.

Director's Order 18 requires that a Reference Manual be prepared to "help NPS managers and field staff understand and implement Departmental and NPS policies applicable to fire management. The reference manual will contain detailed procedures emphasizing personnel safety, the use of wildland fire for beneficial purposes, monitoring of smoke behavior and the concept of risk management." The Reference Manual for DO #18 is published only online and is available at http://www.nps.gov/fire/fire/fir_wil_pla_reference18.cfm.

1.3 RELATIONSHIP OF FMP TO GGNRA PLANNING

1.3.1 GGNRA General Management Plan and General Management Plan Update

In 1980, GGNRA and PRNS collaborated on a joint planning and NEPA process that produced a joint General Management Plan (GMP) and Environmental Assessment. The GMP EA (NPS 1980) recognized the need to incorporate prescribed burning into research programs designed to enhance ecosystem management in the park. The GMP defined a series of land management zones to guide the strategy for "how the park will be managed and developed in the future based on legislative and administrative requirements, resource studies, and public preferences." This zoning approach allows for the treatment of specific resources, while relating them to an overall approach to the park as a whole. Fire management actions for different areas of the park need to respect and reflect this current zoning, to minimize visitor, user, and resource management conflicts.

The park is currently in the initial stages of preparing a new general management plan to replace and update the 1980 GMP. PRNS is undergoing a similar process. The new GGNRA GMP will address those lands directly administered by the park focusing on sites that do not have recent land use plans, such as Muir Woods National Monument and the San Mateo County lands that have been added to the park since 1980. Planning for Area A of the Presidio, Fort Baker, and lower Fort Mason Center will not be addressed in the GMP update as these sites have recently updated land use

management plans. Golden Gate lands north of the Bolinas-Fairfax Road will be addressed in the *Point Reyes National Seashore General Management Plan Update*; that process is ahead of the process at GGNRA and a Draft EIS will soon be released for public review.

1.3.2 GGNRA Natural Resource Management Plan

The Natural Resources Management Plan (1999) describes the status of GGNRA's natural resources and a park-wide program aimed at resource preservation, monitoring, maintenance, and restoration. A primary challenge identified by the plan is how the park will address the changes in ecosystem composition and accumulation of fuels resulting from the focus over the past century on suppression of all fires.

The Natural Resource Management Plan recognizes the benefits that can be gained through hazardous fuel reduction programs, including prescribed burning, geared towards preventing catastrophic losses of park resources from unplanned ignitions. Consistent with the GGNRA FMP in force at the time it was drafted, the Natural Resource Management Plan calls for prescribed fire to be used to revitalize fire-adapted communities and reduce the encroachment of fire-sensitive trees. Prescribed burning and fire effects monitoring is woven into strategies for protection of the endangered San Bruno elfin butterfly, Mission blue butterfly, Northern spotted owl, old-growth forest species, and a rare manzanita and ceanothus species found in GGNRA. Since habitat modification through prescribed fire and mechanical fuel reduction projects can have direct and indirect effects on wildlife and their habitats, the plan calls for careful interdisciplinary planning to protect existing habitat values and guide habitat enhancement.

1.3.3 GGNRA Cultural Resource Management Plan

The GGNRA Cultural Resource Management Plan (1998) is a prioritized listing of 128 cultural resource projects for the park providing a problem statement, description of the recommended project or activity, and an estimate of budget and staff needed to complete each project. The Cultural Resource Management Plan does not include overarching objectives for resource protection and does not address fire management planning as a strategy. A forthcoming update of this plan may incorporate objectives that integrate both fire and vegetation management as means to protect, restore, or rehabilitate cultural resources and landscapes within the park.

1.4 RELATIONSHIP OF FMP TO LOCAL FIRE MANAGEMENT PLANNING

1.4.1 Marin County Fire Department

1.4.1.1 Marin County Fire Management Plan

The Marin County Fire Department has developed a Marin County Fire Management Plan that addresses the threat and prevention of wildfires in Marin County.

1. To create wildfire protection zones that increase safety for firefighters and reduce risk to park neighbors.

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2. To assess all wildlands, not just the state responsibility areas. Analyses will include all wildland fire service providers: federal, state, local government, and private. It will identify high risk, high value areas, and develop information on and determine who is responsible, who is responding, and who is paying for wildland fire emergencies.
3. To identify and analyze key policy issues and develop recommendations for changes in public policy. Analysis will include alternatives to reduce the total losses by increasing fire protection system effectiveness.
4. To focus and monitor the wildland fire protection system in fiscal terms. This will include all public and private expenditures and economic losses.
5. To translate the analyses into public policies.

1.4.1.2 Marin County Community Wildland Fire Protection Plan (CWPP)

Adopted by the Marin County Board of Supervisors in July 2005, the CWPP provides guidance to the Marin County Fire Department (MCFD) in creating a more efficient fire-protection program focused on meaningful solutions to better protect Marin communities. The CWPP identifies areas where cost-effective, pre-fire management investments can be made to help minimize citizen losses and reduce costs from a major wildfire. With a CWPP approved and signed by the State Fire Marshall, MCFD may apply for National Fire Plan funding to complete the projects proposed in the CWPP.

The CWPP proposes a 5-part strategy to protect homes mapped as “at risk” by reducing fuel hazards using an integrated approach of the following elements:

- (1) Fuelbreak Network. MCFD has been working cooperatively with other local agencies and landowners to develop a 40-mile long system of fuel breaks (see Figure 2, Marin Co. CWPP Map) sited so as to take advantage of ridgetop roads and naturally occurring areas of lower fuels, such as grasslands. The fuel breaks will reduce the potential for a wildland fire to spread into the interface area from open space areas. The first several sections of the fuel breaks are proposed largely for GGNRA-managed lands (see Table 1, CWPP Fuelbreak Sections on GGNRA Lands).
- (2) Fire-Prone Forest Clearing. MCFD will continue clearing stands of flammable eucalyptus and Monterey pine that endanger residential communities.
- (3) Access Improvements. MCFD will continue to improve roadside fuel reduction and construct turnouts where needed.
- (4) Wildfire Awareness Campaign. MCFD will conduct community outreach to wildland-urban interface neighborhoods.
- (5) International Urban-Wildland Interface Code Adoption. The Board of Supervisors adopted a new County building code ordinance on 9/12/06, 2006 requiring each new residential project in the wildland urban interface zone (WUI) to have a fire protection plan. The Marin County WUI zone is shown in Figure 2, Marin Co. CWPP Map.

Table 1 – CWPP Fuelbreak Sections on GGNRA Lands

Fuelbreak Section	Description	Length (miles)	Miles Completed	Percent Complete
Sausalito	Shore of SF Bay over Waldo Tunnel to Alta Ave Fire Rd	2.3 mi	0	0%
Marin City	Alta Ave Fire Road to Tennessee Valley Rd	1.3	0.6	50%
Tamalpais Valley	Tennessee Valley Rd to 3 Corners (intersection of Highway 1 & Panoramic Hwy)	3.0	0.0	0%
Homestead Valley	3 Corners to Panoramic Highway to Mountain Home Inn	2.4	1.3	53%

Source: Marin Co. CWPP, 2006.

1.4.2 VEGETATION MANAGEMENT PLAN, PRESIDIO OF SAN FRANCISCO

The Vegetation Management Plan for the Presidio (VMP) (NPS 2001) was completed in 2001 as part of a collaborative planning effort between the NPS and the Presidio Trust for both Area A (under NPS management) and Area B (under Presidio Trust management) of the Presidio. The VMP addresses all vegetation resources and contains policies and actions that guide fire management activities as well as natural resources management activities, including efforts to test the efficacy, through research, of using fire to enhance and/or manage threatened and endangered plant species. Prescribed burns for resource benefit and fuel reduction projects in Area A or performed by NPS staff in Area B should conform to the resource objectives of the VMP and this FMP, meet any requirements for Section 7 consultations where habitat of listed plants is involved and be coordinated with the Presidio Trust.

1.4.3 Mt. Tamalpais Area Vegetation Management Plan

The Mt. Tamalpais Area Vegetation Management Plan (MTVMP), prepared in 1995, presents strategies for managing vegetation on the 19,000+ acres owned by the Marin Municipal Water District (MMWD) and an adjacent 1,150 acres owned by the Marin County Open Space District (MCOSD). The plan provides specific recommendations for reducing the risk of impacts from wildland fire and enhancing biodiversity, both primary goals of the plan. GGNRA lands are present in both MMWD watersheds (West Marin and Mt. Tamalpais) and have common boundaries with MMWD holdings. All jurisdictions in the MTVMP area face many of the same resource challenges such as high fuel accumulation, a complex and lengthy urban wildland interface, and the spread of highly flammable, nonnative plant species within the interface. Addressing the issues incrementally within each jurisdiction contributes to the overall success in combating these challenges.

The MTVMP called for a network of fuel breaks to help firefighters contain wildfires; both the MMWD and MCOSD have signed on as partners to the CWPP and its proposed fuelbreak system. The MTVMP also calls for prescribed burning of 100 to 200 acres per year (less than one percent of watershed land) to control nonnative plants, reduce fuels, and maintain natural habitats.

The FMP Final EIS anticipated that the NPS would continue to provide staff support and, when available, financial support, through the federal WUI funding program to support MTVMP projects. To qualify for federal funding under the National Fire Plan, projects should be included in the CWPP for that jurisdiction. Projects are selected by the California Fire Marshall following interagency consultation. The NPS would continue to seek opportunities to work cooperatively on projects with both agencies.

1.4.4 POINT REYES NATIONAL SEASHORE FIRE MANAGEMENT PLAN

The NEPA process for the PRNS FMP concluded with the signing of the ROD on 10/29/04. The Operational Strategy for the FMP describes the process PRNS will use in implementing the selected alternative in conformance with the commitments for environmental protection made in the ROD. The 18,000 acres of GGNRA lands included in the PRNS FMP are under the direct administration of PRNS through an agreement between the two parks. The alternative selected for implementation allows up to 2,000 acres of prescribed burning and 1,500 acres of mechanical treatment annually within the park. With the exception of smaller research burns, prescribed burning would not occur within the area currently leased for agriculture.

The GGNRA and PRNS FMPs share the same goals and a common boundary. The planning areas of the PRNS and GGNRA FMPs adjoin each other at the Bolinas–Fairfax Road, with PRNS managing lands north of the road and GGNRA managing lands to the south. In reference to this interface, the PRNS FMP states that “Prescribed burning in the southernmost portion of the ridge [Bolin Ridge] in coastal chaparral and mixed scrub habitats would also help achieve a natural resource benefit by simulative reproduction in the rare, fire adapted species Marin manzanita and Mason’s ceanothus” (NPS 2004). To the greatest extent possible, the San Francisco Bay Area Parks Network will work cooperatively to develop projects that address resource challenges common to the network parks and promote an efficiency of scale through joint staffing and/or funding of projects. The parks share a prescribed fire specialist position, duty stationed at PORE but serving both parks by developing a yearly program of work that includes prescribed fire and fuels planning, as well as project implementation

1.4.5 Cal Fire California Fire Plan

The California Department of Forestry and Fire Protection (Cal Fire) published the California Fire Plan (CFP) covering State Areas of Responsibility in July 2004. The goal of the CFP is the reduction of wildfire costs and losses through the protection of assets at risk by executing strategically sited vegetation management projects and a public education program stressing the homeowners responsibility to provide defensible space and use “fire safe” building materials. The implementation strategy of the CFP proposes:

- √ Creation of local forums to determine what the fire problem is through input from citizens, community groups, local agencies and other stakeholders.
- √ Identification of assets at risk, enabling the stakeholder forums and the Unit to set priorities for vegetation management project work. These assets include

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citizen and firefighter safety, structures, watersheds, wildlife and habitat, timber or unique areas of cultural or historic significance, and air quality.

- √ Development of wildfire protection zones through vegetation management projects that reduce the potential for large damaging wildland fires.
- √ Development and implementation of vegetation management projects cooperatively with stakeholder forums. Projects may include a combination of mechanical clearing or prescribed fire.

1.4.5.1 Cal Fire, San Mateo/Santa Cruz Unit

Cal Fire adopted a Fire Management Plan for its San Mateo/Santa Cruz unit in 2004 (<http://cdfdata.fire.ca.gov/pub/fireplan/fpupload/fpppdf136.pdf>). There is no mention of federal land management in the Plan nor are any of the individual national park units referred to or mapped. Battalion 1, consisting of Belmont Fire Station and Cordilleras Fire Station is responsible for the northern portion of San Mateo County including open space lands near Pacifica and the San Francisco Watershed lands adjacent to Sweeney Ridge. Battalion 5 serves the San Mateo portion of the Skyline Corridor with Fire Stations at Skylonda and Saratoga Summit.

GGNRA is in negotiation with Cal Fire with the objective of having that agency agree to accept GGNRA San Mateo lands as part of their Direct Protection Area (DPA). In conformance with the Master Cooperative Wildland Fire Management and Stafford Act Response Agreement between the State of California and federal land management agencies, the NPS would relinquish fire protection responsibilities to Cal Fire. As a result of turning over DPA responsibilities, the NPS would have only limited control over suppression actions at the time of a fire and would need to insert special resource protection instructions into the unit's Annual Operating Plan each April.

1.4.6 San Francisco Co., Recreation & Park Dept., Parks & Significant Natural Areas Program

The San Francisco Recreation and Park Department is responsible for managing the City's parks and "significant natural areas." The Natural Areas Management Plan was adopted in 1995 and the program staffed in 1997. It is a community-based habitat restoration program. San Francisco parks and natural areas adjacent to GGNRA lands include:

- Balboa Natural Area (1.8 acres) west of Sutro Heights and east across the Great Highway from Ocean Beach and the Cliff House,
- Lake Merced Park, east of Fort Funston, which has natural area designation for nearly half of its total acreage (395 acres out of a total of 814 acres),
- Mountain Lake Park, near Lake Street south of the Presidio is primarily within the jurisdiction of the Presidio Trust (13.1 of a total of the total 14.2 acres), includes a 1.1 acre section managed by City Recreation and Parks, and
- Sharp Park Golf Course in Pacifica bordered to the southwest by Mori Point and to the southeast and east by Sweeney Ridge. More than half of the golf course

lands (237.2 acres of the total 411 acres) are designated as a significant natural area.

Sharp Park is unique in the City's Significant Natural Areas Program in that it supports habitat for the federally-listed "endangered" San Francisco garter snake and "threatened" California red-legged frog; the common yellowthroat and the San Francisco fork-tailed damselfly, a federal bird of conservation concern; and possibly the bumblebee scarab beetle, a federal species of concern. Historic records indicate the park once supported the federally endangered Mission Blue Butterfly and the federally threatened Bay Checkerspot Butterfly.

Prescribed burning is included as a strategy for controlling the spread of nonnative plant species and encouraging the germination of native species in the San Francisco Recreation and Park Department's County Natural Areas Program (NAP). A principal management policy of the NAP is providing fire breaks where appropriate and maximizing indigenous vegetation for fire control. The management plan for Sharp Park calls for significant reduction in the cypress and eucalyptus stands on the eastern side of the park adjacent to Sweeney Ridge. There are opportunities here for GGNRA to work with City of San Francisco staff to reduce the expansion of and thin the density of existing groves along the common boundary.

1.4.7 San Francisco Peninsula Watershed Management Plan

The 23,000-acre San Francisco Peninsula Watershed, managed by the San Francisco Public Utilities Commission (SFPUC), shares a boundary with Sweeney Ridge on the north and the Phleger Estate on the south. The watershed lands are designated as a Hazardous Fire Area by the Cal Fire. As such, the area is subject to closure by the SFPUC, as necessary or as requested by Cal Fire, during times of high fire danger. A secondary goal of the Peninsula Watershed Management Plan (SFPUC 2002) is reducing the risk of wildland fire and potential adverse effects to the watershed, adjacent urban areas, and the public. Fire in the watershed would not only place nearby populated urban areas at risk but could also affect water quality, water supply to contract jurisdictions, and ecological and cultural resources within or near the watershed. A primary reason that the public has had restricted access to the watershed lands is to reduce the potential for the deliberate or accidental start of a wildland fire. Watershed Management Plan Policies call for the increased protection of watershed resources through the improvement of firefighting facilities and implementation of a fire management plan for the watershed.

In implementing the GGNRA FMP, the NPS will coordinate with the SFPUC Land and Resources Management Section to ensure that NPS actions conform to the Watershed Management Plan and FMP to the extent possible that allows NPS to its objectives. GGNRA staff meets annually with the SFPUC Land and Resources Management Section to discuss issues of joint interest and will inform SFPUC staff of proposed fire management actions at the Phleger Estate and Sweeney Ridge.

1.4.8 San Mateo County Parks and Recreation Department Documents

GGNRA shares common boundaries with two large parks managed by the San Mateo County Parks and Recreation Division of the Environmental Services Agency – San Pedro County Park and Huddart County Park.

The 974-acre Huddart County Park is on the southern boundary of Phleger Estate near the Town of Woodside in southern San Mateo County. Most visitors to Phleger park their cars in Huddart Park and hike in to Phleger on the connecting trail network. Huddart has similar vegetation community composition as is found in Phleger including redwood forest, mixed evergreen forest, oak woodlands and chaparral. Huddart itself is bordered to the west by Purissima Open Space Preserve and to the south by Teague Hill Open Space Preserve.

San Pedro Valley Park, south of Sweeney Ridge in Pacifica, encompasses 1,150 acres of coastal scrub, grasslands and riparian habitat that includes the middle and south forks of San Pedro Creek, which provides habitat for the federally threatened steelhead.

1.4.8.1 *Decision-Making Guidelines for Vegetation Management*

San Mateo County Parks recently completed this operational manual which presents clear and consistent guidelines and procedures for park staff to follow in conducting vegetation management activities and provides tools for selecting and prioritizing future vegetation management projects. The June 2006 document describes current fire management actions at County parks as limited to routine actions in and around developed areas of the parks using mowing, trimming overhead branches near fireplaces and herbicide use along fences, parking lots and to reduce non-native plants and poison oak.

The Guidelines recommend that County Parks come into compliance with Cal Fire requirements for a 100-foot wide fuel reduction zone between wildlands and developed areas. To meet with this requirement, the Guidelines recommend that parks with tracts of natural lands create and maintain the zone of reduced fuels on the parks' perimeters. Where the fuel reduction zone crosses forested areas, maintenance would be needed to treat small diameter trees and understory brush (pp. 46 and 74). Appendix A of the Guidelines contains the Department's procedures for conducting prescribed burns, flaming invasive non-native plants, grazing used for vegetation management, pile burning and establishing fuel breaks.

1.4.8.2 *Huddart and Wunderlich County Parks Draft Master Plan*

Released in May 2006, the draft plan includes a chapter prepared by Carol Rice of Wildland Resource Associates, dedicated to the reduction of risk of wildland fire in these two parks. Recommendations for Huddart Park, adjacent to the Phleger Estate include:

- Mowing grass to create 30-foot wide buffers along roads, park boundaries, parking and picnic areas and other areas with ignition potential.
- Restricting parking and vehicle use to paved surfaces.

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- Closing trails on Red Flag Days.
- Removing dead, downed material from roadsides, thinning forest understory and small diameter trees to create a vertical separation between the ground and canopy, thinning shrubs to form isolated groupings, and removing taller shrubs near trees.
- Providing a 100-foot radius of defensible space around structures by mowing, pruning, and removing flammable material from roofs, decks, and propane tanks.
- For newly landscaped areas, planting fire-resistant plants in groupings isolated by hardscape or mowed grass.
- Removing pyrophytic invasive, exotic plants and restoring habitat with less flammable native plants.
- Using goat and horse grazing to reduce fuels where appropriate.
- Assess hydrant siting, water pressure and volume and identify any needed improvements.
- Evaluate exterior construction features (e.g. roofing, siding) for ignition resistant construction.
- Improving the hairpin turn on Richards Rd. at McGarvey Gulch in Huddart Park to meet standards for Cal Fire and Woodside Fire Protection District vehicle weight and turning radii.
- Installing safety zones to make it safer for firefighters in order to increase the likelihood fire suppression resources will be committed to that location

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2. FIRE MANAGEMENT STRATEGIES

2.1 FIRE MANAGEMENT GOALS

As part of the NEPA process for the FMP, GGNRA staff developed goals for the overall fire management program based on guidance from Federal Wildland Fire Management Policy, NPS Management Policies, Director's Order #18, and other fire-related guidance documents, in conjunction with public input from meetings and workshops. In the listing below, elements of the adopted FMP alternative are paired with the seven FMP goals to demonstrate how the selected alternative will help the park achieve the goals of the FMP.

Goal 1. Ensure that firefighter and public safety is the highest priority for all fire management activities.

Objectives:

- √ In cooperation with Bay Area Network Parks, provide the fire management workforce with the training, equipment, operating procedures, safety measures, and information needed to manage risks and carry out their activities safely.
- √ Ensure that all fire management employees meet the Interagency Qualification Standards for their positions and those held while assigned to an incident.
- √ Identify, inform, and protect visitors, communities, park partners, and other groups and individuals that potentially would be affected by fire management activities.
- √ Comply with the National Wildfire Coordinating Group and agency medical standards and fitness requirements for staff and make sure staff has personal protective equipment appropriate to the job or assignment.
- √ Follow all aviation policies and practices during fire management activities. The fire management officer or designee will stay abreast of aviation policy changes by maintaining periodic contact with the regional aviation manager and the designated park Aviation Officer.

Goal 2. Reduce wildland fire risk to private and public property.

Objectives:

- √ Annually analyze fire hazards, fire values, and risks to inform project priority selection for fire management units (FMUs).
- √ Support the development of evacuation plans for wildland urban interface communities, where such plans do not exist.
- √ Develop prevention plans to reduce the number of human-caused ignitions.

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Goal 3. Protect natural resources from adverse effects of fire and fire management activities, and use fire management wherever appropriate to sustain and restore natural resources.

Objectives:

- √ Manage ecosystems within the natural range of variability for plant community structure and fuel loads.
- √ Reduce potential spread of nonnative plant species to adjacent natural areas and ensure any fire activities include follow-up actions (planting, seeding, etc.) to meet overall vegetation goals. Ensure that any fill used and/or maintenance activities do not introduce weeds.
- √ Reduce nonnative trees and shrubs (Monterey pine, Monterey cypress, acacia, eucalyptus, etc.) to the greatest extent possible consistent with vegetation management objectives and to the extent that hazardous fuels are reduced.
- √ Protect and restore rare and endangered species and sensitive habitat through fire management activities and project implementation.
- √ Reduce erosion from fire roads and reduce sediment transport through ongoing maintenance of roads and the removal and site restoration of unnecessary fire roads.
- √ Develop standards for the use of water and retardants in fire management activities, such as minimization of the use of saltwater and brackish water, and avoidance of use of nearby water sources with rare species, for the protection of water quality and aquatic habitat characteristics.
- √ Identify and protect natural soundscapes through the course of mechanical treatment activities involving the extended use of power equipment.

Goal 4. Preserve historic structures, landscapes, and archeological resources from adverse effects of fire and fire management activities, and use fire management wherever appropriate to rehabilitate or restore these cultural resources.

Objectives:

- √ Survey for and identify historic resources within a project area in the earliest possible stage of planning fire management activity.
- √ Conduct surveys for areas of potential archeological resources (based on sensitivity modeling or prediction) prior to project implementation. Avoid ground disturbance prior to survey of sensitive areas for archeological resources. Protect archeological resources (known, predicted historical, or discovered sites).
- √ Develop standard procedures for projects calling for the use of fire and other treatments in order to maintain the setting of historic sites and to maintain the integrity of cultural resources.
- √ Regularly monitor fire management activities to assess their effects on cultural resources.
- √ Protect historic structures and landscape features through the course of fire management project implementation.

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- √ Use fire management activities to preserve and in some cases to perpetuate historic vegetation patterns.
- √ Rehabilitate pastoral landscapes where fire danger would be lessened by the establishment of a lower fuel-loading plant community.

Goal 5. Refine management practices by improving knowledge and understanding of fire through research and monitoring.

Objectives:

- √ Monitor and evaluate the effects of fire and fuels management activities on park resources. Evaluate monitoring information to refine fire management actions and project objectives.
- √ Identify issues or missing information important to developing effective implementation of the park's fire and fuels management program.
- √ Continue ongoing inventory and baseline data collection to enhance existing resource information systems. Use vegetation maps, fire history maps, and other tools to develop risk assessments that will be used to identify and set priorities for appropriate treatments.
- √ Conduct research that will help park managers to understand fire regimes, refine prescriptions, provide data for fire behavior models, and effectively implement the fire management program.
- √ Research the role of fire in old-growth redwood forests.
- √ Conduct research into issues of Sudden Oak Death, and the potential of fire as a management tool.
- √ Determine how fire can be used to target nonnative plant species for eradication.
- √ Research the effects of fire exclusion.
- √ Determine how current fire frequency affects ecosystems with respect to the historic fire regime.
- √ Determine how post-fire recovery patterns may be used in restoration projects.

Goal 6. Develop and maintain staff expertise in all aspects of fire management.

Objectives:

- √ Implement annual program reviews for fire management office and personnel.
- √ Implement training plans for each employee to reach target qualifications for the positions in the fire management organization. Conduct annual training appropriate to instructor qualifications.
- √ Keep abreast of the latest developments and technology applicable to fire management.
- √ Establish and promote measurable qualifications and staff experience to accomplish fire management program objectives in a safe manner.
- √ Follow all safety standards and guidelines identified within the Interagency Incident Business Management Handbook.

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Goal 7. Effectively integrate the fire management program into park and park partner activities.

Objectives:

- √ Develop a fire management program that is consistent with, and meets the goals of, the park's General Management Plan (GMP) and resource management plans.
- √ Encourage interdisciplinary pre-project planning for fire management activities.
- √ Plan for and conduct fire management activities in an integrated manner with respect for overall resource goals and in an effort not to exacerbate existing problems.
- √ Conduct educational outreach programs on the park's fire management activities and fire safety for park partners, including tenants in park structures within project areas.

Goal 8. Foster informed public participation in fire management activities.

Objectives:

- √ Continue and enhance communication and education programs to broaden an understanding of the NPS fire management mission, for both internal and external audiences.
- √ Maintain and expand the current park website to provide information about fire management activities in the park as well as fire safety.
- √ Support an increase in fire ecology and safety programs in schools.
- √ Increase public meetings and homeowners group presentations.
- √ Provide more interpretive programs on fire safety and ecology.
- √ Provide trailhead messages on fire safety.

Goal 9. Foster and maintain interagency fire management partnerships and contribute to the firefighting effort at the local, state, and national level.

Objectives:

- √ Maintain cooperative fire management agreements with county and city fire departments.
- √ Continue interagency coordination and cooperation with federal land management agencies and other related agencies supporting or participating as full partners in wildland fire management activities and programs.
- √ Attend interagency planning meetings prior to each fire season to enhance coordination and cooperation to maximize efficiency to manage wildland fire incidents.
- √ Continue participation in regular fire management coordination meetings to share information and discuss related issues with organizations such as FIRESafe Marin and Fire Safe San Mateo.

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Goal 10. Minimize smoke generation during prescribed burning through the use of a smoke management plan (SMP) that details best management practices or non-burning alternatives where these options would meet resource management and fuel reduction objectives and also achieve emissions reduction.

Objectives:

- √ Confer regularly with Air Resources staff at the NPS Pacific West Regional Office, other parks, fire agencies, and the Bay Area Air Quality Management District (BAAQMD) to keep current on best management practices and non-burning alternatives.
- √ Maintain current information on smoke-related health issues affecting firefighters such as exposure limits, exposure monitoring, risk minimization, and respiration technology.

2.2 GENERAL MANAGEMENT CONSIDERATIONS**2.2.1 Legal Considerations**

The NPS is constrained from implementing fire management actions that do not comply with relevant federal laws, regulations, or policies. The most widely applied federal laws include the NPS Organic Act, the enabling legislation establishing GGNRA, NEPA, NHPA, the ESA, the Clean Water Act (CWA) and the Clean Air Act (CAA). NPS regulations and policies are developed on a national level in NPS Management Policies (2006) and the NPS Director's Orders addressing specific topics for example Director's Order 12 (Environmental Impact Analysis), Director's Order 18 (Wildland Fire Management), Director's Order 28 (Cultural Resource Management – *currently under revision*), and Director's Order 77 (Natural Resource Management - *currently under revision*). The Pacific West Regional Office generates policy guidance that applies to all national parks in the region. GGNRA issues policy guidance through “standard operating procedures” (SOPs) that only apply to the park and GGNRA staff.

2.2.1.1 Enabling Legislation

Congress established GGNRA by Public Law 92-589 “in order to preserve for public use and enjoyment certain areas of Marin and San Francisco Counties, California (San Mateo County added by P.L. #96-607).” In addition to providing for recreation and educational opportunities consistent with sound principles of land use planning and management, the NPS was also instructed to “preserve the recreation area, as far as possible, in its natural setting, and protect it from development and uses which would destroy the scenic beauty and natural character of the area.”

2.2.1.2 Endangered Species Act

The Endangered Species Act (ESA), as amended, (PL 93-205, 87 Stat. 884, 16 USC §1531 et seq.) protects threatened and endangered species from unauthorized take and directs federal agencies to ensure that their actions do not jeopardize the continued existence of such species. There are approximately 1,300 species that found entirely or in part in the USA and its water that are listed or proposed for listing as threatened or

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endangered under the ESA. Currently, 9 animal and 3 plant species as threatened or endangered under the ESA that occur on lands directly managed by GGNRA that could be affected by FMP projects. Further information on each of these species can be found in the GGNRA FMP Final EIS on pages 205 – 211.

Two federal agencies share responsibility for implementing the ESA -- generally, the USFWS manages land and freshwater species, while the NMFS manages marine and "anadromous²" fish species. As part of the NEPA process for the GGNRA FMP Final



California red-legged frog
by Marc Jennings

EIS, the NPS completed formal consultations with the USFWS and NMFS as required by Section 7 of the ESA. In signing the Record of Decision, the NPS adopted all the protective measures recommended by the NMFS and FWS to ensure that adverse effects to the listed plants and animals would be avoided. It is the responsibility of NPS staff to ensure these measures are followed as FMP projects are implemented.

2.2.1.3 Clean Air Act

All GGNRA prescribed burns must be submitted to the Bay Area Air Quality Management District (BAAQMD) with a Smoke Management Plan for approval. The BAAQMD grants approval to the NPS to conduct burns based on air basin air quality and competing requests to burn submitted by other entities. Due to these extenuating circumstances, plans for burning may not always be approved for implementation if air basin conditions are poor or there are too many competing requests for approval to burn.

2.2.1.4 National Historic Preservation Act

The National Historic Preservation Act (1966), as amended, requires agencies to take into account the effects of their actions on properties listed in or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation has developed implementing regulations (36 CFR 800) that allow agencies to develop agreements for consideration of these historic properties. The NPS, in consultation with the California State Historic Preservation Officer (SHPO), developed a detailed Programmatic Agreement for implementing FMP projects based upon an existing draft Department of the Interior Fire Management Plan Programmatic Agreement. The Programmatic



Murray Circle, East Fort Baker

² Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn. In the FMP planning area, anadromous fish listed under the ESA are coho salmon and steelhead.

Agreement for the GGNRA FMP provides a process for NHPA compliance through stipulations for identification, evaluation, treatment, and mitigation of adverse effects of FMP actions which could affect historic properties. The requirements in the Programmatic Agreement are incorporated into the mitigation measures developed and adopted specifically for implementing FMP projects.

2.2.2 Jurisdictional Considerations

2.2.2.1 Direct Protection Areas (DPA)

The NPS has wildland fire protection responsibility for all federally owned lands inside the boundary of GGNRA. This makes federally-managed lands within the congressionally designated GGNRA boundary the Federal Responsibility Area or NPS - Direct Protection Area (DPA). The Northern Lands of GGNRA on Bolinas Ridge, managed under an agreement with Point Reyes NS are in the DPA of Point Reyes. The NPS has the financial responsibility, and the fire protection force to accomplish this. However due to the limited capacity of its protection force, Marin County Fire Department, San Francisco Fire Department, California Department of Forestry and Fire Protection, and other nearby fire agencies in Marin and San Mateo counties provide strong backup and reinforcement to any fire in or near lands directly managed by GGNRA.

2.2.3 TECHNICAL OR LOGISTIC CONSIDERATIONS

2.2.3.1 Limited Season for Effective Use of Prescribed Burning.

The normal weather window for prescribed burning at Golden Gate is from mid-April to November. Burning in grasslands should be conducted after the grasses have cured, which can be as late as early July. Summer and fall burns must be scheduled to take place between the dissipation of the morning coastal fog and the onset of strong afternoon sea breezes. Often the fog persists all day keeping much of GGNRA too wet for prescribed burning. The later months of the prescribed burning period, from late September until the first couple of rains in November, can be relatively fog free. Difficulties in scheduling prescribed burns still can occur because red flag conditions can develop quickly if the fuels moistures are already very low.

2.2.3.2 Risk-related Considerations

GGNRA has adopted a full suppression policy for all wildland fires, even those started naturally by lightning, due to high values at risk in the wildland urban interface. Consequently, there is no wildland fire use within GGNRA. Prescribed fires cannot burn overnight in GGNRA limiting the size of each prescribed burn unit to a size that can be successfully controlled within the normal burn window of a typical day. This precludes fire management strategies involving large-scale landscape fire restoration within the park.

2.2.3.3 Park Resources or Values Considerations

GGNRA has unique cultural and natural resources which affect the timing, location and layout of fire management projects. Recurring special events and the constraints of high year-round visitation by local visitors and tourists also require careful advance

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planning. Some projects are modified from an optimal layout from the perspective of operational defensibility in order to avoid adverse impacts to viewsheds or privacy afforded by vegetation, especially on the park boundary.

Where sensitive resources are present within or near a project perimeter, GGNRA may be required to obtain additional permits from regulatory agencies, hold public meetings with homeowners associations, add staffing for prescribed burns, reduce smoke generation, or plan smaller burn units that incorporate buffers around sensitive resources.

2.2.3.4 Staffing Considerations

The NPS and interagency guidelines for prescribed burning require that all NPS prescribed burns have a Contingency Plan identifying “contingency resources” (such as fire trucks on stand-by) that must be available based on the prediction of a worst-case scenario (NPS 2006b, Chapter 10; USDA 2006). Resources may be requested from competing projects especially in the peak of the national fire season in the summer months when resources needed for prescribed burns are also needed for emergency fire suppression. According to the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide, when specific contingency resources are identified for more than one prescribed fire, the local fire management organization(s) must evaluate and document the adequacy of all contingency resources within the area. The evaluation must consider: 1) Local, current, and predicted fire danger and 2) Local and regional wildland fire activities. Once a contingency resource is committed to a specific wildland fire action, it can no longer be considered a contingency resource for another prescribed fire project and a suitable replacement contingency resource must be identified or the ignition halted.

2.2.3.5 Funding Considerations

There are eight communities bordering GGNRA that are listed as federal “communities at risk from wildfire” under the National Fire Plan (Stinson Beach, Sausalito, Tamalpais & Homestead Valleys and Marin City in Marin County, the City of San Francisco, and the cities of Woodside, Daly City and Pacifica in San Mateo County). Communities are listed as “at risk” if they are within the wildland urban interface with federally managed lands. Each state, in cooperation with five federal land management agencies, originally submitted towns to be listed as communities at risk which were published in the Federal Register in 2001.

Currently, in California, the responsibility of adding or removing communities from the “at risk” list has been assigned to the California Fire Alliance by the Director of Cal Fire. Each September, the California Fire Alliance Board reviews application forms from individual communities requesting that they either be added or removed from the “at risk” list. The current communities at risk list for California, as well as the application form requesting a change in status, can be found on the California Fire Alliance website http://www.cafirealliance.org/communities_at_risk.

In 2003, the Healthy Forests Restoration Act (HFRA) provided communities with the opportunity to partner with federal agencies in planning and implementing fuel reduction

projects within the wildland urban interface with federal lands through the cooperative preparation of a Community Wildfire Protection Plan (CWPP). A CWPP identifies and prioritizes areas for hazardous fuel reduction treatments near federal lands and recommend the types and methods of treatment that will protect one or more at-risk communities and its essential infrastructure. The at-risk communities are so designated due to their proximity to undeveloped federal lands and the assumed high fire hazard these lands represent. A group of geographically-linked communities at risk may join together with adjacent federal land managers and local fire agencies to develop a strategy for hazard reduction through a CWPP. Communities with CWPPs in place are often given priority for funding of hazardous fuels reduction projects carried out under the HFRA and the National Fire Plan.

The 2007 Healthy Forests Report indicates that 46 states have identified and documented over 44,000 communities-at risk. Further, approximately 1100 CWPPs have been completed covering nearly 3000 communities; 450 additional CWPPs are being developed (USFS 2007).

2.3 WILDLAND FIRE MANAGEMENT OPTIONS

To accomplish FMP goals, wildland fires will be suppressed and prescribed fire will be introduced where appropriate for hazard fuel reduction and/or resource benefit. GGNRA, in accordance with NPS policy, uses Minimum Impact Suppression Tactics (MIST³) in all fire management activities. Mechanical fuel reduction projects will focus on Wildland Urban Interface areas and protection of park visitors, staff and sensitive natural and cultural resources. Mitigation measures addressing potential environmental impacts will be incorporated into site specific projects as assigned through interdisciplinary project review as required by the NEPA process completed for the FMP. Fire managers, in consultation with resource advisors, will balance the potential resource impacts of wildland fire with the potential impacts of fire suppression activities in choosing the appropriate management response to wildland fire and appropriate MIST techniques to apply.

GGNRA contains significant natural and cultural resource values. Values to be protected and their susceptibility to damage or loss by fire are discussed in more depth by Fire Management Unit (FMU), in Section 2.4 of this FMP and in Chapter 3, Affected Environment of the GGNRA FMP Final EIS. Resource management objectives drive strategies with the objectives of restoring and maintaining the naturally functioning ecosystems, restoring cultural landscapes and protecting sensitive resources.

Wildland fires at GGNRA are managed with supporting cooperation of local fire departments, state wildland firefighting organizations and federal land management agencies. This approach to wildland fire management involves partnership, cooperation and collaboration and is defined by the California Fire Protection Agreement and the

³ MIST is defined as the application of techniques that effectively accomplish wildland fire management objectives while minimizing the impacts to cultural and natural resources commensurate with ensuring public and firefighter safety and effective wildland fire control. Further information is provided in Section 3.2 and the MIST Guidelines are in Appendix E, Section 9.

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California Fire Assistance Agreement. Cooperating fire departments include the Marin County Fire Department (MCFD), Southern Marin Fire Protection District, California Department of Forestry and Fire Protection (Cal Fire) and the North County Fire Authority (Northern San Mateo County). Cooperation with volunteer fire districts (Muir Beach and Stinson Beach) and homeowners associations is also critical and should be defined by locally developed agreements as well as the State Mutual Aid Agreement.

Along with other Bay Area Network Parks staff, the GGNRA Division of Fire Management provides technical assistance on fire management matters to two national park units in Contra Costa County on the east side of San Francisco Bay -- Eugene O'Neill National Historic Site and John Muir National Historic Site in Danville and Martinez, respectively. This relationship should be formalized by an inter-park agreement in the future. The network prescribed fire specialist is responsible for providing fuels management program advice to these parks.

2.4 ENVIRONMENTAL FACTORS INFLUENCING FIRE MANAGEMENT

2.4.1 Fire Regime and Fire History

2.4.1.1 San Francisco Bay Area Fire Regime

Five successive fire regimes have been identified for the Pleistocene era in the central California coast. The “management practices” or human influence on the landscape during last the last four eras have dramatically influenced the disturbance regime for this landscape, though to a lesser degree than change in climate.

Table 2 shows the changes in Bay Area climate over the last 128,000 years and summarizes the changes in the dominant vegetation. For central and northern California, pine is generally an indicator of cooler or glacial conditions, and oak is an indicator of warm conditions. Redwood is an indicator of increased moisture and moderated summer coastal temperature related to coastal fog, also related to coastal upwelling (Heusser 1998).

Table 2 -- San Francisco Bay Area Climatic Changes

Time Period	Climatic Characteristics	Dominant Plant Communities
128,000 – 28,000 BP	Much cooler than present	Conifers predominate
28,000 – 13,000 BP	Cold and dry	NA
13,000 – 7,500 BP	Warm and wet	Oaks begin to increase
7,500 – 2,900 BP	Warm and dry	Oak woodland, prairies, coastal scrub dominate until modern era
2,900 – 900 BP	Cooler	NA
900 – 625 BP	Warm and dry at end	Medieval Warm Period
625 – 500 BP	Current climate	NA
500 – 300 BP	Wetter and cooler	Little Ice Age
300 BP – present	Current climate	Nonnative plants introduced

Source: NPS, Pacific West Regional Office, 2004.

Note: BP = before present. NA = not applicable

Additional information on GGNRA Fire Regimes, Fire History, Climate and Fire Weather can be found in the GGNRA FMP Final EIS, pages 135 to 151 (November 2005).

Natural Fire Occurrence (128,000 to About 10,000 Years BP)

During the last 20,000 years, the Earth's climate underwent a dramatic transition from glacial to interglacial conditions, a change as large as any change during the past three million years. These climatic variations resulted in large biotic responses, including migrations of individual species and rearrangements of vegetation associations.

Prior to human settlement of central California, natural ignition sources for wildfire would be lightning or spontaneous combustion. Recent records of lightning strikes in the Bay Area show that fires could occur along the Marin coastline throughout much of the year, regardless of the high probability of dense fog. Without human intervention, it is thought that fire could linger in tree trunks for weeks, and reemerge under drier conditions; thus a fire could burn through the summer and fall until the rainy season began (Stuart 1987).

Native American Period (≈10,000 BP – 1775 AD)

There is increasing evidence that Native American land management practices, including the use of fire, caused cumulative and permanent effects in plant communities and species composition for many Bay Area vegetation types. Although information on their burning practices is scant, both the Coast Miwok and Ohlone peoples are known to have regularly burned extensive areas of coastal prairie, coastal scrub, marshlands, and oak woodland (Collier and Thalman 1996, Duncan 1992, Kelly 1978, Levy 1978).

Fire is thought to have been used as a tool for communication, driving game, security from human enemies and predators, improving the flow of springs, increasing productivity for grazing, increasing yield of food sources (acorns, grasses, forbs, tubers, bulbs, fruits, grains), controlling plant pests and diseases and removing competing conifers from oak woodland.

Fire management was more common in grassland, oak savannas, and ecotones of grassland and chaparral than in shrublands and forests (the latter two communities burning between 10 and 28 years on average). Sapsis and Martin (1994) estimated that fire burned from one half million to over 19 million acres of California's total area each year. The exact spatial extent of the influence of burning on the landscape is not known and has been debated. Still, the level of fire use necessary to maintain specific resources in conditions required by the various cultures suggests that extensive and very intensive burning would have been common in important vegetation types (Anderson and Moratto 1996).

Spanish-Mexican Influences (1769-1848)

Spanish and later Mexican settlement introduced year-long cattle and sheep grazing, burning, and cultivation that led to the extirpation of many native animal species and the further spread of nonnative plants. The rapid, extensive conversion of the landscape to nonnative annual vegetation was so complete that the original extent and species

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composition of most native perennial grasslands are largely unknown (Burcham 1957, Holland and Keil 1995).

The move toward fire exclusion began early in California. The first law against starting fires was issued under Spanish rule in 1793 (Barrett 1935, Gordon 1977). It was aimed at halting Indian burning of grasslands that reduced the amount of forage available to Spanish horses and livestock. Ranchero owners burned coastal scrub, chaparral, and oak woodland to expand pastures. The rancho period, primarily under Mexican rule, was relatively short-lived (1822-1846), but it exerted such a strong influence on the landscape that the fence lines, roads, and vegetation pattern are still visible today. Within GGNRA, there were three ranchos in San Mateo County (Buri Buri, Corral de Tierra, and San Pedro), two in San Francisco (Laguna de la Merced and Cañada de Guadalupe, although the majority of the latter was in San Mateo County, and three in Marin County (Saucelito, Tomales y Baulines, and Las Baulines).

American Influences (1848-1945)

In this period, the large ranchos were subdivided into smaller farms, ranches, dairies and timber operations and a 1900-acre parcel in the Marin Headlands was sold to the Army. Beginning in the 1850's, fences went up, fertile marine terraces were tilled, and redwood and Douglas fir forests in Marin and San Mateo County were logged quickly and on a large scale. The entire Phleger property was logged and milled onsite 1852 to 1855. After redwood was removed, loggers focused on cordwood (oak, bishop pine, madrone, etc.). In some areas after the trees were cut, workers skimmed the soil for clay to make bricks (Fairley 1987).

Agriculture, farming, erosion control, landscaping and trade spread fire-adapted nonnative species changing the landscape and altering the fire regime. Eucalyptus was first planted in San Francisco Bay Area in 1856 (McClatchie 1902). Extolled for its qualities as a fast-growing timber species, eucalyptus became a widely planted for ornamental use, timber, and windbreaks. French broom (*Genista monspessulana*), Portuguese broom (*Cytisus striatus*), Scotch broom (*Cytisus scoparius*), and Spanish broom (*Spartium junceum*) all were introduced into California in the mid-1800s for landscaping and to control roadside erosion control. The ability of these plants to fix nitrogen, to produce copious amounts of long-lived seed, and to tolerate almost any soil condition allowed these species to grow rapidly and form dense stands, making regeneration of most native species difficult or impossible.

Wildland fires were frequent and large in the late 1800s and early 1900s (Perry 1984) preventing some grasslands from being invaded by brush. The Forest Reserve Act of 1891 introduced programs to control fire and grazing. By the 1880's, the State Board of Forestry was urging the public to support fire exclusion in forests to increase future wood production.

Modern Influences (1945-present)

Grazing by domesticated livestock and clearing of pastureland continued to be practiced until the 1960s (Burcham 1957). These practices had resulted in lighter fuel loading, especially near residential areas, markedly lowering the fire danger for the area. By

1990, explosive growth had filled in the central flats of the San Francisco Bay Area and agriculture had moved beyond the suburbs.

In general, disturbances by fire have gone from long intervals in the pre-human period to shorter intervals in the late Native American and Spanish-Mexican periods, moderate intervals in the early Anglo era, back to long intervals in the modern era. The altered fire regime has led to an increase in crown and surface fuels, increased tree density bringing high-intensity fires and higher fire frequency in some areas (which continued until 1940s), conversion of oak woodland to grassland, and the invasion of understory woody vegetation.

If current management strategies are continued indefinitely, it is difficult to predict where this change in fire regimes will ultimately lead, especially with the potential of future warmer and drier climate patterns resulting from global climate change. However, if warm, dry years become more common, as some suggest is likely (Fried et al. 2003, Union of Concerned Scientists 2002), the recent paradigm of large, severe fires would be expected to continue.

2.4.1.2 *San Francisco Bay Area Fire Regime Research*

Fire history can be reconstructed from a variety of data sources: tree-ring analysis (dendrochronology), cultural and historical accounts, written records, and the analysis of charcoal in sediment cores. Each of these data sources has its limitations in regards to spatial and temporal detail and accuracy.

Sunget and Martin (1984) studied the occurrence of lightning in the Marin coastal area and the potential for a fire start. Storms with lightning occurred 1.9 times per year at Mount Tamalpais in the years 1901 and 1908-1926. The weather station at this site indicates that 18 percent of these storms occurred in September coinciding with high fire hazard conditions.

Many researcher have studied the fire history in redwood and Douglas fir/hardwood forests in the Bay Area. A recently published analysis of tree ring fire scars in coast redwood forests in Point Reyes, Jackson State Forest (Mendocino area) and Redwood National Park finds that pre-20th century fire intervals ranged from seven to 20 years. It is thought that these forests experienced frequent, recurrent surface fires likely set by Native Americans (Brown, 2007). A recently published study of fire regimes of redwood forests in northern San Mateo County found an average fire return interval of 13 and 16 years for two sample sites in Huddart County Park, directly adjacent to GGNRA's Phleger Estate (Stephens and Fry, 2007).

Additional studies have been completed within the San Francisco Bay Area and are discussed in the GGNRA FMP Final EIS, November 2005, pages 147-150.

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2.4.1.3 Recent Fire History in Marin and San Mateo Counties

Table 3 lists fires by date for the two counties, and Figures 3 and 4 show wildfire locations. Months are given when known. Table 4 presents a summary of GGNRA wildfire occurrences over the last two decades.

Table 3 -- Wildfire History of Coastal Marin and San Mateo Counties

Date	Description
1859 Sept.	Wildland fire, Mount Tamalpais, burned for three months.
1865	Woods of Marin along the shore of Bolinas Bay burned for two weeks.
1877	Area west of San Andreas Lake burned over large territory for more than three weeks.
1878	1,200-1,500 acres of chaparral, grass, and timber burned near Nicasio.
1880	Campers caused fires, burned 5-mile by 10-mile area in San Mateo County.
1881 Sept.	65,000-acre wildland fire burned for seven days, one fatality. Started near Blithedale Canyon, Mill Valley, by a man who set fire to a pile of brush.
1887	Fire spread from below San Andreas Lake to San Mateo Creek, burning 2,500 acres of second growth bay, oak, and madrone.
1889	On the ridge between San Andreas Lake and Crystal Springs Lake and two ridges west of San Andreas Lake. "For miles the hills are black and bare, the fire burned for at least 4 days spreading at least 1 ½ square miles a day."
1890 Oct.	More than 8,000 acres burned between San Rafael and Bolinas.
1891 June	12,000 acres of Mount Tamalpais burned; fire started in Bill Williams Gulch near Ross.
1892 Aug.	Fire started on Bolinas Road by two men cooking breakfast, spread over several hundred acres.
1893 Aug.	Fire thought to have been started by campers burned over 3,000 acres of Mount Tamalpais and Mill Valley.
1894 Sept.	Mill Valley fire originated from a campfire left by hunters started in redwood forest and "burned over a large stretch of country."
1904 Sept.	15,000-20,000 acres of grass and timber burned on the west side of Bolinas Ridge.
1913 July	On Mount Tamalpais, between 1,600 and 2,000 acres burned, from Rock Springs to Larkspur, including summit of mountain, Blithedale and Cascade Canyons, most of Fern Canyon, and spot fires beyond Muir Woods National Monument on the Dipsea Trail. Started west of West Point Inn at 10 A.M. probably by railroad sparks.
1919 Sept.	Fire started near Pipeline Reservoir, burned 40 houses on the ridge and stopped within 100 yards of Muir Woods.
1919	Fire swept from the hills above Sausalito, burned a hall, 5 stores, and 12 homes.
1923	Fire burned from Bolinas Ridge to within four miles of Fairfax, with a total size of 30-50 square miles.
1928	200 acres of brush burned around Fort Barry.
1929 July	"Great Mt. Tamalpais Fire," involving 2,500 acres of brush, forest, and grassland. Fire burned into Mill Valley from Fern and Cascade Canyons; 117 homes burned.
1929	A week-long fire around the town of Montara; completely burned down the town.
1931 Dec.	Illegal campfire in large group of charred redwoods in Cathedral Grove, Muir Woods.
1932 Nov.	Thanksgiving Eve Fire. Started at 10:25 P.M. in heavy grass 50 feet west of Panoramic Highway near Alpine Club. North winds spread it toward Muir Woods and Tourist Club. Sixty acres burned, including two acres of chaparral inside Muir Woods' boundaries.

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Date	Description
1933 Dec.	Fires prohibited in Muir Woods; all fireplaces eliminated.
1945 Sept.	18,000-acre fire that began at the entrance to Carson Canyon (Kent Lake).
1946	Large intense fires in northern San Francisco watershed.
1959 July	2:53 A.M. fire report in Kent Canyon near logging operations on Brazil Ranch. No wind; burned 50 acres before being controlled by 75 men.
1965 Oct.	150 acre fire ¼ mile from Muir Woods, near southeast boundary.
1995 Oct. 3-7,	12,354 acres at Mount Vision in Point Reyes NS comprised of 11,598 acres NPS, 386 acres State Park lands and 370 acres private. Forty-eight structures destroyed; 1,200 firefighters participated, took 4 days to contain and 9 days to control fire.

Source: NPS, Pacific West Region, 2004.

Table 4 – GGNRA Recent Wildfire History

Area	Past Two Decades (1987-2006)		Past Decade (1997-2006)	
	Human-caused Fires (average per year)	Lightning Fires (Average per year)	Human-caused Fires (average per year)	Lightning Fires (Average per year)
All GGNRA Lands	7.5	0.15	8.5	0.2
GGNRA Marin County	4.15	0.05	4.8	0.1
GGNRA – San Francisco County	3.1	0.1	3.6	0.1
GGNRA – San Mateo County	0.25	0	0.1	0

Source: PWR GIS, 2007

2.4.2 CLIMATIC AND TOPOGRAPHIC INFLUENCES

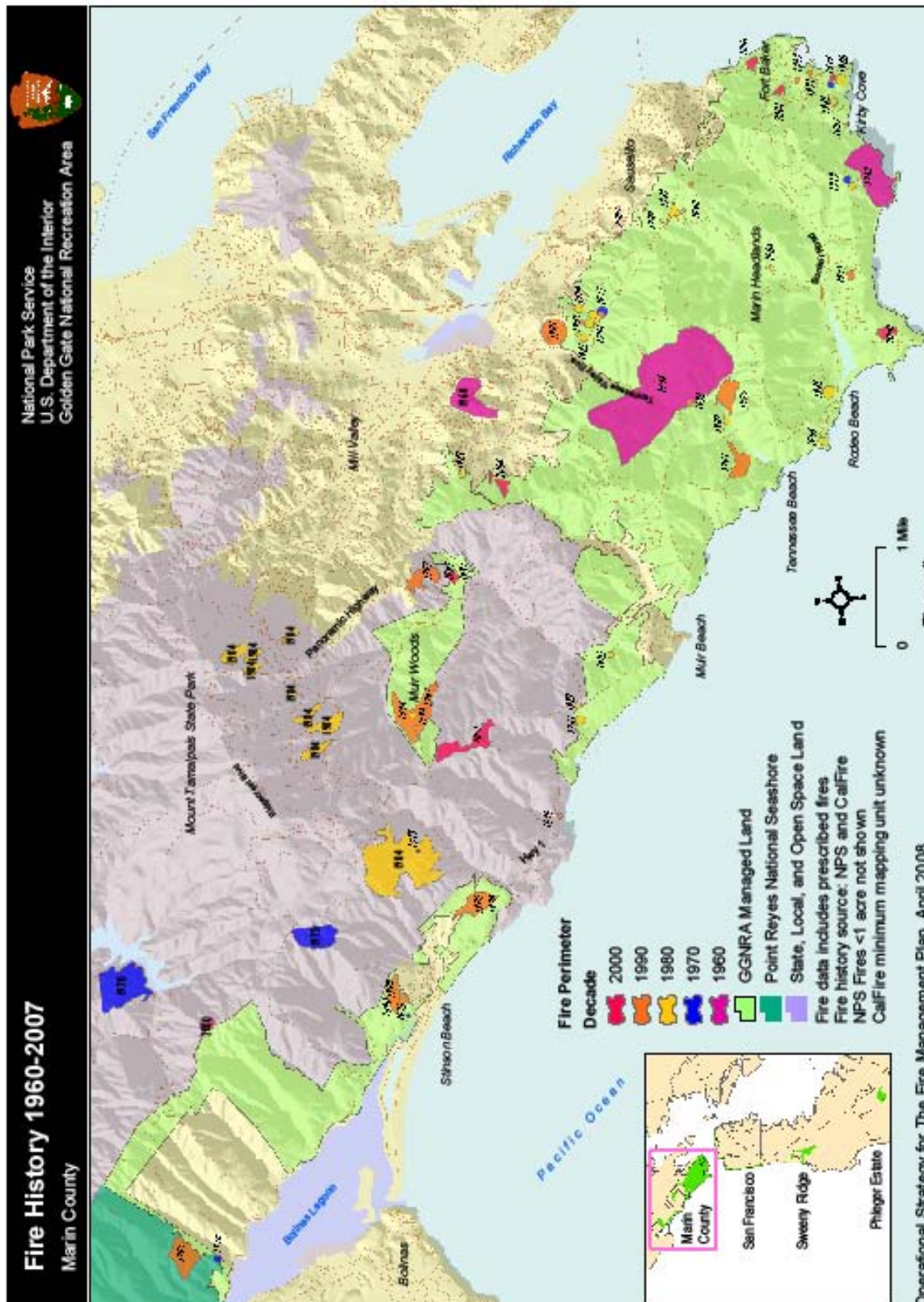
2.4.2.1 *Relative Humidity*

The average relative humidity of coastal California is high because of the frequent ocean winds and fogs. Dry northeasterly winds from the interior of the state bring fire weather to the Bay Area periodically during the fall, sending the humidity down to 20 percent.

In general, relative humidity is moderate to high along the coast throughout the year. Inland humidity is high during the winter and low during the summer. Since the ocean is the source of the cool, humid, maritime air of summer, it follows that relative humidity tends to decrease with increasing distance from the ocean. Where mountain barriers prevent the free flow of marine air inland, humidity decreases more rapidly. Where openings in these barriers permit a significant influx of cool, moist air it mixes with the drier inland air, resulting in a more gradual decrease of moisture. This pattern is characteristic of most coastal valleys (Golden Gate Weather Services 2002).

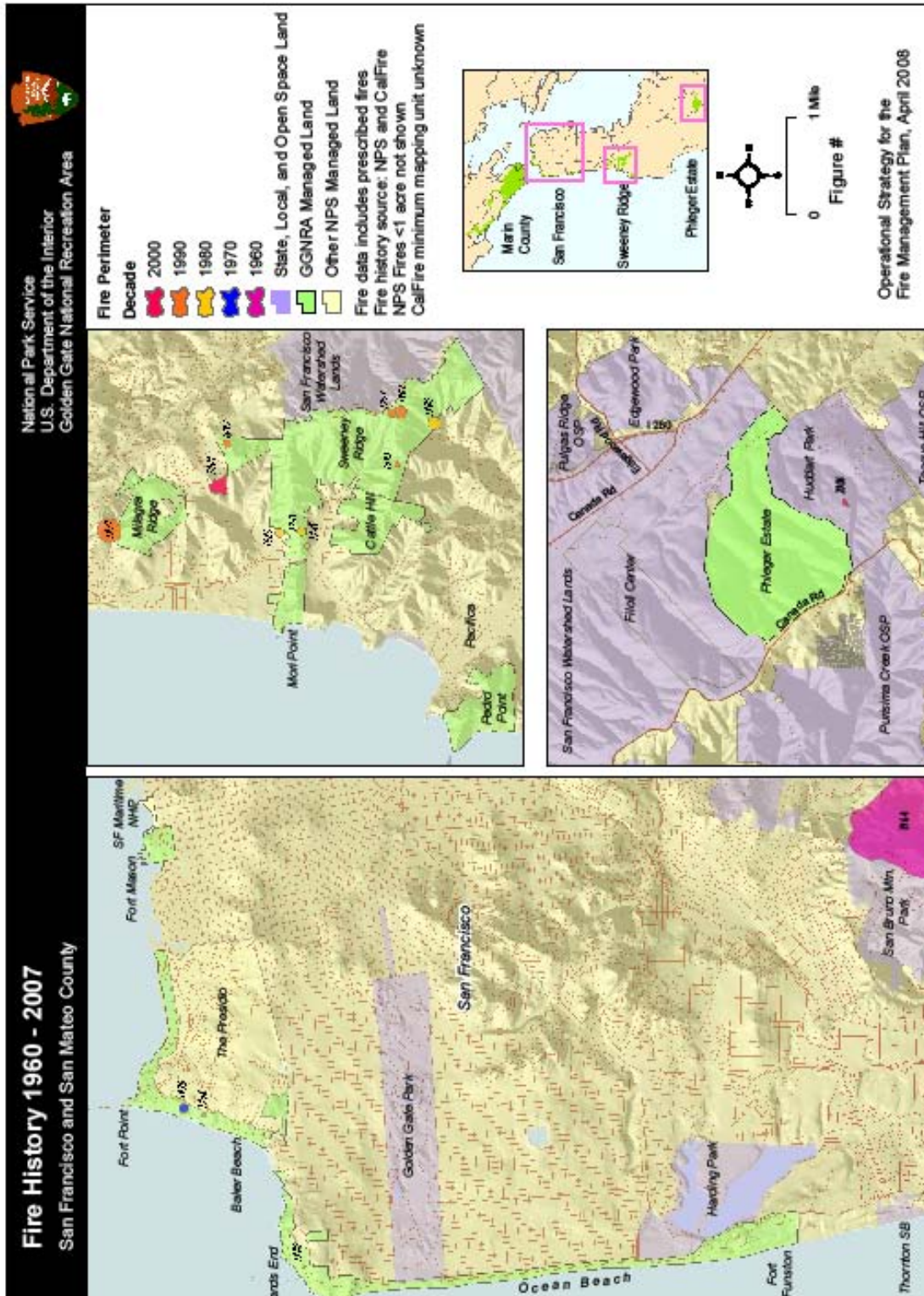
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Figure 3 – Locations of Historic Wildfires in Marin County



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Figure 4 – Locations of Historic Wildfires in San Francisco/San Mateo Counties

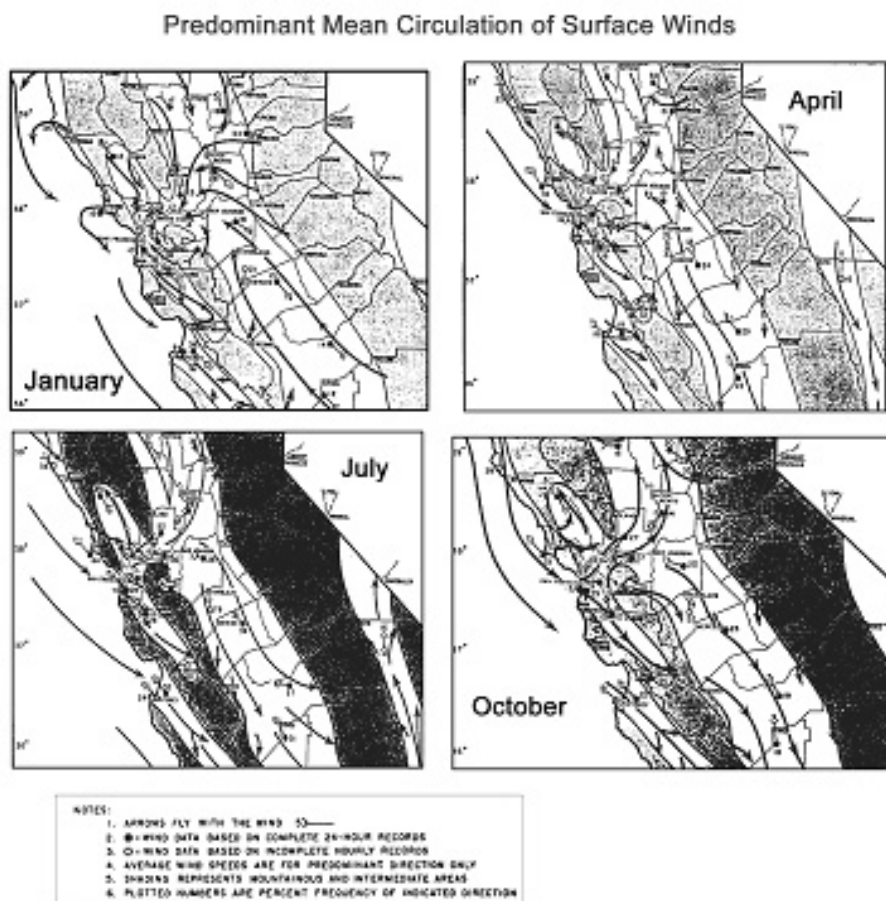


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2.4.2.2 Wind Patterns

California lies within the zone of prevailing westerlies and on the east side of the semi-permanent high-pressure area of the northeast Pacific Ocean. The basic flow in the free air above GGNRA is therefore from the west or northwest during most of the year. A local characteristic of the northwest wind alongshore is the creation of a jet effect around some of the more prominent headlands. Eddies form near the Golden Gate and just south of Point Reyes. Wind speeds in the immediate vicinity of these major headlands can be two or three times as great as the wind flow at nearby points (Golden Gate Weather Services 2002).

Figure 5 – Predominant Wind Patterns in Central California



Source: Bell 1958

The typical northwest summer wind is reinforced by the dynamics of the thermal low-pressure area located over the Central Valley and the southeastern desert area. In the San Francisco Bay Area, there is a marked diurnal pattern in the strength of the wind even though an onshore circulation tends to continue throughout the 24-hour period.

This helps to carry locally produced smoke away from the Bay Area, but creates problems for the regions immediately south and east of the source area.

When wind patterns shift from the prevailing pattern in the summer, winds can flow out of the Great Basin into the Central Valley, the Southeastern Desert Basin, and the South Coast. The result is high pressure over Nevada and lower pressure along the central California coast. The lower coastal pressure causes the hot interior air to be rapidly drawn to the west from the hot, dry interior. The winds are dry, strong, and gusty, sometimes exceeding 100 miles per hour, particularly near the mouths of canyons oriented along the direction of airflow. These interior winds are known as Diablo winds in the Bay Area, “northers” in the Sacramento and San Joaquin valleys, and Santa Ana winds in southern California (Golden Gate Weather Services 2002).

Figure 5 illustrates the predominant wind patterns in central California (Bell 1958). In the winter, the regional surface winds blow from the north-northeast. During spring and summer, stronger north-northwest winds dominate. These northwesterly winds are primarily caused and/or strengthened by the combination of high pressure offshore and the warmer air inland. During the fall transition, when warm easterly winds break through to the coast while inland conditions remain hot and dry, the coastal region faces its most significant fire threat.

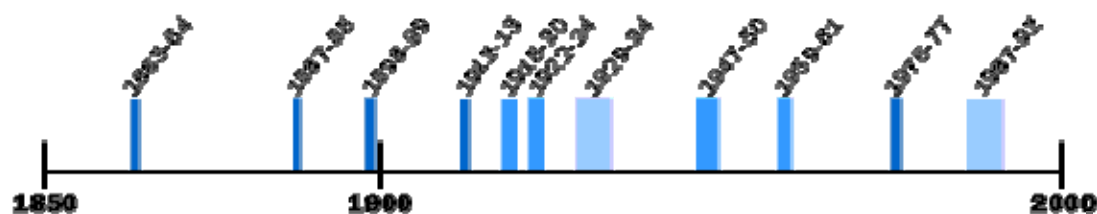
2.4.2.3 *Recurrent Drought*

One dry year does not normally constitute a drought in California. Droughts occur slowly, over a multiyear period. There is no universal definition of when a drought begins or ends. Areas most reliant on annual rainfall typically feel impacts of drought first.

Droughts exceeding three years are relatively rare in northern California, the area which is the source of much of the state’s developed water supply. The 1929-1934 drought years established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Figure 6 compares the 1929-1934 droughts in the Sacramento and San Joaquin valleys to the 1976-1977 and 1987-1992 droughts. The driest single year of California’s measured hydrologic record was 1977. California’s most recent multiyear drought was 1987-1992.

Measured hydrologic data for droughts prior to 1900 are minimal. Multiyear dry periods in the second half of the 19th century can be qualitatively identified from the limited records available combined with historical accounts, as illustrated in Figure 6, but the severity of the dry periods cannot be directly quantified.

California sustained two epic drought periods, extending over centuries. The first epic drought lasted more than two centuries before the year 1112; the second drought lasted more than 140 years before 1350. Studies of epic droughts evaluated drowned tree stumps rooted in Mono Lake, Tenaya Lake, West Walker River, and Osgood Swamp in the central Sierra Nevada. These investigations indicate that California has been subject to droughts more severe and more prolonged than those evidenced by the brief historical record.

Figure 6 – California’s Historical Dry Periods, 1850-Present

Notes:

Dry periods prior to 1900 estimated from limited data.

Covers dry periods of statewide or major regional extent.

2.4.2.4 *El Niño and La Niña*

Under “normal” circumstances over the Pacific Ocean, trade winds rush toward the equator to replace rising sun-heated air and cause an upwelling of air off Peru. These winds are pushed farther west by a high-pressure zone over Tahiti and attracted by a low-pressure zone over northern Australia. During an El Niño episode, the situation is reversed, with a low over Tahiti and a high over Australia. The trade winds die, the upwelling stops, and the ocean surface warms up in the eastern Pacific. The jet stream over the North Pacific, which normally brings storms to Oregon, Washington, and British Columbia, moves south, picking up warmth from the warm-water bulge below, and drenches California (Gilliam 2002).

During severe El Niño episodes like 1982-1983 and 1997-1998, the Bay Area received more than twice its “normal” rainfall. Houses were destroyed by mudslides, bridges were washed out, and highways were blocked. Although El Niño events occur every four to seven years, they vary greatly in timing and strength. A mild El Niño will scarcely have any important effect, but a strong one can bring disaster. The outlook for El Niño episodes in the 21st century is uncertain. As global warming continues, increasing temperatures of both the air and the water, El Niño events may increase in frequency and intensity (Gilliam 2002).

The opposite of El Niño is the less well-known La Niña. La Niña occurs when trade winds are stronger than usual over the Pacific Ocean, pushing more sun-warmed surface waters westward, causing more upwelling off Peru, and further intensifying the oceanic currents of the northern Pacific Ocean (Gilliam 2002). The wintertime effect of La Niña in the Bay Area is likely to be colder, windier weather and perhaps abnormal rainfall in either direction, too much or too little (and sometimes neither), depending on the erratic location of the jet stream. If La Niña persists into the summer, stronger upwelling off the California coast brings more fog to the area (Gilliam 2002).

2.4.2.5 *Climate Change*

Surface temperature measurements recorded daily at hundreds of locations for more than 100 years indicate that the Earth’s surface has warmed by about 1 degree Fahrenheit in the past century. This warming has been particularly strong during the last 20 years, and has been accompanied by retreating glaciers, thinning arctic ice, rising

sea levels, lengthening of growing seasons for some, and earlier arrival of migratory birds (Union of Concerned Scientists 2004).

GGNRA winters will quite probably become warmer, windier and wetter during the next century (Fried et al. 2003, Union of Concerned Scientists 2004). Summers may well become warmer, though winter will become proportionally even warmer. El Niños may increase in intensity and/or frequency.

Changes in the timing or amount of precipitation over the next century are likely to have a greater impact than changes in temperature (Union of Concerned Scientists 2004). For example, increases in the amount of winter rains could change the extent and mix of plant communities, expanding grasslands will likely encroach on the foothill shrublands of the coastal ranges. In many cases, however, plant and animal species will not be able to shift northward or upslope because the potential habitat has been claimed by development or nonnative species, or contains unsuitable soils or other physical limitations.

The frequency and/or magnitude of wildfires, floods, and disease and pest outbreaks will likely change in coming decades. Fried et al. (2003) predict that these conditions will produce more intense, faster-spreading fires in most locations. Their model shows that, despite any enhancement of fire suppression efforts, the number of escaped fires (those exceeding initial containment limits) increased 51% in the San Francisco Bay Area. Area burned by contained fires could increase by 41%. Furthermore, Fried et al. (2003) predicted that fire return intervals in grass and brush vegetation types would be cut in half on average. Their reported estimates represent a minimum expected change, or best-case forecast. In addition to the increased suppression costs and economic damages, changes in fire severity of this magnitude would have widespread impacts on vegetation distribution, ecological condition, and carbon storage, and would greatly increase the risk to property, natural resources, and human life.

In August, 2006, the journal SCIENCE published the results of research conducted by Westerling *et al.* which concludes that global climate change has already increased the duration and intensity of the wildfire season in the western United States. They determined that, since 1970, the length of the wildfire season has increased by 78 days and the average burn duration of large fires has increased from 7.5 to 37.1 days. When examining wildland fires, between 1970 to 1986 versus wildland fires since 1986, Westerling *et al.* found a fourfold increase in major incidents and a six-fold increase in acreage burned. According to Westerling *et al.* four critical factors -- earlier snowmelt, higher summer temperatures, longer fire season, and expanded vulnerable area of high-elevation forests -- are causing the increase. During this period, spring and summer temperatures increased by ~0.9°C and mountain snowpack melted 1- to 4-week earlier. As a result, high altitude forests become combustible earlier in the year and remain in that state over a greater period of time due to sparse summer rainfall and low humidities. Look over the fire record for the recent past, they found that years with an earlier snowmelt (and a longer drier summer) had five times as many wildfires as years in which the snowpack melted later. According to the report in the August issue of SCIENCE:

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The fires in Yellowstone Park in 1988 seemed to inaugurate this new era of major wildfires in the western United States. The fires lasted more than 3 months, burning 600,000 ha [~1.482 million acres] of forest, and -- despite the investment of \$120 million and deployment of 25,000 firefighters -- were only extinguished when snow began to fall in mid-September. The Yellowstone fires exemplify a common statistic of wildfires: Less than 5% of all wildfires account for more than 95% of the area burned. A small fraction of fires get very large and become uncontrollable despite human efforts to suppress them, regardless of money expended. Such efforts can cost more than \$20 million per day, and seasonal expenditures by governmental agencies in recent years have reached \$1.7 billion.”

An introductory article in the August 18, 2007 *SCIENCE* by S. Running, reports the results of seven general circulation models running future climate simulations for several different carbon emissions scenarios in preparation for the upcoming Intergovernmental Panel on Climate Change. The models all predict that June to August temperature would increase 2° to 5°C during the period of 2040 to 2069 in western North America. The models also predict that rainfall would decrease up to 15% during the same time period. If the increase was 3°, roughly between the highest and lowest predictions, the trend would show a spring/summer increase roughly three times the rate Westerling *et al.* determined for current trends. Wildfires in Canada and the western United States could increase by 74 to 118% in the next century.

2.4.3 Fire Weather

Post-frontal offshore flow can bring high fire danger to the Pacific Coast from British Columbia to southern California. The bulge of the Pacific High moving inland to the rear of a front produces offshore northeasterly winds (Fischer and Hardy 1976).

The fire season usually starts in June and lasts into October. Several synoptic weather types produce high fire danger. One is the cold-front passage followed by winds from the northeast quadrant. Another is similar to the east-wind type of the Pacific Northwest coast, except that the high is farther south in the Great Basin. This Great Basin High produces the foehn-type Diablo winds in the central Coast Ranges. Peak occurrence of these winds is in November, and there is a secondary peak in March. A third high fire-danger type occurs when a ridge or closed high aloft persists over the western portion of the United States. At the surface, this pattern produces very high temperatures, low humidity, and air mass instability (Fischer and Hardy 1976).

2.4.4 Prescribed Fire Windows

The approximate weather window for prescribed burns in grassland at GGNRA is from June to November. Burning can begin in some areas after annual grasses have cured, which does not normally occur until mid-June to early July. While areas with annual grasses generally have the most flexible burn windows in GGNRA, burns must still be timed to occur between the dissipation of the coastal fog and the onset of afternoon sea breezes.

In shrublands and forested areas, burning can be extremely difficult due to the narrow burning window from late September to early October when fuels dry out. Northeast wind events during this same timeframe can result in Red-Flag Days on which no prescribed or pile burning is allowed. “Burn days,” or days when burns would be in prescription, often do not coincide with weather conditions appropriate for burning in GGNRA, as on many of these days smoke dispersal would contribute to air quality problems.

2.5 GGNRA WILDLAND FIRE RISK/HAZARD VALUE ANALYSIS MODEL

2.5.1 Objectives

The GGNRA Risk/Hazard Value Analysis identifies and prioritizes areas of concern in the park due to the threat of wildfire. The products of the analysis are data and maps which will be used for fire management project planning such as prescribed burns and hazard fuel reduction. The analysis helps in prioritizing projects in order to meet objectives laid out in the fire management plan.

2.5.2 Analysis Area

The analysis area includes NPS lands managed by GGNRA, the Presidio Trust, PRNS and lands that will soon become part of GGNRA (i.e., Cattle Hill and Pedro Point). In addition, some lands outside of NPS jurisdiction were included such as Mount Tamalpais State Park and San Francisco Public Utilities Commission Peninsula Watershed. Lands outside of NPS management were included in the analysis because fuel model and other fire behavior input variables existed for these areas and their addition presents an overall perspective of fire risk, hazard, and values both within and surrounding NPS lands.

2.5.3 Methodology

A Geographic Information System (GIS) in combination with FlamMap fire and Asset Analyzer was used to analyze four variables consisting of fire risk (potential for ignition), fire hazard (potential fire behavior and crown fire), and values (potential loss due to fire, primarily the wildland urban interface). Asset Analyzer Arcview 3.3 extension was used to combine and weight the variables. Input variables were normalized from 0 to 100 (low priority to high priority) then weighted to define their contribution to the final output. The results were categorized into classes representing low, moderate, high areas of concern for fire management. The analysis does not address the ecological need to restore natural historic fire regimes. Instead, this analysis is intended to help direct fire

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management projects (mechanical thinning, prescribed fire, etc.) for effective and cost efficient protection of highly valued resources.

2.5.3.1 Input Variables

Risk – potential for fire ignition

Fire risk was based on 26 years (1980-2006) of NPS historical fire ignition records. The assumption is that the greatest potential for future fire starts is related to where fires have historically occurred. A point density calculation was performed on the historical ignition locations to create a density of fire frequency throughout the analysis area. The result was a raster dataset consisting of fires/year/acre. The kernel method (radius 2000m) was used to create the density surface. Fire densities were then reclassified into low, moderate, high risk of ignition.

Fire Risk		
Fire Density (fires/year/acre)	Fire potential	Asset Analyzer Value
0 - 0.05	Low	33
0.06 – 0.28	Moderate	66
0.29 – 0.88	High	100

Hazard – potential fire behavior

Potential crown fire activity and fire line intensity as predicted by FlamMap fire modeling software were used as hazard variables in the analysis. FlamMap computes potential fire behavior based on spatial variables of elevation, slope, aspect, fuel model, canopy cover, tree height, canopy base height, and crown bulk density along with fuel moisture and wind direction variables.

In 2004, Fire ecologists, botanists, GIS specialists and local fire experts from GGNRA, PRNS, and the NPS Fire Program Analysis team convened to translate local vegetation types into fuel mode consistent with the Anderson framework (Anderson 1982). Fuels are any organic material (live and dead vegetation, litter, and duff) that may combust during a fire. Fuel models are a numeric description of the quantity and arrangement of fuels developed to allow easy input of environmental parameters and fuel characteristics into fire behavior prediction models. The fuel models used describe potential fire behavior for a given fuel loading (weight per area) and arrangement (surface versus crown fuels), which generally corresponds to a vegetation type (Rothermel 1972).

Vegetation maps from 1994 aerial photography were assigned fuel models based on the alliance-association vegetation type and field plot information. GGNRA and PRNS field crews measured vegetation and fuels during 2001-2002. Data collected to validate vegetation data was also used for the creation of the fuel model data including percent cover and height of each vegetation stratum ocularly measured at 1690 plots (Noonan 2003).

Table 5 -- GGNRA Vegetation Types and Fuel Model Types

Fuel Model Types with Predominant Vegetation Community	Fuel Model Acres	Composition of Vegetation Community by Fuel Model Type	Acres
1-Coastal Dunes	21	Coastal Dunes	183
1-Grassland	1,983	Fuel Model 1	21
2-Coastal Scrub/Chapparal	1,780	Fuel Model 5	8
4-Coastal Scrub/Chapparal	132	Fuel Model 8	154
5-Coastal Dunes	8	Grasslands	1,983
5-Coastal Scrub/Chapparal	623	Fuel Model 1	1,983
6-Coastal Scrub/Chapparal	4,991	Coastal Scrub/Chapparal	7,526
6-Douglas-fir/Coast Redwood	41	Fuel Model 2	1,780
6-Riparian Forest/Shrubland	8	Fuel Model 4	132
8-Coastal Dunes	154	Fuel Model 5	623
8-Douglas-fir/Coast Redwood	350	Fuel Model 6	4,991
8-Herbaceous Wetlands	92	Douglas-fir/Coast Redwood	1,556
8-Unclassifiable Vegetation	8	Fuel Model 6	41
8-Native Hardwood Forest	1,381	Fuel Model 8	350
8-Non-native Evergreen Forest	590	Fuel Model 9	924
8-Riparian Forest/Shrubland	328	Fuel Model 10	241
9-Douglas-fir/Coast Redwood	924	Herbaceous Wetlands	92
10-Douglas-fir/Coast Redwood	241	Fuel Model 8	92
10-Non-nat Evergreen Forest	9	Native Hardwood Forest	1,381
98-Water	45	Fuel Model 8	1,381
99-Built-up Disturbed (unburnable)	717	Nonnative Evergreen Forest	599
99-Unveg Shoreline/Outcrop (unburnable)	469	Fuel Model 8	590
Sum Acres	14,896	Fuel Model 10	9
		Riparian Forest/Shrubland	336
		Fuel Model 6	8
		Fuel Model 8	328
		Unclassifiable Vegetation	8
		Fuel Model 8	8
		Sum Burnable Acres	13,665

Source: NPS, GGNRA Fire GIS, GGNRA Fire Management Office, 2008.

Fire hazard was modeled for extreme conditions (97th percentile weather) using data derived from the Barnabe RAWS station. Corky Conover (NPS) analyzed historic data from the Barnabe Remote Automated Weather Station (RAWS) in Fire Family Plus (FF+) software program. The “G” model was used to obtain 97th percentile fuel moisture estimates for all fuels size classes. Barnabe RAWS is located in the San Geronimo Valley, east of Olema and may not represent weather conditions in all locations of GGNRA; however it was felt the data from this station is sufficient for fire planning purposes.

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All wind directions were analyzed (1), and then only easterly wind directions (2), and finally all wind directions from the NW-SE in a clock wise manner (3). The lowest fuel moisture values from these three FF+ runs were used to create an initial fuel moisture file (*.fms) in the FARSITE program to use in the FlamMap model runs. Wind was modeled uphill at 7 miles per hour (mph). 97th percentile wind speed per Barnabe weather station is 15mph; however since FlamMap was set model winds uphill it was felt 15mph was too extreme to yield realistic results.

Initial fuel moisture percentages for all fuel models

1 Hr.	10 Hr.	100 Hr.	Herbaceous	Woody
2	5	8	30	93

FlamMap modeled output of fireline intensity (BTU/ft/s) was reclassified into rankings of low, moderate, high, and extreme based on the fire suppression guidelines (National Wildfire Coordinating Group 2004). Crown fire was reclassified into three rankings (unburned and surface fire, passive crown, active crown).

FlamMap potential fireline intensity

Fireline Intensity	Btu/ft/sec	Asset Analyzer Value
Unburnable	0 - unburnable	0
Low	1 – 100	25
Moderate	101 – 500	50
High	501 – 1000	75
Extreme	> 1000	100

FlamMap potential crown fire activity

Crown fire activity	FlamMap results	Asset Analyzer Value
Low	Unburned or surface fire	0
Moderate	Passive crown fire (torching)	50
High	Active crown fire	100

Values - values at risk from fire

GGNRA borders residential communities in San Mateo, San Francisco and Marin counties for approximately 40 miles. A wildland fire near this boundary could threaten homes and private property. The Wildland Urban Interface was used to delineate values at risk. Wildland Urban Interface is defined as the intermix of housing or developed lands with undeveloped lands. For the analysis a kernel method (radius 2000m) density calculation of tax parcel locations was reclassified into four categories ranking from low (rural) to high (urban). An attempt was made to eliminate parcels with no structures or housing units from the analysis using digital aerial photography from

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2001 and 2004, however the data was not field verified. It was also assumed for the analysis that a parcel containing a structure represents one housing unit and does not take into account multiple-housing units such as apartment complexes. Developed GGNRA lands such as Capehart housing and Fort Cronkhite in the Marin Headlands were also classified as wildland urban interface.

Values at Risk (Density of developed lands)

Density description	Density	Asset Analyzer Value
Non-Wildland Urban Interface	Less than 1 unit / 40 acres	25
Rural	(1 unit / 40 acres) to (1 unit / 5 acres)	50
Intermix	(1 unit / 5 acres) to (1 unit / 1 acre)	75
Urban	Greater than 1 unit / 1 acre	100

2.5.3.2 Analysis using Asset Analyzer

Asset Analyzer is an Arcview 3.3 GIS software extension developed by the Southern Sierra Geographic Information Cooperative. Asset Analyzer applies a weighted sum to multiple variables in order to identify areas of high concern or priority. Input variables must be normalized on a scale of 0-100 (lowest priority to highest priority). Weighting the input variables allows a range of scenarios to be developed focusing on specific goals. For example, identifying areas of high fire behavior in relation to WUI or identifying areas prone to fire starts in relation to high fire behavior.

Asset Analyzer was run four times with different weighting schemes that emphasized different inputs. Asset Analyzer does not allow an input variable to be set at 0%; therefore 1% was used when a particular variable not to be considered in the analysis.

Input Variable Weighting for Asset Analyzer runs

Analysis Run	Risk of Ignition	Fireline Intensity	Crown Fire Potential	WUI Density	Variable Total
1. Equal Weight	25%	25%	25%	25%	100%
2. Fire Behavior Emphasis	1%	49%	49%	1%	100%
3. WUI/Crown Fire Emphasis	10%	10%	40%	40%	100%
4. Ignition Risk/Fire Behavior Emphasis	33%	33%	33%	1%	100%

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2.5.3.3 *Model Results and Discussion*

Asset Analyzer offers the flexibility of emphasizing one or more of the input variables through the weighting process. Four results were presented to fire management for consideration when setting project priorities:

1. Equal Weighting of Variables – Weighting variables equally gives an overall estimate of ignition risk, fire behavior potential, and potential loss due to fire. It provides a broad picture of fire management areas of concern.
2. Fire Behavior Emphasis – Fireline intensity and crown fire potential give an estimate of fire control difficulty, likelihood of fire escaping initial attack, and fire costs.
3. Wildland Urban Interface and Crown Fire Emphasis – Crown fire in proximity to WUI is important for understanding the potential for extreme fire behavior and threats to human life and property and for estimating costs from a large fire.
4. Ignition Risk and Fire Behavior Emphasis – Likelihood of ignition in relation to potential fire behavior gives an estimate of potential fire frequency and fire control difficulty.

There is not a correct or ultimate input variable weighting combination that will yield a best or desired outcome. All four analyses will be considered when setting fire management priorities. It is important to look at each analysis and the weighting of each variable in order to understand what is driving the model. In order to understand why one area of the park falls into a particular category of “area of concern” versus another you need to look at the input variables – it could be close to WUI, could have high crown fire potential, a combination of variables, etc.

It is not surprising that portions of the park along the boundary rank higher in terms of the hazard model due to their close proximity to development and the fact that many of these areas contain heavy fuels, nonnative forest, and hilly terrain. Maps of the results of the analysis are represented in Figures 7 through 10.

Figure 7 –Value Model Input Variables: WUI & Fire Density

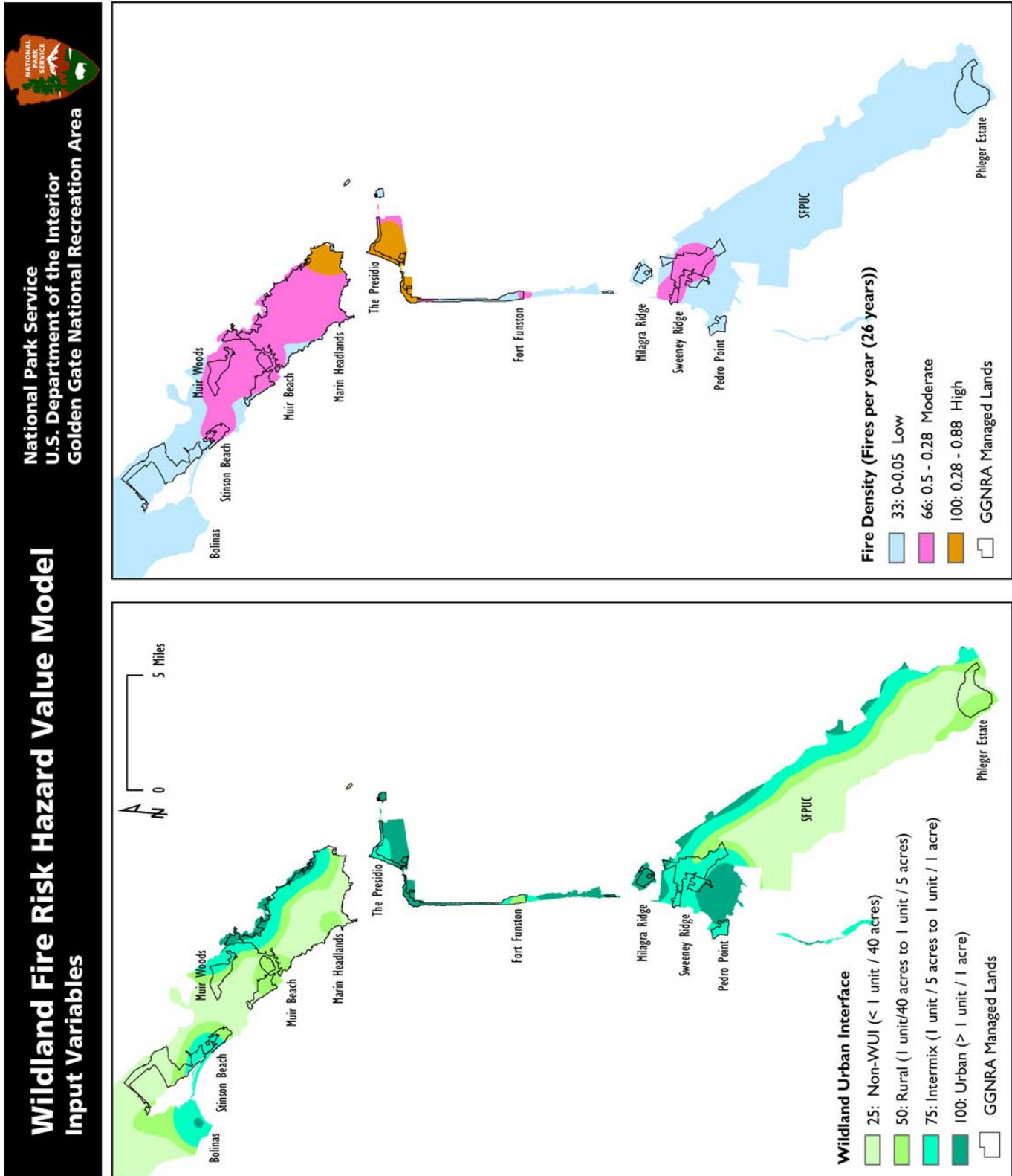


Figure 8 –Model Input Variables: Intensity & Crown Fire Potential

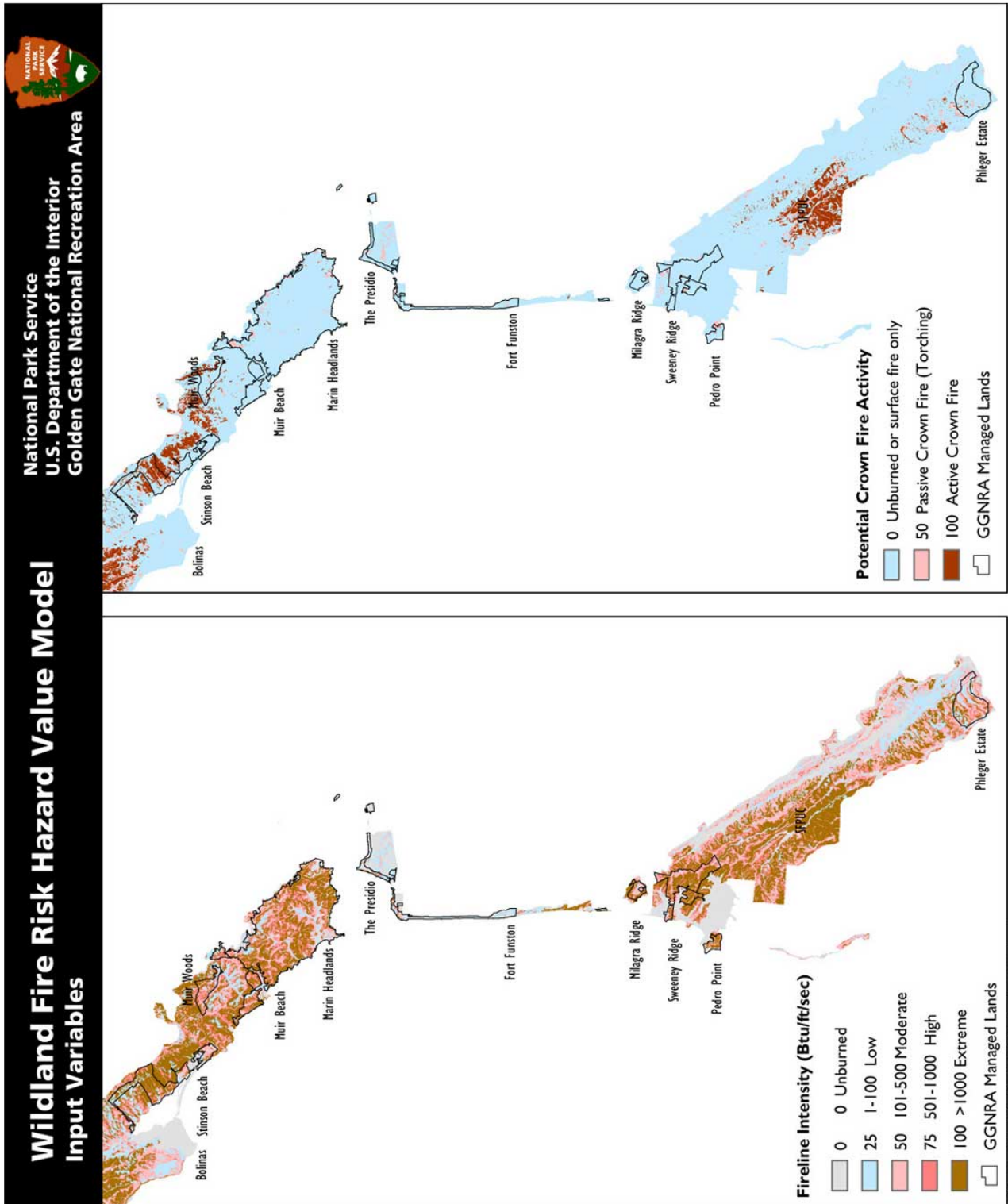
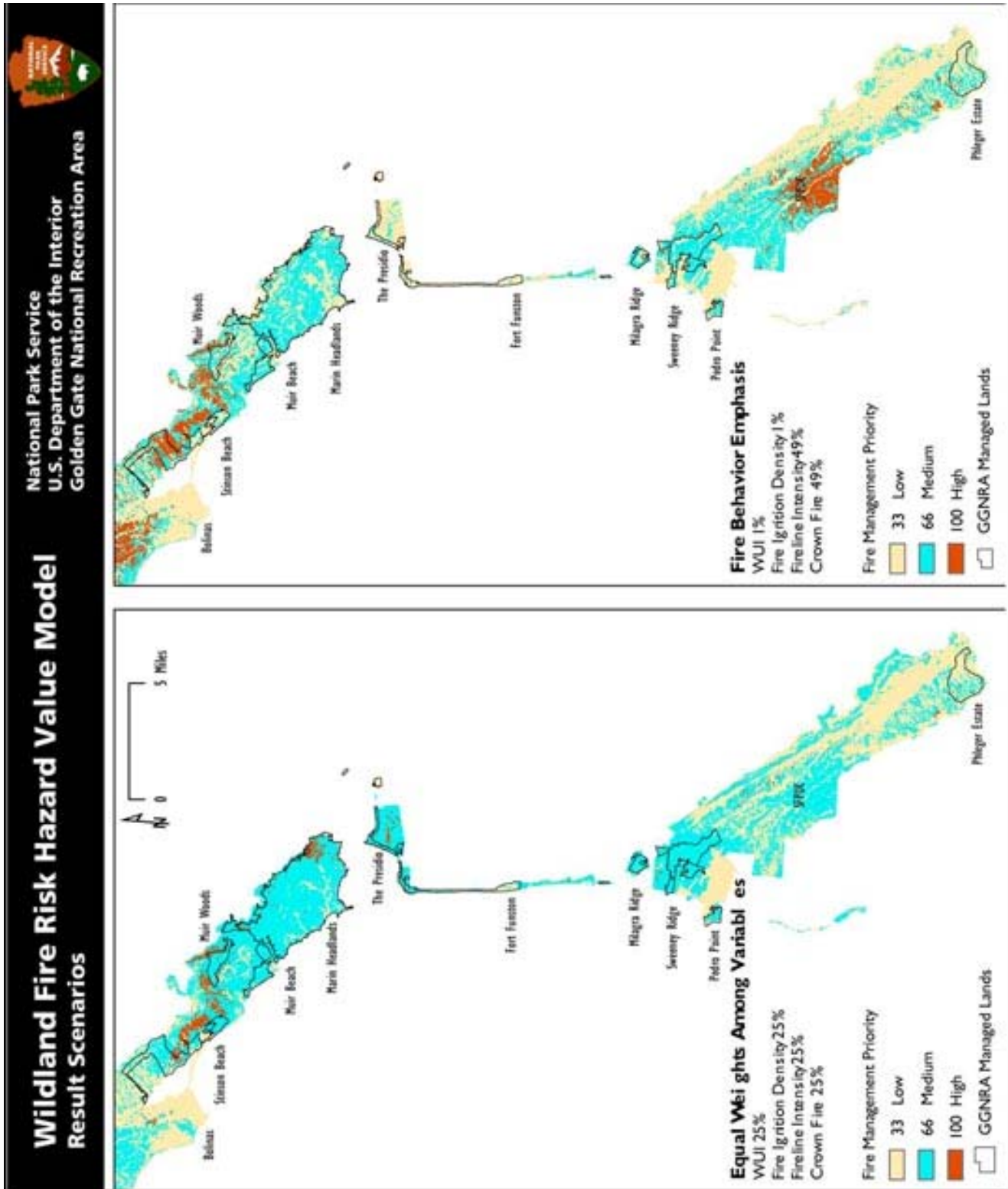
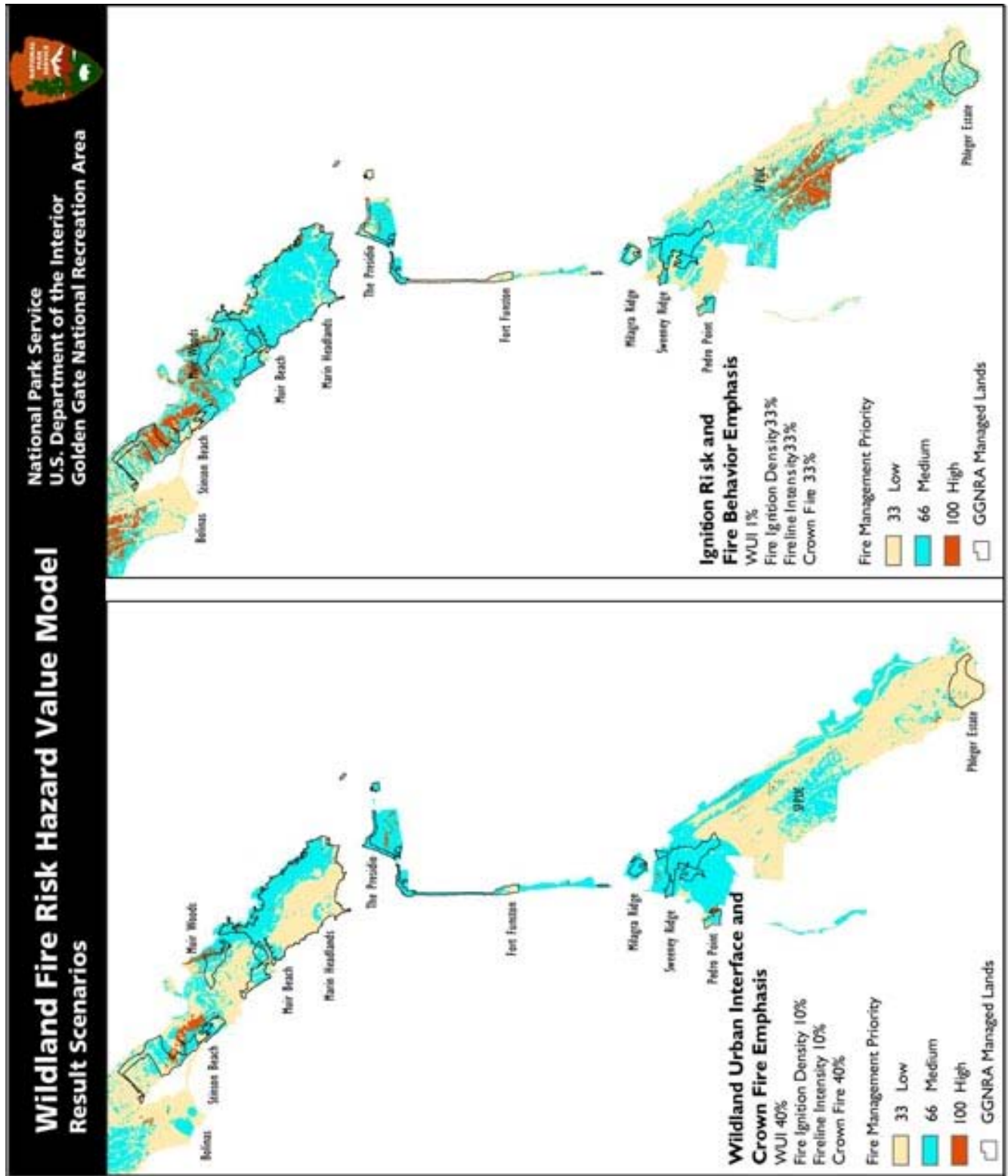


Figure 9 - Model Results: Equal Weight & Fire Behavior Emphasis



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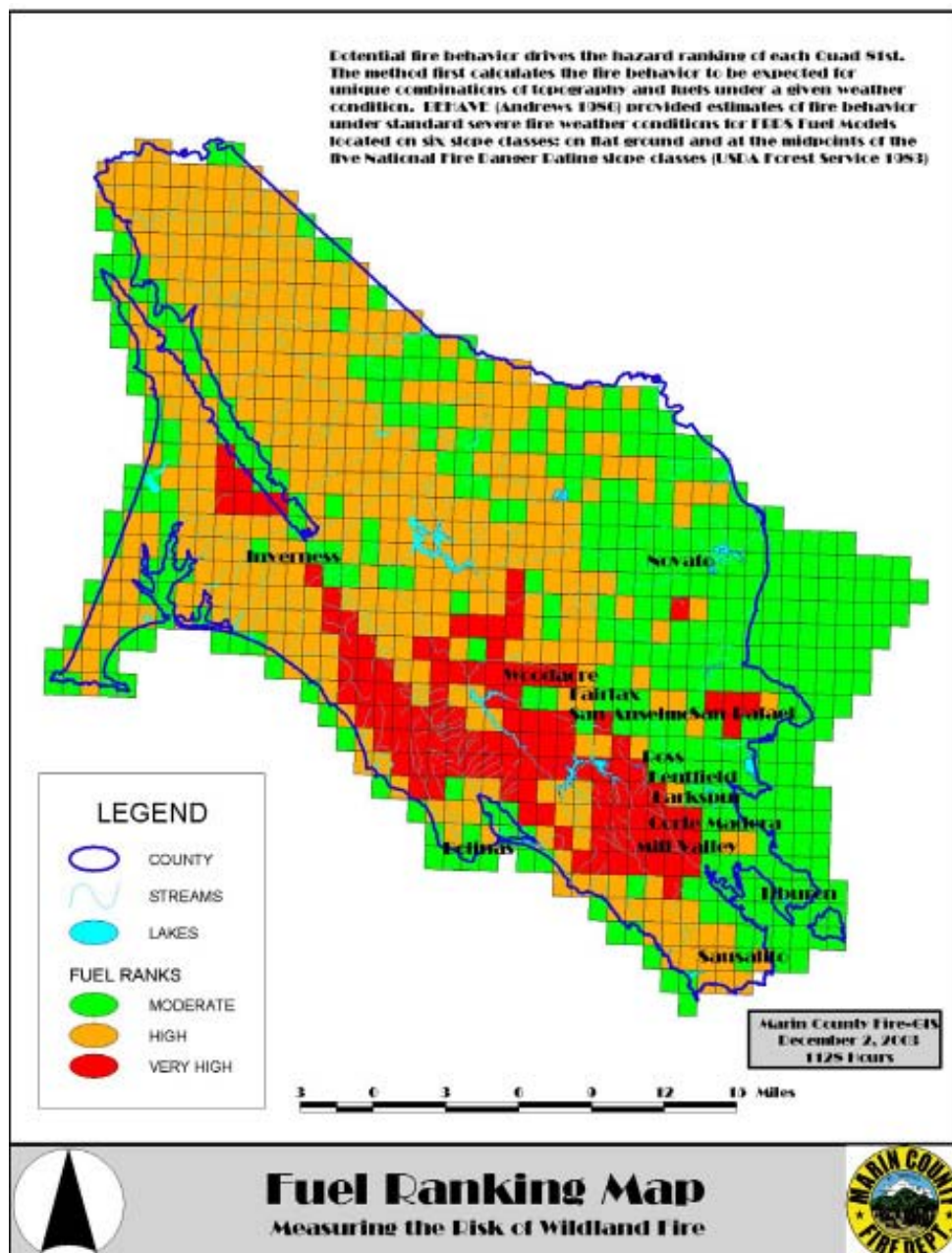
Figure 10 - Model Results: Crown Fire & Ignition Risk Emphasis



2.6 MARIN COUNTY FIRE DEPT HAZARD MODEL

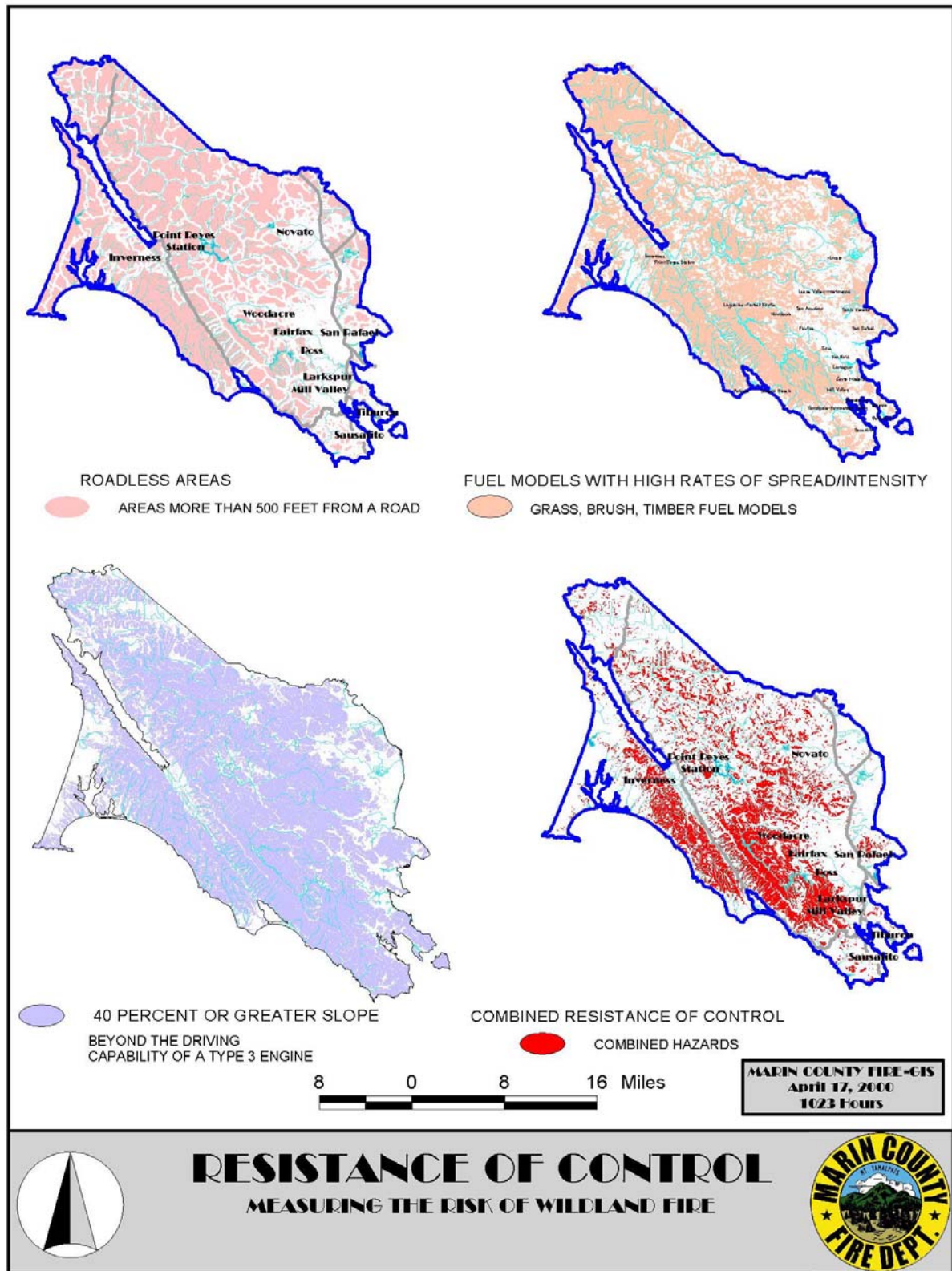
The Marin County Fire Department, using data provided by GGNRA Fire Management and GIS personnel, developed a wildland fire hazard model to identify the highest risk areas in the county. Fire behavior factors such as rate of fire spread and level of fire intensity, fuel type under extreme weather conditions (see Figure 11), was combined with variables such as slope, proximity to roads, etc. to map those areas of the county where it would be more difficult to control a wildland fire, denoting a higher level of risk. The results are shown in Figure 12.

Figure 11 – Marin County Fire Department’s Fuel Ranking Map



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Figure 12 – Marin County, Inputs Fire Department’s Fuel Ranking Map



2.7 CAL FIRE RISK ASSESSMENT FOR SAN MATEO COUNTY

To develop a wildfire risk assessment for San Mateo County, Cal Fire gathered data on vegetation type, fire history, fire weather history, level of service (distance to a fire station), slope, presence of ladder fuel, and crown closure. Much of Sweeney Ridge, Pedro Point and Milagra Ridge are rated as having high fuel loading. In addition, Sweeney Ridge is rated as having a moderate to high level of assets at risk overall combining public and private assets into one value. The Sweeney Ridge rating may stem from its proximity to the San Francisco watershed as the Ridge is given a lower risk rating when only residential structures are considered. An assessment of risk is often prepared to support recommendations for vegetation management projects to reduce the potential for wildland fire to spread. Of the Cal Fire vegetation management proposals, one – the South Firebreak -- is near GGNRA property. The South Firebreak is near the Phleger Estate; extending from Canada Road north of Woodside west along the PG&E right of way, ending at Skyline Boulevard (Highway 35).

2.8 STRATEGIC APPROACH OF THE FMP

FMP implementation is based on the following strategies:

- Reduction of hazardous accumulations of vegetation (fuels) in areas where these activities would have the highest likelihood of reducing the potential risk of wildland fire to lives and property;
- Enhancement of the conditions of natural resources (e.g., increasing abundance or distribution of habitat for threatened and endangered species; reducing infestations of nonnative plants; increasing native plant cover); and
- Protection or enhancement of cultural resource elements and values (e.g., burning would be used to reduce vegetation in areas that are identified as important historic viewsapes).
- Annually, a maximum of 275 acres would be subject to mechanical fuel treatments, and a maximum of 320 acres would be subject to prescribed burning. Under maximum annual achievement, acreage treated by county is estimated as shown below in Table 6.

**Table 6 – Annual Maximum Achievement
Distribution of Acres by County**

Treatment Type	County	Acreage
Mechanical Treatment	Marin	225
	San Francisco	10
	San Mateo	40
	TOTAL	275
Prescribed Burning	Marin	285
	San Francisco	<1
	San Mateo	35
	TOTAL	320

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- Prior to each funding cycle, fire management and resource management personnel would review the past year's accomplishment, modify the coming year's project list as necessary, and develop a new "fifth year" implementation schedule for the five-year plan to maintain its long-range implementation focus. After modification, the annual program will be presented to the park's internal review processes to ensure regulatory compliance and conformance to the GGNRA FMP Record of Decision and Final EIS.
- The FMP will be reviewed annually to determine if course corrections are needed based on the prior year's experience, recent research findings or changes in the environmental, policy or regulatory setting. Changes proposed to the FMP will also be subject to the park's internal review processes.
- Mechanical treatments will be used to reduce hazardous fuel accumulations and to create and maintain defensible space and fuel breaks. Some areas may be mechanically treated prior to burning to increase the efficacy of the burn.
- The focus for prescribed burns will be: 1) enhancing ecosystem health by reducing invasive nonnative plant species; 2) fostering the restoration of native habitat; 3) rehabilitating cultural landscapes; or 4) reducing hazardous fuel accumulations. Prescribed burns would be conducted to approximate natural fire intensity and fire intervals to the extent possible while ensuring the protection of life and property.
- Prescribed burns intended for resource enhancement will initially be small and will be intensively researched during preparation and monitored during implementation. If research results indicated that ecological conditions improved after burning, the size of the burns can be increased. All prescribed burns would be conducted under specific burn plans in accordance with national fire policy requirements. Research topics may include:
 1. The effects of fire on management of nonnative plant species such as eucalyptus, Scotch/French broom, and Harding grass;
 2. The effects of fire on the species composition and fuel load of coastal grassland and scrub communities;
 3. The role of fire in Douglas-fir/coastal redwood communities and the effect of fire on fuel loading in these communities;
 4. The interaction between plant diseases such as sudden oak death (SOD) and fire; and
 5. The effects of prescribed fires and wildfires on plant and/or animal communities, including rare or sensitive species and their habitat.

2.8.1 GGNRA Fire Management Units (FMU)

An FMU is any land management area that can be defined by management goals and constraints, topographic features, access corridors, values at risk or values to be protected, political boundaries, fuel types, or major fire regime groups that set it apart from management characteristics of an adjacent unit. FMUs provide the framework for development of a wildland fire program. As directed by NPS Reference Manual #18 (NPS 2006b), each FMU should be unique as evidenced by management strategies, objectives, and attributes; should be consistent with management goals and objectives found in land and resource management planning documents; should avoid redundancy and should be kept to a minimum.

In developing the FMUs for GGNRA, staff referenced the goals of the FMP, area topography and hydrology, adjacent development density, and distribution of park resources and divided the planning area into three FMUs:

- Unit 1. Wildland Urban Interface FMU: areas around the park exterior adjacent to suburban development and developed areas within the park;
- Unit 2. Park Interior FMU: larger, more open and undeveloped tracts of the park relatively distant from built-up areas; and
- Unit 3. Muir Woods FMU: targeting Muir Woods National Monument and its unique natural setting, high visitation levels and its access limitations.

The distribution of the three FMU types across GGNRA-managed lands in the three counties is shown below in Table 7 and depicted in Figures 13 and 14. Nearly sixty-six percent of the area to be treated under the FMP is in Marin County. All of the lands in San Francisco County are in the WUI FMU while San Mateo County lands are split between WUI FMU lands near Pacifica neighborhoods and Park Interior lands primarily at Sweeney Ridge.

Table 7 -- Distribution of FMU Acreage by County

FMU	Marin	San Francisco	San Mateo	Total Acres
Wildland Urban Interface	2,524	923	1,479	4,926
Park Interior	7,910	NA	1,765	9,675
Muir Woods	552	NA	NA	552
Total Acres	10,986	923	3,244	15,153

Source: GGNRA Fire Management Office Data 2004.

NA = not applicable

2.8.2 Descriptions and Strategies of the FMUs

2.8.2.1 *Wildland Urban Interface FMU*

The Wildland Urban Interface (WUI) FMU includes those lands that border developed or “interface” zones and totals 4,926 acres. For the GGNRA FMP, the WUI zone is defined as any land within 1,200 feet of an urban/developed area. Where it made practical sense, the WUI FMU boundary was extended to include fire roads, trails, and jurisdictional boundaries. Many of the lands in the WUI FMU are in close proximity to values at risk (i.e., homes, infrastructure, etc.); have high hazard fuel loading and steep slopes, are exposed to dry, easterly winds during the fire season and have high visitation (and, correspondingly, an increased chance of ignitions).

The primary strategy in the WUI FMU is to reduce hazardous fuel loads through mechanical fuel reduction projects and prescribed burning targeted to complement the mechanical treatments. Prescribed fire would be available as a resource management tool, but restricted in its use and applied to answer specific research questions.

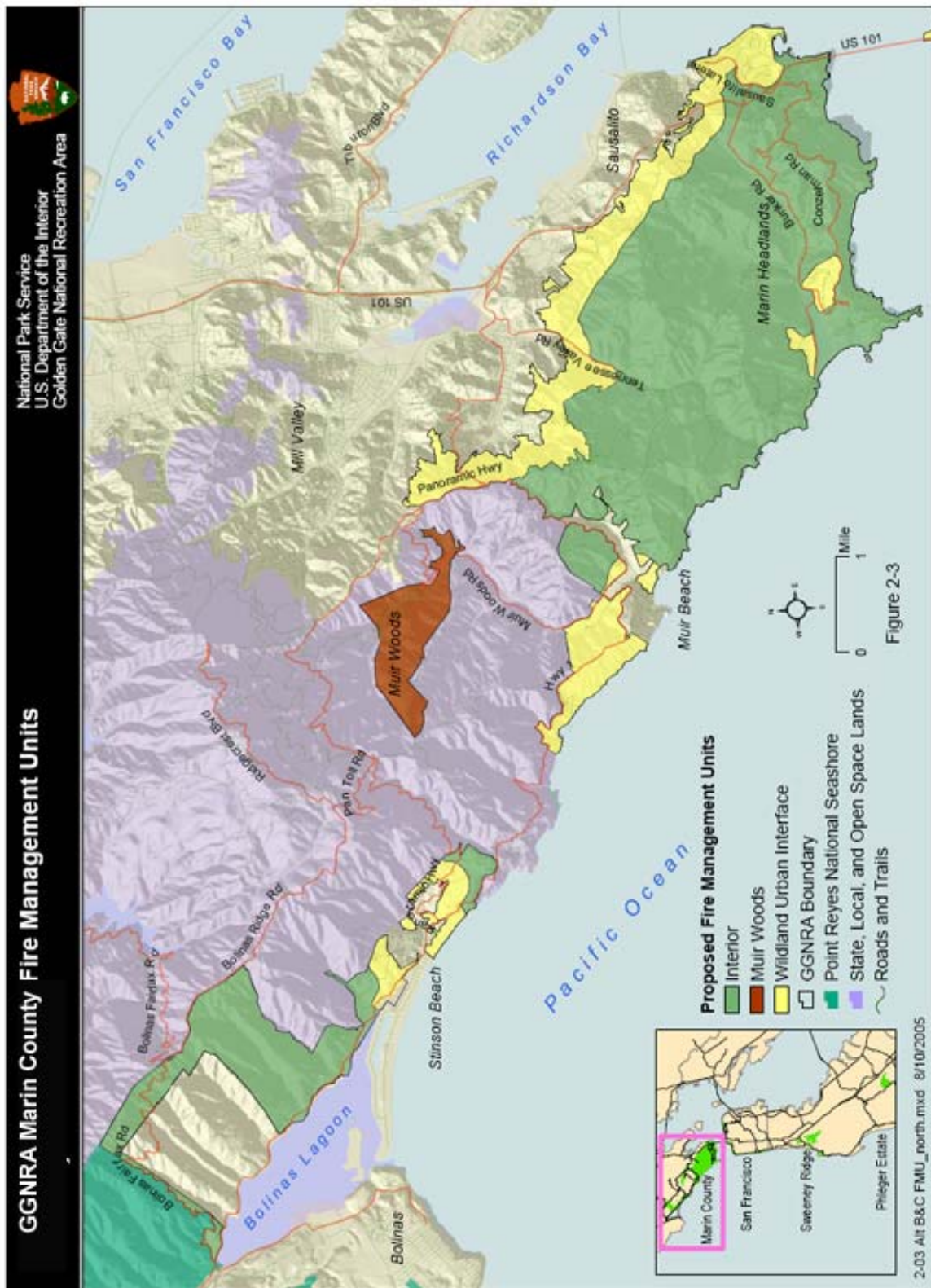
Examples of fire management treatments in this FMU would include:

- Removal of nonnative evergreen trees in most project areas where needed to achieve fire management objectives;
- Removal of nonnative evergreen trees that do not contribute to the historic setting and that are spreading beyond boundaries of the historic Forts Baker and Barry;
- Control and reduction of nonnative plant species in coastal scrub and grassland communities with mechanical treatments in combination with follow-up burning treatments in most project areas, and when possible, restoration and expansion of these native plant communities;
- Research prescribed burns to enhance Mission Blue Butterfly habitat;
- Limited research prescribed burns in the Douglas-fir/redwood community to reduce fuel loading at the Phleger Estate project area; and
- Research into prescribed burning for restoration of grassland communities.
- Reduction of hazardous fuel loading along the GGNRA boundary within close proximity to homes and other improvements which would prevent homeowners from meeting PRC 4291 addressing residential defensible space.

2.8.2.2 *Park Interior FMU*

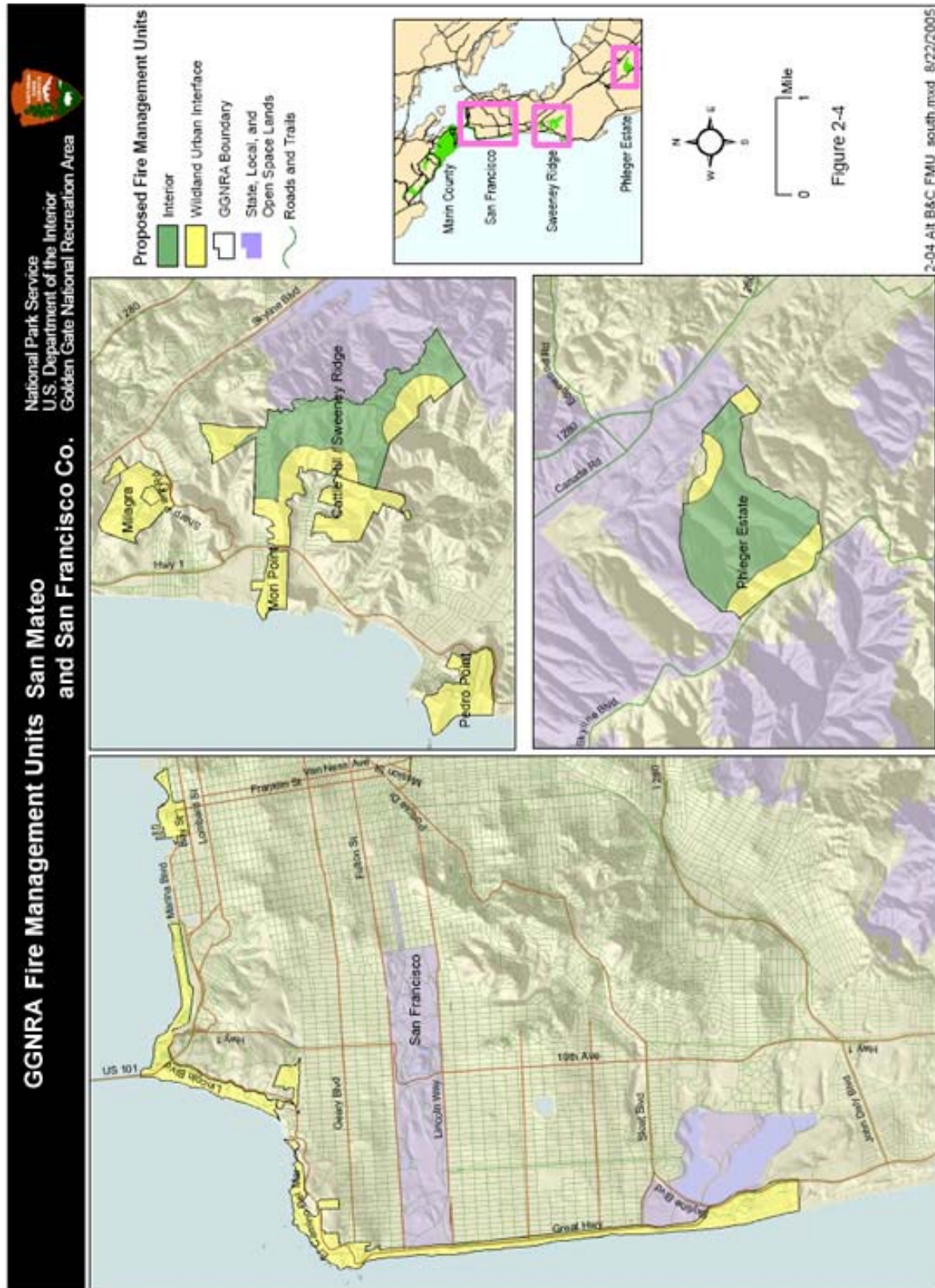
The Park Interior FMU is the largest FMU and is characterized by a lower probability of fire threatening structures and the potential to use prescribed fires to achieve some resource management goals. The park interior lands include larger expanses of natural areas and cultural landscapes, inclusive of ranching and farming lands, and contain relatively intact native plant communities and contiguous areas and corridors of wildlife habitat.

Figure 13 – Fire Management Units, Marin County



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Figure 14 – Fire Management Units, San Francisco & San Mateo Counties



All wildfires occurring in this FMU will receive prompt initial attack and subsequent aggressive suppression action.

Prescribed burns will be used reduce fuel loads and to implement natural and cultural resource management goals. Prescribed burn projects will take into account the vegetation type, restoration goals, and location and will have a strong research and monitoring component. Examples of the types of projects that would occur in this FMU include:

- Prescribed burns, including broadcast burns, to manage nonnative perennial grasses;
- Research burns, and potentially broadcast burns, for management of coastal scrub communities in the Marin Headlands;
- Research into use of fire for managing Sudden Oak Death syndrome in key locations;
- Use of some prescribed fire, including broadcast burns, for management of Harding grass and broom in the coastal scrub and grassland communities in Tennessee Valley.
- Mechanical treatment to reduce fuel loading and resistance to control of wildland fire starts along roads and near sensitive resources and historic properties.

2.8.2.3 *Muir Woods FMU*

Muir Woods National Monument is a separate FMU due to the area's unique values at risk (first-growth redwoods), the area's high visitation (and consequent ignition potential), and a successful and ongoing fire management program.

The management priority in the Muir Woods FMU is the protection of the pristine character of the National Monument. Many species contribute to the ecosystem in and around the Monument and this diversity calls for a variety of prescription parameters. The buildup of fuels in close proximity near residential development east of Panoramic Highway in Homestead Valley increases the risk of wildland fire. The exclusion of fire from the Monument over most of past century and a half has perpetuated and increased the likelihood of higher-intensity fires to occur. Prescribed fire will be used in the redwood/Douglas-fir forest to restore the role of fire to this ecosystem. Prescribed fire may also be used for management of nonnative species, such as in the Conlon Avenue area near the maintenance yard.

A fire chronology based on fire scar examination was done for two redwood (*Sequoia sempervirens*) forest sites in Marin County (McBride and Jacobs 1978). Fire frequencies averaged 21.7 and 27.3 years. The difference between the two sites was attributed to the increased influence of fog (Jacobs et al. 1985). The short interval is thought to be an artifact of Native American burning. Natural fires would ignite and burn through sections of the forest, cleaning out undergrowth, dead and down material, and litter on the forest

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floor. The beneficial effects of this process were numerous in that nutrients were released into the soil, forest density was regulated, fire-dependent species were provided with a favorable environment for reproduction, and wildlife was provided with more favorable habitat. Redwoods themselves require bare mineral soil to reproduce successfully from seed after the passing of a fire. Conversely, pests and pathogens find conditions generally less favorable.

The interruption of this ecological cycle through 150 years of fire suppression has produced visible deleterious effects. The buildup of dead and down material on the forest floor and the density of undergrowth create conditions favorable to catastrophic fire. Increased amounts of fuel produce fires that burn faster, hotter, and with greater intensity. Control becomes more difficult and the likelihood of adverse ecological effects such as mortality in mature trees is increased.

The existing fire hazard can be illustrated by the Ben J. Fire of June 13, 2001, which may have been started by an illegal campfire. The fire burned on the slopes west of Redwood Creek and the Hillside Trail and south of the Ben Johnson Trail. NPS staff responded quickly and was able to contain the fire. If this fire had occurred in late summer/early fall, during the height of the fire season, it would have been much hotter and spread faster, posing a significant threat to the first-growth redwood groves.

The NPS reintroduced fire into the ecology of Muir Woods National Monument during the second half of the 1990s under the 1993 FMP. Three burns were conducted in the redwood/Douglas-fir forest. In 1996, the nine-acre Upper Deer Park prescribed burn between Deer Park Fire Road and the Dipsea Trail was conducted to serve as an anchor point for future suppression efforts and as a starting point for future burns. In 1997, the Deer Park 2 prescribed fire (52.5 acres) was completed, and in the following year in 1998, the Johnson prescribed fire (35 acres) was conducted on neighboring forested units. Two prescribed burns in the Conlon Avenue area at the lower end of Camino Del Canyon were completed in 1997 and 1999 (20 acres each) in order to reduce nonnative broom species in these grassland areas. Several other burns were planned but not executed. The California Department of Parks and Recreation conducted several burns around the FMU to create fuel breaks and manage nonnative plant species.

The objectives for the fire management strategy in the Muir Woods FMU are to:

- Restore the role of fire in the relevant vegetation communities;
- Reduce fuel loading and the threat of catastrophic wildfire; and
- Further study fire effects in old-growth coast redwood forest.

Strategies recommended for the Muir Woods FMU include:

- Prescribed burning to reduce fuel loading.
- Prescribed burning to reintroduction fire as a component in the FMU's fire-adapted plant communities.

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- Small-scale mechanical fuel reduction projects, such as construction of shaded fuel breaks and understory thinning, to reduce the risk of a high-intensity fire.
- Mechanical fuel reduction treating roughly 5 acres annually. In woodlands hard hit by sudden oak death (SOD), thinning could be used to reduce standing snags and ladder fuels and to remove smaller-diameter trees.
- Mowing alone or followed by prescribed burning to control nonnative species. Mowed brush would be left to cure in place followed by prescribed fire.
- Prescribed burning to research the relationship between fire and SOD and to limit or control French broom in the Conlon Avenue area.
- Use of established trails, roads, and natural features as much as possible as fire control lines to limit disturbance to soil and subsurface cultural resources.
- Design all burn preparations and operations to minimize impact to FMU resources to the greatest degree possible.
- Post-burn rehabilitation will be planned in advance as part of a prescribed burn.
- Annual acreage of prescribed burning would range from small 0.5-acre research burns up to the annual maximum of 50 acres.
- Annual maximum of mechanical clearance of 5 acres includes clearing defensible space around park structures and treating areas of nonnative plants.
- Expansion of the public education program to support prescribed burn projects. Current interpretive opportunities at Muir Woods include school and public programs on fire ecology, a self-guided walk on fire ecology, a public display on fire ecology and control burning, a fire wayside exhibit, and placement of the fire weather station and interpretive information in an area visible to the public.

2.9. GGNRA PROJECT AREAS

The three FMUs are further broken down into a total of 17 project areas, to allow a finer level of understanding of existing resource values, vegetation and fire management conditions, treatment options, and management objectives specific to the referenced park area. It is the project areas that form the framework for planning the five-year implementation program. Project areas are delineated logically by practical and geographical boundaries such as roads and trails, watersheds, park boundary, and buffers from urban development (see Figures 15 and 16). Table 8 shows the park's acreages and vegetation classification by project area. The following descriptions of the 17 project areas are sorted by county.

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

2.9.1. Marin County Project Areas**2.9.1.1 Alta Project Area**

FMU: entirely within the WUI FMU.

Extent: Bordered on the northeast by Marin City and Sausalito, on the southwest by the Alta Trail, and on the southeast by the Wolfback Project Area.

Vegetation: More detailed mapping on this area is needed. Vegetation types include coastal scrub/chaparral, native hardwood forest, and nonnative evergreen forest (primarily eucalyptus).



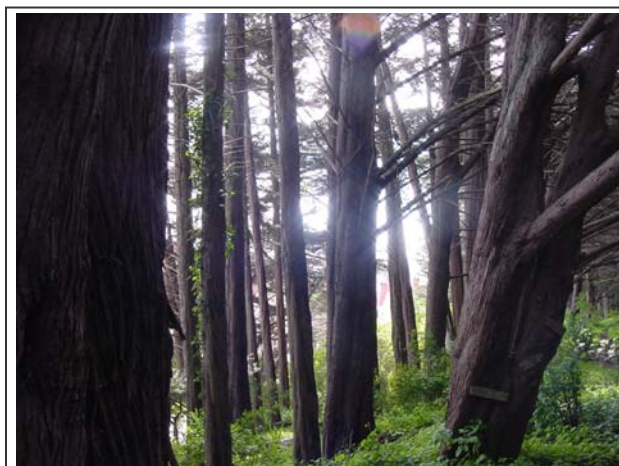
Special Resources: The project area has mission blue butterfly habitat.

Fire Management Issues: 1) large stands of nonnative evergreen forest adjacent to residential areas in Marin City and Tamalpais Valley, and 2) needed fuel reduction on fire roads, eliminating stands of broom and other nonnative vegetation and fostering the conversion to grassland and native scrub.

2.9.1.2 Fort Baker Project Area

FMU: entirely within the WUI FMU.

Extent: The project area includes the Fort Baker cantonments, the Bay Area Discovery Museum, the future Fort Baker Retreat and Conference Center, the U.S. Coast Guard station, the north anchorage of the Golden Gate Bridge and the Vista Point viewing area. It is bordered by San Francisco Bay to the east and south, Sausalito to the north, and the Marin Headlands project area to the west. The most developed areas of Fort Baker are those closest to the Bay.



Vegetation: a mix of coastal scrub, grasslands, oak woodland, and nonnative forests.

Special Resources: The project area contains important mission blue butterfly habitat.

Fire Management Issues: (1) dense stands of nonnative trees that have expanded beyond the historic landscaping boundaries are a fire hazard putting nearby historic structures at risk; (2) need to reduce fuel loading in the Highway 101 and Alexander Avenue corridors; and (3) reduction of fuels to improve defensible space around buildings and below the High Vista neighborhood.

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

Table 8 – Acres of Vegetation Type by Project Area

Table 3-10: Acres Within Each General Vegetation Class By Project Area

Project Area	FMU	County	Acres	Developed	Coastal Dunes	Coastal Scrub/Chaparral	Douglas-Fir/Coast Redwood	Grassland	Herbaceous Wetlands	Native Hardwood Forest	Nonnative Evergreen Forest	Riparian Forest/Shrubland	Unvegetated Shoreline/Outcrop
Alta	WUI	Marin	153			55				60	38		
Fort Baker	WUI	Marin	178	75		34		26		12	31		
Homestead Valley	WUI	Marin	166			94		23		44	5		
Marin Headlands	Park Interior	Marin	3,667	202	30	2,230	3	785	53	11	92	116	145
Milagra Ridge	WUI	San Mateo	245	10		204		23			3	5	
Mori Point	WUI	San Mateo	110	3		15		79	3			2	8
Muir Beach/Green Gulch	WUI/Park Interior	Marin	1,202	15		905		208	4	3	11	25	31
Muir Woods National Monument	Muir Woods	Marin	558	6		2	472	2		59	2	15	
Oakwood Valley	WUI/Park Interior	Marin	567	2		310		27		171	45	12	
Phleger Estate	WUI	San Mateo	1,205			82	556	9		558			
San Francisco	WUI	San Francisco	923	347	150	69				8	122	75	152
San Pedro Point	WUI	San Mateo	229	1		142					33		53
Stinson Beach	WUI/Park Interior	Marin	1,683	38		555	561	172	13	265	10	34	35
Sweeney Ridge/Cattle Hill	WUI	San Mateo	1,432	29		1,231		95			64	13	
Tam. Valley	WUI	Marin	495	3		147	1	42		188	109	5	
Tennessee Valley	Park Interior	Marin	1,928	16		1,348		453	19	2	18	30	42
Wolfback/ Sausalito	WUI	Marin	398	14		231		60		49	41	3	
Total			15,139	761	180	7,654	1,593	2,004	92	1,430	624	335	466

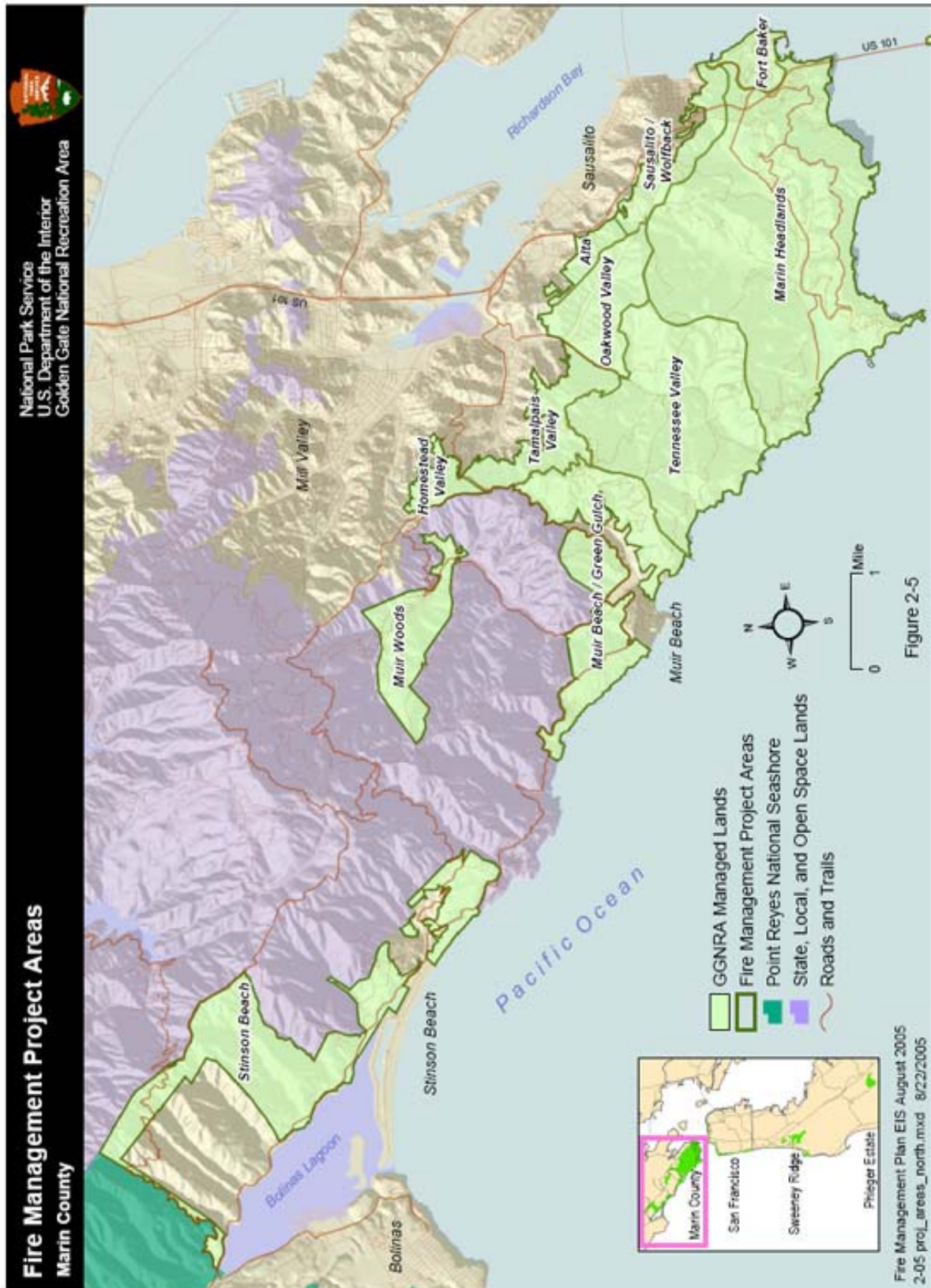
Source: NPS, GGNRA Fire Management Office, 2004.

FMU = Fire Management Unit

WUI = Wildland Urban Interface

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

Figure 15 – FMP Project Areas, Marin County



2.9.1.3 Homestead Valley Project Area

FMU: entirely within the WUI FMU.

Extent: bordered by Panoramic Highway to the west, Shoreline Highway to the south, and the Homestead Valley neighborhood to the north and east.

Vegetation: coastal scrub, grassland, native hardwood forest, and nonnative evergreen forests (eucalyptus and Monterey cypress).

Special Resources: The Douglas fir/redwood forest in the north part of the project area provide habitat for the northern spotted owl.

Fire Management Issues: buildup of hazardous fuels in close proximity to residential areas of Homestead Valley and Tamalpais Valley.

2.9.1.4 Marin Headlands Project Area

FMU: Park Interior FMU except Fort Barry and Fort Cronkhite which are in the WUI FMU.

Extent: The Gerbode Valley and Rodeo Valley watersheds bordered by the Fort Baker Project Area and the City of Sausalito to the east, the Tennessee Valley Project Area to the northwest, and the Pacific Ocean to the west and south.



Vegetation: dominated by coastal scrub and grasslands, with herbaceous wetlands and riparian scrub in the low-lying areas. Nonnative stands of eucalyptus and Monterey pine are present in some of the developed areas, and native hardwood forest is present in Gerbode Valley. A large portion of the land along the Pacific Ocean is unvegetated rocky slopes.

Special Resources: The larger clusters of development from the past military occupation include Fort Barry, Fort Cronkhite, a former Nike missile site, historic coastal fortifications, and the Marine Mammal Center area. The project area supports habitat for several plant and animal species listed under the Endangered Species Act, including the threatened California red-legged frog, the endangered tidewater goby and endangered mission blue butterfly. Two species of bats that are federal species of concern use buildings in this Project Area.

Fire Management Issues: buildup of hazardous fuels adjacent to historic structures, nearby residential communities, and the draw of popular visitor destinations within the project area served by roads that could limit access by emergency responders.

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

2.9.1.5 *Muir Beach/Green Gulch Project Area*

FMU: Park Interior FMU with WUI FMU at the community of Muir Beach, the developed area of Green Gulch Zen Center and along Highway One.

Extent: comprised of the land surrounding the Muir Beach community and the Green Gulch Zen Center and the Banducci Ranch. The area is bordered by Tennessee Valley Project Area to the south, the Tamalpais Valley Project Area to the east, Mount Tamalpais State Park to the north, and the Pacific Ocean to the west.

Vegetation: Primarily coastal scrub and grassland, with herbaceous wetlands and riparian forests in the drainages as well as stands of native hardwood and Douglas fir/redwood forest and nonnative eucalyptus.

Special Resources: Streams providing habitat for coho salmon, steelhead, and the California red-legged frog.

Fire Management Issues: 1) eucalyptus stand adjacent to GGNRA could spread into the park at project area; 2) dune scrub on Muir Beach is often ignited by beach fires which could spread into the residential area; and 3) Muir Beach draws high visitation but is served by Highway One and one access road both of which are bordered in part by areas of high fuel loading that could impede access by emergency responders.

2.9.1.6 *Muir Woods Project Area*

FMU: entirely within the Muir Woods FMU.

Extent: defined by the boundaries of the National Monument. It is west of Mill Valley off Panoramic Highway. Camino Del Canyon, in the eastern section of the Project Area, has several residences, and structures that could have historic significance.

Vegetation: predominantly native hardwood and evergreen forests, including Douglas-fir, old-growth and second-growth redwoods, bay, tanoak, and madrone. The Camino Del Canyon portion includes riparian forest, grassland, and a large stand of eucalyptus around the residential area.



Special Resources: Habitat for the northern spotted owl, marbled murrelet, salmonids, California red-legged frogs. Ten species of bats, including 4 federal or state species of concern, are found in the Project Area.

Fire Management Issues: an area with very high visitation served by a road that could limit access to emergency responders; fuel reduction needed along ingress/egress routes, isolated Camino del Canyon amidst a large eucalyptus stand and is served by a road that is subject to washouts.

2.9.1.7 *Oakwood Valley Project Area*

FMU: Park Interior FMU and WUI FMU.

Extent: bordered by Alta Fire Road to the northeast, Tennessee Valley Road to the northwest, and the Miwok Trail to the south. The Oakwood Valley and Marinview residential communities are adjacent to this project area.

Vegetation: mainly native hardwood forests (oaks), coastal scrub, and some grassland. Riparian forests, as well as nonnative eucalyptus, are present in the drainages.

Fire Management Issues: maintain low fuel conditions and adequate fire road access/egress particularly along the residential community interface.

2.9.1.8 *Stinson Beach Project Area*

FMU: predominantly within the Park Interior FMU and acreage around the Stinson Beach community within the WUI FMU.

Extent: parklands north of Stinson Beach, south of the Bolinas/Fairfax Road and south of Stinson Beach along Panoramic Highway.

Vegetation: large tracts of coastal scrub, grasslands, Douglas-fir/coast redwood, and native hardwood forest, unvegetated shoreline and smaller areas of herbaceous wetlands, riparian forests, and nonnative evergreen forests.

Special Resources: Spotted owl habitat in Stinson Gulch. Several Bolinas Lagoon tributaries, including Easkoot Creek, support coho salmon and steelhead.

Fire Management Issues: 1) fuel reduction needed on parklands surrounding the residential area; and 2) provision of safe fire road ingress/egress especially on days of very high visitation.

2.9.1.9 *Tamalpais Valley Project Area*

FMU: entirely in the WUI FMU.

Extent: bounded by the Miwok Trail on the south and west, Tennessee Valley Road to the southeast, and the unincorporated community of Tamalpais Valley to the northeast. The Homestead Valley Project Area lies due north, the Tennessee Valley Project Area to the south, Muir Beach Project Area to the west southwest and Oakwood Valley Project Area to the southeast.

Vegetation: primarily coastal scrub, grassland, and native hardwood forest, with some large stands of eucalyptus and a riparian forest corridor along Tennessee Valley Road.

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

Special Resources: Tennessee Valley Creek provides habitat for the California red-legged frog. Fire management issues in this area include the need to reduce fuel loads between the park and adjacent communities and to provide for safe fire road access and egress routes.

2.9.1.10 Tennessee Valley Project Area

FMU: entirely within the Park Interior FMU.

Extent: bounded by the Pacific Ocean to the southwest, Coyote Ridge to the northwest, the Miwok Trail to the northeast, and the Hill 88 Ridge to the south.

Vegetation: mainly coastal scrub with roughly a fifth of the acreage in grassland. Herbaceous wetlands, riparian scrub, and nonnative evergreen forests are present in the drainages. Disturbed lands and remnant landscape is found in and around the Miwok riding stables and the old farmhouse. Much of the coastline is unvegetated rock outcrops.

Special Resources: California red-legged frogs.

Fire Management Issues: maintaining adequate fire road access, reducing roadside fuel loading to this area with heavily visited trails.

2.9.1.11 Wolfback Ridge/Sausalito Project Area

FMU: entirely within the WUI FMU.

Extent: Highway 101 and Sausalito to the east, the Marin Headlands Project Area to the west and south, the Oakwood Valley Project Area on the northwest, and the Alta Project Area to the north. Lands lie to the west AND east of the Wolfback Ridge neighborhood.

Vegetation: principally coastal scrub and grassland, native hardwood forest, riparian forest, and nonnative evergreen forest (mostly eucalyptus).

Special Resources: Mission blue butterfly habitat north of Fort Baker.

Fire Management Issues: reducing the density of the eucalyptus forest west and east of the Wolfback Ridge neighborhood.

2.9.2 SAN FRANCISCO COUNTY

2.9.2.1 San Francisco Project Area

FMU: entirely within the WUI FMU.

Extent: all NPS lands within San Francisco County including Fort Mason, Alcatraz, Area A of the Presidio, Fort Point National Historic Site, and the coast from Fort Miley to Fort Funston.

Vegetation: Coastal dune communities, with areas of coastal scrub, native hardwood forest, and riparian scrub and large stands of nonnative evergreen forest and landscaping.

Special Resources: Raven’s manzanita, Marin dwarf flax, and the San Francisco lessingia, western snowy plover, the Presidio Historic Landmark District, Fort Mason and other historic coastal military structures, Sutro Heights, Fort Point Historic Site.

Fire Management Issues: maintenance of defensible space around park buildings (working closely with the Presidio Fire Department responsible for structural fire prevention and suppression), reducing fuels at the interface with residences and conducting limited research burns, in conjunction with FWS consultation, to benefit federally listed plant species.

2.9.3 San Mateo County

2.9.3.1 Milagra Ridge Project Area

FMU: entirely within the WUI FMU.

Extent: In northern Pacifica, the project area borders on Sharp Park Road to the south, Oceana High School to the southwest, a City of San Bruno neighborhood to the southeast, undeveloped , a new Pacifica residential development to the west and the Edgemar area of Pacifica to the northwest.

Special Resources: significant cultural and historical resources, and mission blue butterfly and San Bruno elfin butterfly habitat, California red-legged frog and San Francisco garter snake habitat.

Vegetation: primarily coastal scrub with areas of grassland and riparian forest. Nonnative evergreen forest is also present.

Fire Management Issues: reduction of hazardous fuels adjacent to residential communities.

2.9.3.2 Mori Point

FMU: entirely within the WUI FMU.

Extent: From the Pacific Ocean on the west to Highway 1 across from Sweeney Ridge on the east, near Sheldance Nursery. The City of San Francisco Sharp Park Golf Course and Natural Area is to the north and the former quarry to the south.

Vegetation: dominated by grassland interspersed with coastal scrub. The low-lying areas contain herbaceous wetlands and riparian scrub.

Special Resources: San Francisco garter snake and the California red-legged frog.

Fire Management Issues: none identified in the FMP.

2.9.3.3 Phleger Estate Project Area

FMU: primarily in the Park Interior FMU with a strip of WUI FMU along Skyline Boulevard and Woodside’s Raymundo Road.

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

Extent: From Huddart County Park and the town of Woodside on the south and southeast, respectively, to Highway 35/Skyline Highway to the west and San Francisco Public Utilities Commission's Peninsula Watershed to the north.

Vegetation: dominated by second-growth Douglas-fir/coast redwood and native hardwood forest with several acres of coastal scrub along the northern boundary and a small area of grassland on the east.

Special Resources: The area is in the West Union/Francisquito Creek watershed, which supports steelhead.

Fire Management Issues: buildup of hazardous fuels with the potential for wildland fire in close proximity to developed areas in Woodside or the Peninsula Watershed.

2.9.3.4 *Pedro Point Project Area*

FMU: entirely within WUI FMU.

Extent: bounded on the east by Highway 1 and to the west by the Pacific coast. The Pedro Park area of Pacifica lies to the north and undeveloped lands to the south.

Vegetation: mostly coastal scrub, with nonnative evergreen forest encroaching from the northern boundary and rocky coastal bluffs to the west.

Fire Management Issues: large, dense stand of eucalyptus forest adjacent to the Highway 1 corridor and the Pedro Point section of Pacifica.

2.9.3.5 *Sweeney Ridge/Cattle Hill Project Area*

FMU: divided equally between the Park Interior FMU and the WUI FMU.

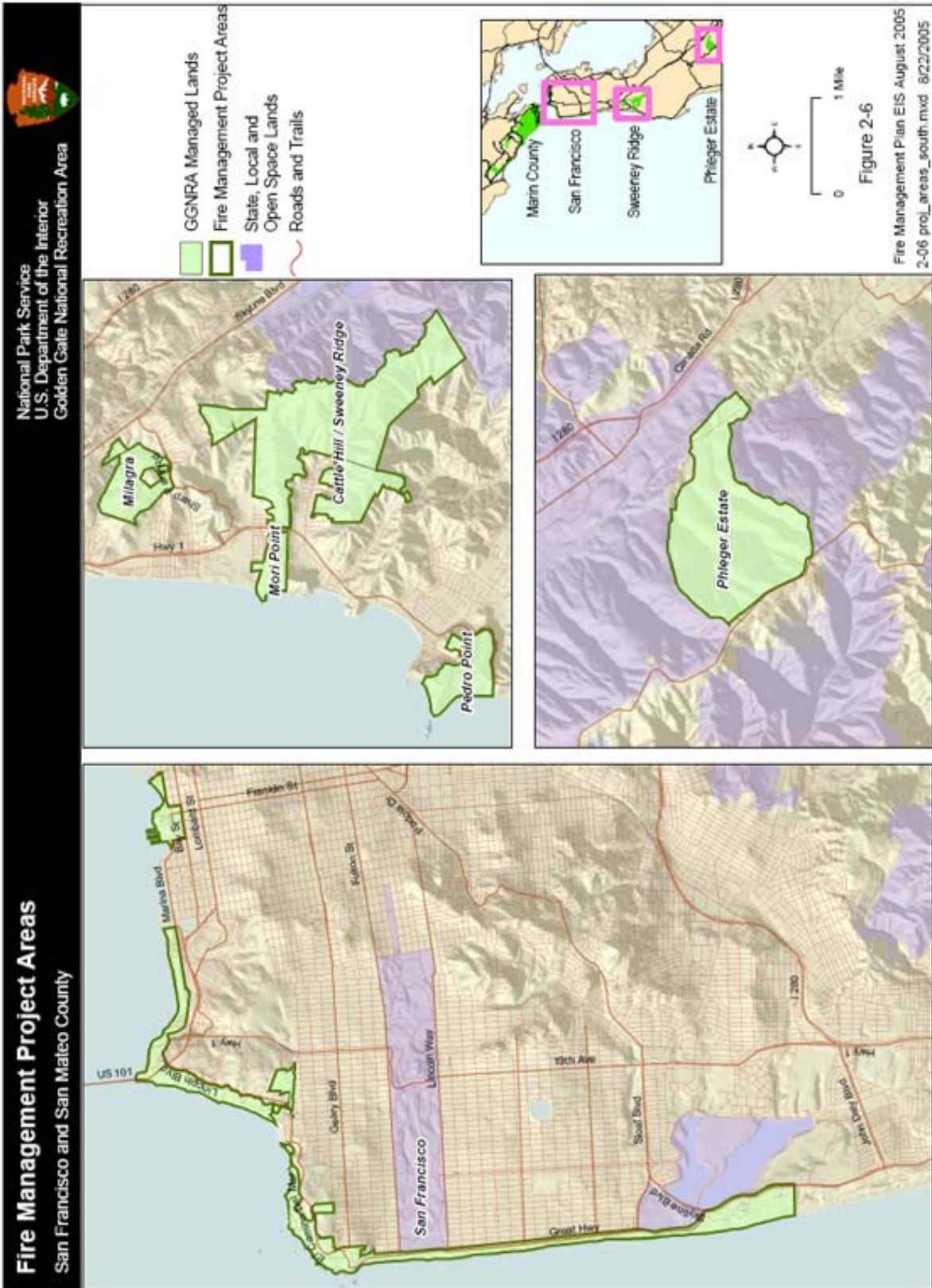
Extent: Lying east of Pacifica, Sweeny Ridge borders the Vallemar neighborhood to the north and east while Cattle Hill forms the southern boundary of this Pacifica neighborhood. Sweeney Ridge is bordered to the south and southeast by San Francisco Public Utility Commission's Peninsula Watershed, the Terra Nova neighborhood of Pacifica on the southwest and Skyline Junior College and residential areas of the City of San Bruno on the north.

Vegetation: primarily coastal scrub, with extensive grasslands in the north and riparian scrub in several of the drainages. Stands of nonnative evergreen forest (mostly eucalyptus) encroach into the project area from outside the park boundary.

Fire Management Issues: reduce fuel loading on the boundary with the Vallemar neighborhood and Skyline Junior College where fuels may pose a threat to structures and urban developments; maintain adequate fire road access for local fire agencies .

CHAPTER 2 – FIRE MANAGEMENT STRATEGIES

Figure 16 – FMP Project Areas, San Francisco & San Mateo Counties



CHAPTER 3 – FIRE MANAGEMENT PROGRAM COMPONENTS

3. FIRE MANAGEMENT PROGRAM COMPONENTS

The fire management plan addresses strategies for reducing the accumulation of hazardous fuels in specific areas and for abating hazardous fire conditions resulting from past fire suppression programs, expansion of urbanization to park borders, or establishment of non-native, invasive plants. These strategies will entail strategic planning, interdisciplinary coordination, and inter-organizational collaboration as needed to provide appropriate treatment using adaptive management practices that range from site specific to landscape level. Fire management planning will also include monitoring programs that record fire behavior, smoke behavior, fire decisions, and fire effects to provide information on whether specific objectives are met and to improve future fire management. Fire education and communication are critical components of all preventive fire management planning and allow for communication of hazardous fuel reduction and fire prevention strategies across park boundaries.

Although prescribed fire remains the preferred and most widely used NPS tool for managing the accumulation of hazardous fuels, fire management planning will incorporate other activities, such as manual, mechanical, biological and, rarely, chemical treatments (applying integrated pest management principles), that may be appropriate in specific instances, as guided by NPS and DOI policies and legal requirement.

All components of fire management planning, including suppression, prescribed fire, or mechanical fuel reduction, will factor in the protection of natural and cultural resources, while maintaining that safety of employees and private citizens.

3.1 DESIGNATION OF WILDLAND FIRE PROTECTION RESPONSIBILITY

Federal land management agencies own and administer 48 million acres in California and have wildland fire protection responsibility for these lands designated as the Federal Responsibility Area (FRA). For GGNRA, the NPS FRA includes all lands managed by the NPS within the GGNRA legislative boundary. Unincorporated areas of the State of California, excluding the federal lands, are within the State Responsibility Area (SRA). The SRA is mainly privately owned forestlands, watersheds, rangelands, unincorporated communities with some non-federal public owned lands.

The federal agencies and Cal Fire, in conformance with their "Cooperative Fire Protection Agreement", have examine the unincorporated lands in the State and identified areas of the FRA and SRA where an exchange of wildland fire responsibilities would improve overall firefighting capabilities. The redrawn boundaries that result from the exchange define the "Direct Protection Area" (DPA) for an agency – the area of primary responsibility delineated by practical boundaries regardless of ownership. The objective of the DPA is to maximize on efficiency and effectiveness of each jurisdiction's resources. For example, if Cal Fire can only access a group of privately owned parcels in the SRA via an NPS road, it may make more sense for these parcels to be protected

by NPS firefighters who have a quicker response time. The exchange of responsibility is formalized by an agreement signed between the agencies.

3.2 GENERAL IMPLEMENTATION PROCEDURES FOR SUPPRESSION ACTIONS

All wildland fires will receive prompt and aggressive initial attack action to reduce burned acreage and protect improvements and residences in close proximity to wildland fuels (NPS 2006b). The objective of wildland fire suppression, as an integral part of wildland fire management in the NPS, is to manage wildland fires safely and efficiently to accomplish protection objectives. It is integrated into land and resource management plans and activities on a landscape scale, across agency boundaries, and is based on best available science. Protection priorities are (1) human life and (2) property and natural/cultural resources (NPS 2005b).

Federal agencies and Cal Fire have entered into Cooperative Fire Protection Agreements which provide for interagency cooperation. Because GGNRA has limited fire management capabilities, most suppression activities will be accomplished in

conjunction with the local fire agencies. Wildland fire suppression is accomplished by the closest available resources, whether federal, state or local government agencies through cooperative agreements. For GGNRA, Cal Fire and its mutual aid partners provide aggressive initial response and assume interim Incident Command of initial attack actions until a qualified federal Incident Commander and personnel arrives to assume Unified Command of the incident.

Under all circumstances, the NPS Incident Commander (IC) must be qualified for the complexity of the wildland fire incident. The GOGA-PORE Incident Complexity Analysis for Type 4 and 5 Incidents shall be used to determine the complexity of the incident. (see Appendix A, Part 12).

Within the boundary of the park, all wildland fires will be suppressed according to federal and local government protocols as determined by the Unified Incident Commanders. Federal actions will be consistent with direction provided in RM #18, Director's Order #60 Aviation Management (2003) and Interagency Standards for Fire and Fire Aviation Operations (NIFC 2006).

Agencies that have been given direct protection responsibility have the option of not requesting NPS tactical resources if they so desire. NPS units may have a delayed response that could be as much as four to twelve hours. Depending upon the severity



of the fire, NPS resources will provide liaison and agency representation, develop rehabilitation plans and provide tactical resources as requested by Cal Fire. Other fire agencies may be called upon by Cal Fire through its mutual aid agreements. If qualified for wildland firefighting, the Presidio Fire Department (the structural fire agency for GGNRA) will provide suppression assistance, as requested by the GGNRA wildland fire staff.

An Agency Representative will be requested to proceed to all fires or to fires that have the potential to spread into NPS lands. The Agency Representative is responsible for requesting a Resource Advisor through the Incident Ordering Point (ex., CAL FIRE Felton EEC) through Park Dispatch and/or the Fire Management Office.

The Resource Advisor will assist in identifying sensitive resources and provide input on appropriate actions to minimize the impacts to these resources. The Agency Representative will work through the IC whose agency has the DPA responsibility to emphasize those concerns and implement appropriate actions.

3.3 AGREEMENTS GOVERNING SUPPRESSION ACTIONS

In Marin County, all suppression activities on federal lands will be managed in cooperation with Marin County Fire Department, the Southern Marin Fire Protection District and other local government fire agencies. Due to the proximity of numerous local government and Cal Fire jurisdictional protection areas, Unified Command with Marin County Fire Department is often required for actual or potential multi-jurisdictional threats.

If qualified for wildland fire response, the Presidio Fire Department Station at Fort Cronkhite could respond to wildland fires as initial attack at Fort Baker, Fort Barry, Fort Cronkhite and the Capehart Housing area as well as Conzelman Road (M. Kiolassa, Ass't Chief, Presidio Fire Dept., pers. comm. 3/4/08).

Woodacre Emergency Command Center (ECC) is responsible for contacting the appropriate fire management or law enforcement personnel to respond to a report of a wildland fire. Typically the Fire Management Officer, Fire Duty Officer or Chief Ranger (as qualified), responds to the Incident Command Post and serves as a Unified Incident Commander, Agency Representative or Resource Advisor (as qualified). Other NPS fire resources will respond depending upon availability.

In City and County of San Francisco. The closest available fire resource will be dispatched along with NPS units. All fires will be managed using ICS. The Presidio Fire Department responds to structural and wildfire in the Presidio (both NPS and Presidio Trust jurisdictions), Fort Mason, Aquatic Park, Fort Point and, through a separate agreement, the San Francisco Maritime Museum. Through a mutual aid agreement with the Presidio Fire Department, the San Francisco Fire Department provides first response services to the Ocean Beach corridor, including Fort Funston, and Lands End, Sutro Heights, and Fort Miley (M. Kiolassa, Ass't Chief, Presidio Fire Dept., pers. comm. 3/4/08).

CHAPTER 3 – FIRE MANAGEMENT PROGRAM COMPONENTS

In San Mateo County. NPS lands in San Mateo County are the Phleger Estate, Sweeney Ridge, Cattle Hill, Pedro Point, Mori Point and Milagra Ridge. With the exception of Phleger Estate, adjacent to the Town of Woodside at the southern limits of San Mateo County, the remaining NPS areas are clustered around the City of Pacifica in northern San Mateo County and occupy coastal bluffs, slopes and ridgetops.

The San Francisco Peninsula Watershed, situated between Sweeney Ridge to the north and the Phleger Estate to the south, is an SRA land managed by the San Francisco Public Utilities Commission. Watershed management personnel of the Peninsula Watershed are equipped with wildland fire patrol units and can provide limited immediate response to wildland fires on NPS lands adjacent to Peninsula Watershed lands (T. Ramirez, pers. comm. 12/05/06).

The NPS is currently negotiating an agreement with Cal Fire whereby that agency would add all NPS properties in San Mateo County to the Cal Fire DPA. The agreement conforms to the requirements of the Master Cooperative Wildland Fire Management and Stafford Act Response Agreement between the State of California and federal land management agencies with holdings in California. In turn, once this interagency agreement is adopted, those mutual aid agreements that local fire departments in the County have with Cal Fire would apply to the Cal Fire DPA revised to include the NPS lands.

3.4 Minimum Impact Suppression Tactics

The policy at GGNRA is to suppress all unplanned ignitions using Minimum Impact Suppression Tactics (MIST) to the extent feasible given the constraints along the urban interface. Suppression of fires will be aggressive and will be conducted with the highest regard for human safety. MIST Guidelines for GGNRA are in FMP Appendix A, Part 9.

Suppression will be accomplished through a combination of cooperative agreements with local fire agencies and qualified park fire personnel. Annual operating plans will identify individual suppression concerns in order to minimize suppression impacts. Furthermore, all control efforts will be evaluated for consideration of effects on resource values.

3.5 PREPAREDNESS ACTIONS

The term “preparedness” refers to 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.

The Network approach to the Fire Management Program requires, close coordination and operational consistency with PRNS in preparation for fire season is important. The FMOs from each unit should meet on a regular basis to coordinate preparedness activities, establish joint projects and procedures for wildland fire, mechanical fuels reduction and prescribed fire, readiness, funding issues, problem areas, and other items.

The following items will be reviewed annually by the GGNRA FMO:

- Conduct preparedness review.
- Prepare mutual severity needs analysis for coming fire season when conditions exceed those of a normal fire year (consider: pre-positioning of suppression resources; augmentation and support outside local organization needed).
- Review new policies, roles and responsibilities.
- Review and update as necessary all delegations of authority and Agency Administrator Briefing Package.
- Identify any mutual safety issues and mitigating actions required.
- Clarify mutual criteria for team transitions, managing mutual multiple fire activity.
- Update WFSAs and designate ID teams for preparing WFSAs for fires which escape initial attack.
- Develop mutual and integrated action items to implement staffing levels (Ref: Step-up Plan).
- Identify strategies to communicate fire program principles to cooperators and publics (Red Flag alerts, severity, closures, etc.).
- Agree on mutual standards to evaluate performance of the preparedness operations within the Bay Area National Parks Network.
- Address other issues requiring coordination.

3.5.1 Fire Prevention

Prevention objectives for the planning area will include:

- Reduce the number of human-caused wildland fires.
- Integrate fire prevention messages into a variety of programs, ranger activities, and local media, targeting the community, schools, visitors, and landowners.
- Coordinate fire prevention efforts with all cooperators and affected landowners.
- Prepare and post prevention-related signs and messages.

3.5.1.1 Training and Fire Readiness

The purpose of wildland and prescribed fire training is to promote safe and effective individual performance in accomplishing fire management goals and objectives.

All wildland fire personnel will be qualified and certified for the position(s) assigned, according to the Wildland and Prescribed Fire Qualifications System Guide (PMS 310-1, 2006). The Interagency Standards for Fire and Fire Aviation Operations, Chapter 2, "Requirements for Fire Management Positions" details additional requirements for fire positions (NIFC 2006). Reference Manual #18 (NPS 2006b) and Director's Order #18 (NPS 2005) provide the guidelines for training and readiness.

CHAPTER 3 – FIRE MANAGEMENT PROGRAM COMPONENTS

All employees involved in wildland fire and prescribed fire operations will have their qualification records entered into and maintained annually in the Incident Qualification and Certification System (IQCS) and ROSS.

Refresher courses (firefighter safety, basic aviation operations, etc) and other required annual training will be coordinated by qualified staff and held annually.

Readiness actions (in addition to those listed above) are described below.

- Fire caches and equipment shall be inspected and documented for completeness and serviceability on a pre-season and fire season basis.
- Ensure timely follow-up actions to preparedness inspections.
- GGNRA will maintain supplies, materials, and equipment at the Fire Cache at the Fort Cronkhite Fire Management Office to meet normal fire-year requirements for two Type 6 engines. Minimum staffing during fire season includes 1-Duty Officer, 1-Engine Operator and 1-Firefighter for 5 days/week coverage. Per Interagency Red Book, this minimal staffing allows for response to in-park incidents only. Preferred and optimal staffing includes the 1-Duty Officer, 1-Engine Boss/Engine Module Leader, 1-Engine Operator and 1-Firefighter for 7 days/week coverage. This optimal staffing allows for the full range of wildland responses both in-park and out-of-park.

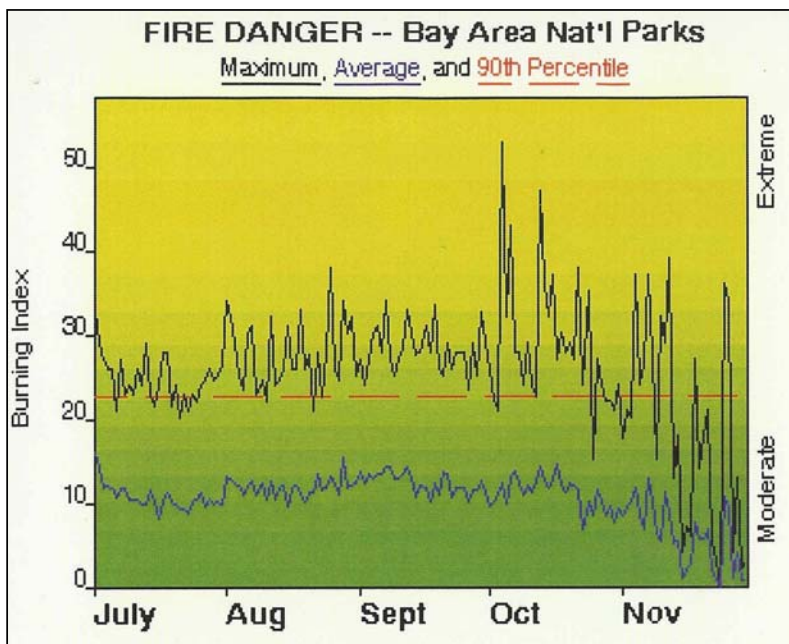
The following preparedness activity schedule will be followed annually as appropriate:

1. Year-round: NFDRS Weather Station (#042308) monitored daily.
2. Annually: Local Preparedness Review.
3. May 1: Annual Operating Plan (AOP) between Marin County Fire Department will be updated and agreed to by all parties.
4. May 1: Annual Operating Plans will be updated with Cal Fire for San Mateo County.
5. May 1– June 15: All fire line qualified permanent personnel will take the Work Capacity Test; seasonal personnel will be tested upon entering on duty.
6. May 1 – June 30: All GGNRA Red Carded employees will have completed both annual refresher and Work Capacity Test.
7. May 1 – July 30: Red Cards will be signed by FMO and distributed to employees.
8. June 15 – 30: All engines and support equipment will be serviced and fire-ready; Step-Up Plan reviewed and updated.
9. May 15 – June 30: Training for all seasonal employees completed, including mandatory refresher for all carded employees.
10. May 1 – end of season: Roster of all fire qualified personnel maintained, with PPE/initial attack gear/Red pack ready for two-hour callout.

11. July 15: Annual Preparedness Review (RM#18 & 2006 Interagency Standards for Fire and Fire and Fire Aviation Operations, Chapter 19).
12. November 15: Fire Training and Experience Records will be entered in IQCS for permanent employees.
13. November 31: Equipment winterized, cache inventoried, post-season reviews and reports completed.

California Seasonal and Monthly Outlooks, prepared by the Northern California Geographical Area Predictive Services Unit will be analyzed as early as conditions

Figure 17 – Monthly Burning Index Levels (1981 – 2000)



warrant before and during fire season. Severity funding requests, if indicated from the Outlooks, should also be prepared and finalized in coordination with PRNS. Submissions will move through agency fire channels to Fire Program Staff at the Regional Office. Refer to Interagency Standards for Fire and Fire Aviation Operations, Chapter 9 (NIFC 2006), and/or RM #18, Chapter 18 (NPS 2006b).

3.5.1.2 Fire Weather and Fire Danger

Following the cessation of

winter rains in mid-April, fuels dry rapidly and the light fuels of the annual grassland (2,000 - 7,000 lbs/acre) cure and live, dead and downed round wood material and duff in the understory of the forest stands gradually lose moisture.

Fire season at GGNRA begins in early June. At this time, high-pressure air masses frequently stagnate over the Great Basin. Strong foehn winds, referred to as Mono winds in central California, may develop if there is a low-pressure trough off the coast. These winds bring warm, dry air to the central coast and cause rapid drying of fuels. These episodes usually last 1-2 days and fire danger can be extreme. In typical years, a persistent coastal fog bank is formed by July 1, following the stabilization of the Pacific high over central California. From July through early September, fog moves inland and back out to sea in a 3-4 day cycle in response to heating and cooling in California's Central Valley. Fine fuel moisture fluctuates in this cycle, while wood fuels and duff remain relatively wet. In mid-September the fog pattern changes and fuel moistures drop steadily. It is at this time that conditions contributing to Mono winds occur. The

combination of prolonged drought, low relative humidity and a peak in fuel production often causes fire danger to be high through September and October. In addition, almost one fifth of the area's annual lightning storms occur during this period (Martin and Sugnet, 1984).

In summary, the fire season at GGNRA differs somewhat from most areas in the western United States. Bimodal peaks of fire danger occur in late spring and late summer/early fall. In most years, persistent fog keeps fire danger moderate in July and August when danger is highest in most of the western United States. The period from September 1 through October 31 can be considered the most critical time of fire danger for GGNRA (see Figure 17, Monthly Burning Index Levels). Figure 17 displays the FireFamily Plus Analysis for the FMP area indicating the periods when burning indices are at average, maximum and 90th percentile.

3.5.1.3 *Range Of Potential Fire Behavior*

All of the wildland fuels complexes represented at GGNRA display a range of fire behavior; the most typical are described below.

- May and June. Creeping ground fires in herbaceous litter and underlying duff with overall lighter fuels and soil moistures such as early in the fire season.
- July. Surface fire spread with active flame front generally occurs during periods of lowering fuel moistures.
- August and Early September. Active surface fire spread with torching, short range spotting, usually due to higher frontal winds and/or lower humidity.
- September and October. Running surface fire with torching, intermittent or sustained crown fire, short and long-range spotting under high winds, low humidity, low foliar and surface fuel moistures, during north and east wind conditions where indices can be over the 90th percentile.

Typical fire behavior for predominant vegetation types during the fire season at GGNRA are described below.

- Grasslands. The critical concern in this vegetation type is the rate of spread and ease of ignition with grasslands acting as a vector to ignite other vegetation types. This is one of the most dangerous wildfire types for firefighter safety due to its rapid frontal spread under dry and windy conditions. Production of airborne embers ahead of the flame front is not typical due to the rapid rate of spread.
- Brush and Scrub Dominated Communities. The Coastal Scrub vegetation types tend to be difficult to ignite. However, once ignited, fires in this community are difficult to suppress due to the dense stands and presence of volatile oils that make them burn faster and hotter.
- Non-native Evergreen Forests. The ignition potential of these forests is very high and directly related to the depth of the litter and dead materials on the ground. A continuity of fuel from the ground to the crown of the forest and the

potential for a crown fire to occur is the highest risk factor associated with the 340 acres of eucalyptus in GGNRA-managed lands.

- Hardwood forest. This vegetation type with a closed canopy presents a lower risk for wildland fire due to its relatively light surface fuels and moderate ignition potential is moderate due to the fairly continuous canopy cover. Fire behavior is dependent on the buildup of surface fuels and dead materials within the tree that can carry fire to the crown.
- Redwood/Douglas fir forest – Due to high coastal precipitation and summertime fog drip, wildland fire concerns for this plant community are focused on the extreme weather conditions that develop with offshore winds (Diablo winds) typically in late fall. Accumulations of dead and downed material can increase hazardous fuels and lead to an increased risk of fire during drier time periods. Some of this forest is bounded by eucalyptus groves and/or dense stands of exotics such as French broom. A fire in these adjacent areas with heavy fuels could result in an abnormally hot and fast fire that spreads into the neighboring redwood/fir forest with a higher than expected heat intensity than would be developed under similar environmental conditions in native scrub.
- Riparian forest, shrubland and herbaceous wetlands. The behavior of fire in this type of vegetation can be fairly benign due to high fuel moistures and high humidity, however at certain times of the year significant fire behavior can occur.

3.5.1.4 Weather Stations

GGNRA covers such a wide area across three counties that no single Remote Automated Weather Station (RAWS) could provide accurate fire weather. To increase the range of weather data that is available park-wide three primary RAWS sites can be accessed.

The Barnabe RAWS is located at the 800 foot elevation level in the San Geronimo Valley of Marin County. The weather readings from this station reflect inland valley, non-coastal areas such as Mill Valley, Tennessee Valley and other parts of GGNRA away from beaches. The station will over-predict weather for the Ocean Beach/Lands End area in San Francisco, the Marin Headlands and coastal beaches, Muir Woods and Fort Mason. Barnabe RAWS is cataloged in Weather Information Management System (WIMS) as #042308 and can provide NFDRS indices. The unit is maintained by Bay Area Network Preparedness Staff. Barnabe RAWS is part of Northern California Fire Weather Station 205 and Forecast Trend Zone 562. It is used for the GGNRA Step-Up Plan for Marin and San Francisco County areas.

La Honda RAWS, in San Mateo County, is located on Highway 84, 6.5 miles west of the intersection with Skyline Boulevard at Skylonda and ½ mile north of the intersection with Pescadero Road (see Figure 18, RAWS Weather Stations, San Mateo). The RAWS is located in the upper mid-slope of a ridge at the 800 foot elevation band and the station captures coastal influence weather readings for San Mateo Cal Fire. La Honda RAWS can also be used to determine fire weather for NPS managed lands at Milagra Ridge, Sweeny Ridge, Mori Point, Cattle Hill and Pedro Point. The station will be used for

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Corral de Tierra lands just south of Moss Beach on the San Mateo Coast once acquisition is finalized. La Honda RAWS is in Fire Weather Zone (FWZ) 275 -- San Mateo Hills -- and Forecast Zone 550. Felton ECC in Santa Cruz County manages the WIMS account and maintains this RAWS unit. It is not currently used to determine any Step-Up actions.

Pulgas RAWS, in San Mateo County, is located north of the Phleger Estate and Town of Woodside near the intersection Edgewood Road exit on I-280 (See Figure 18, RAWS Weather Stations, San Mateo County). Located at 600 foot elevation, this station reflects drier inland weather readings as it is situated on the east side of the Coastal Range. Pulgas RAWS picks up fire weather for the Phleger Estate and the southern portions of Crystal Springs Reservoir. The unit is FWZ 275 – San Mateo Hills -- and it is in Forecast Trend Zone 550. Felton ECC in Santa Cruz County manages the WIMS account but the RAWS is maintained by San Francisco Public Utilities Commission staff which manages 23,000-acre Peninsula Watershed just north of the RAWS. This unit is not used for any Step-Up actions.

Station Name	Station ID	MesoWest ID	Fuel Model	Location	Elevation	Owner
Barnabe	042308	BBEC1	7A2A2	38.0281 122.7022	810 feet	NPS/Marin County
La Honda (off Log Cabin Ranch Rd., ±2 mi SE of La Honda)	043304	LAHC1	2	37.3053 122:255	872 feet	SF PUC
Pulgas (Vista Pt., on I-280 NW of Edgewood Rd.)	043309	PUGC1	2	37.4750 122:2981	644 feet	Cal Fire

3.3.1.5 National Fire Danger Rating System (NFDRS)

NFDRS is a multiple index system developed to provide information about current and predicted fire danger conditions. Analysis of fire weather information from Barnabe RAWS uses NFDRS Model A, Slope Class 2 (0-25 percent), perennial herbs, and Climate Class of 2 (semi-arid). Restriction thresholds for Park Visitor Activities will be developed in 2008 for the FMP update. The Northern California Coordination Center Predictive Services Group, in conjunction with the National Weather Service San Francisco Bay/Monterey Weather Forecasting Office, monitors, analyzes and predicts fire weather, fire danger and fire management resource impacts across the Bay Area and East Bay Hills.

Red Flag Warnings are issued to warn of an impending or unusually severe fire weather event. As shown in Table 10, a warning is issued when the combination of conditions shown in the chart are occurring or expected within 24 hours.

Figure 18 – RAWs Weather Stations – San Mateo County

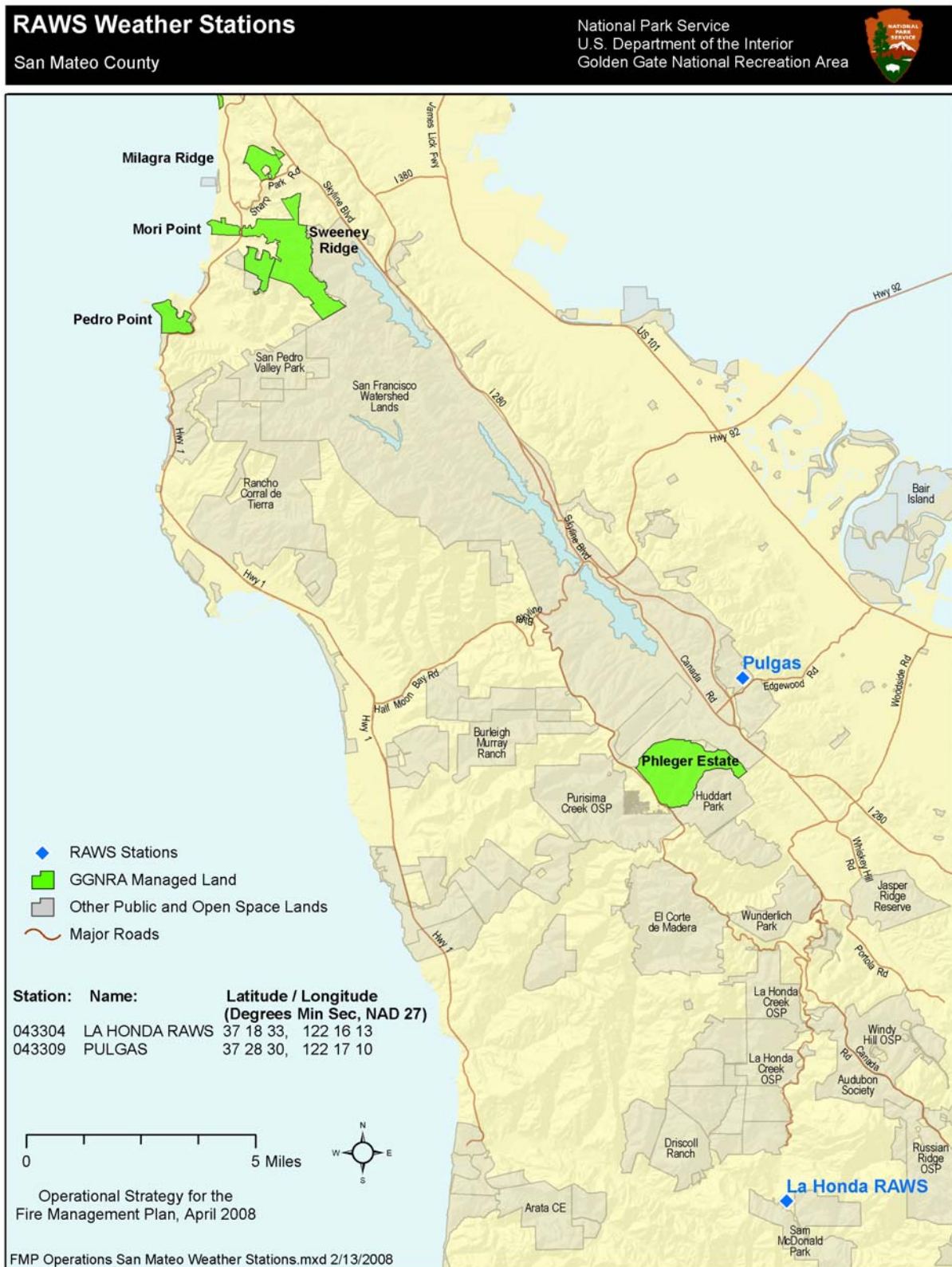


Table 11 – Red Flag Warning Matrix

Red Flag Guidance/Verification Matrix				
The matrix below assume 10-hour fuel moisture of less than 6%, annual grasses are cured, and no wetting rain (greater than 0.10 inch) has fallen in the past 24 hours.				
Relative Humidity	Sustained 20 foot Wind Speed (Note: the wind event should be expected to last at least 8 hours)			
	Sustained Wind 6-11 mph	Sustained Wind 12-20 mph	Sustained Wind 21-29 mph	Sustained Wind 30+ mph
<u>Day MIN 29-42%</u> <u>Ngt MAX 61-80%</u>				RED FLAG WARNING
<u>Day MIN 19-28%</u> <u>Ngt MAX 46-60%</u>			RED FLAG WARNING	RED FLAG WARNING
<u>Day MIN 9-18%</u> <u>Ngt MAX 30-45%</u>		RED FLAG WARNING	RED FLAG WARNING	RED FLAG WARNING
<u>Day MIN < 9%</u> <u>Ngt MAX < 30%</u>	RED FLAG WARNING	RED FLAG WARNING	RED FLAG WARNING	RED FLAG WARNING
To help verify Red Flag Warnings the links above will show you what RAWS sites have met the RFW criteria during the last 24 hours. After clicking on the Day MAX or Ngt MAX RH link <u>double check the times on the observations</u> . Both day and night observations will show up.				

Fire managers can use the NFDRS for computing daily and forecasted fire danger. Local thresholds documented on Fire Danger Pocket Cards that shout “Watch Out” are: 20 foot wind speeds exceed 15 mph, RH less than 25% and temperature over 80 degrees. The pocket card also uses the Burn Index (BI) of above the 90th percentile as a key indicator of increased fire activity. The graphic below from the Bay Area Parks Network Fire Danger Pocket Card shows the BI in relation to past major and minor incidents (See Figure 19, Burning Index Levels during Past Wildfires).

3.5.2 Step-Up Plan

The Step-Up Plan describes a series of escalating management responses which are intended to supplement normal wildland fire capabilities for short periods (i.e., normally one burn period). This policy-compliant plan is in table format and is located in Appendix A, Part 5.

3.5.3 Detection

Typically, most fires will be discovered and reported by local residents or members of the public recreating at GGNRA. It is expected that most individuals wishing to report a

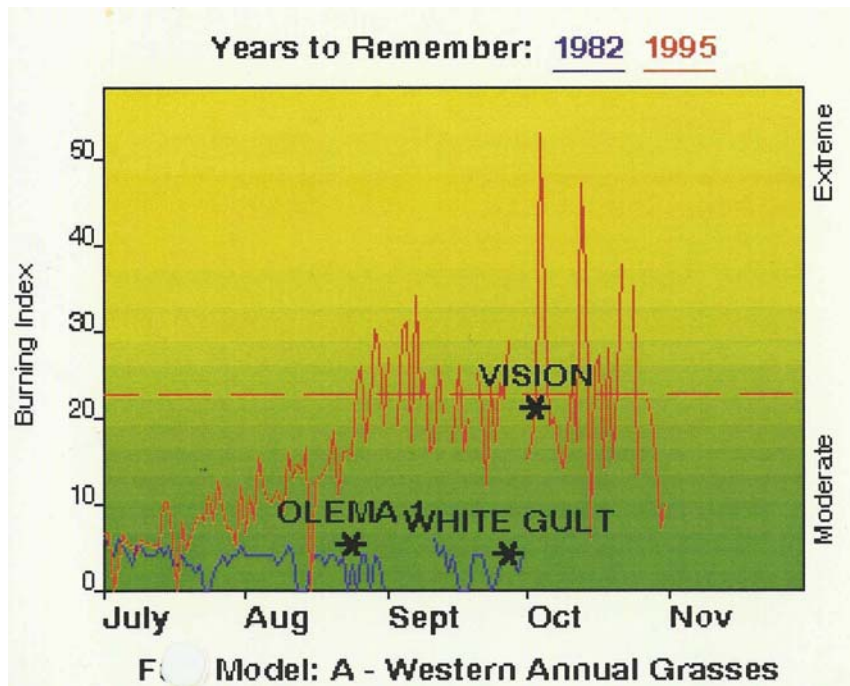
fire would contact 911 rather than notifying GGNRA staff directly. In Marin County, 911 calls are routed to the Marin County Sheriffs Department Communications Center (“Comm Center”). If the 911 call is in reference to a reported wildland fire, the Comm Center transfers the caller to Marin County Fire Department’s Woodacre ECC. Woodacre ECC then makes the appropriate notifications and tactical resource dispatching. There is also the potential for park visitors in Marin County and San Francisco parks to notify an NPS employee. In this event, the park employee will contact GGNRA Park Dispatch at the Presidio. GGNRA Park Dispatch will, in turn, notify Woodacre ECC and also begin the dispatching of NPS fire resources.

3.6 INITIAL ATTACK

Initial Attack is an aggressive suppression action consistent with firefighter and public safety and values to be protected.

All unplanned wildland fires must receive aggressive initial attack action (IA) by the nearest available suppression forces. Generally, first on scene would be a local fire department engine company. In Marin County, this would likely be Southern Marin Fire for Alta Ridge or Marin County Fire Department. In San Francisco, the Presidio Fire Department would respond to wildland fires in the Presidio, Fort Mason, Fort Point and San Francisco Maritime Museum. The San Francisco Fire Department would be the initial responder to

Figure 19 – Burning Index Levels during Past Wildfires



fires at Fort Funston, Sutro Heights, Land’s End and Fort Miley. Cal Fire would respond to Phleger Estate and the North Coast Fire Authority along with Cal Fire would respond to Sweeney Ridge, Milagra Ridge, Cattle Hill, Mori Point and Pedro Point near Pacifica.

NPS personnel will respond after notifying GGNRA Park Dispatch and Woodacre ECC (for Marin County) or Cal Fire’s Felton

ECC (for San Mateo County). Woodacre ECC will be the ordering point for all initial attack fires within GGNRA in Marin County. Cal Fire’s Felton ECC will be the ordering unit for fires in San Mateo County. If a federal Type 3 IC is not immediately available to take over

the incident, a Battalion Chief or higher from the Marin County Fire Department, Southern Marin Fire Protection District, North Coast Fire Authority or Cal Fire may assume that position with the FMO and Superintendent's concurrence.

On federal lands in San Mateo County, where Cal Fire has direct protection area responsibility, Cal Fire will provide all qualified incident command.

3.6.1 Initial Attack Priorities and Closest Resources

In the unusual event that there are multiple simultaneous fires within GGNRA, a fire start which has the potential to threaten life or property would have priority for suppression actions.

GGNRA will follow the Closest Forces Concept for initial attack actions on GGNRA lands. Employing the closest forces concept means that regardless of the protecting agency, the fire suppression resource that has the shortest timeframe to be the first to reach the incident location will be the one dispatched. This concept is standard operating procedure for all cooperating fire protection agencies in Marin, San Mateo and San Francisco Counties and is included as part of operating plans with our local fire agencies.

3.6.2 Appropriate Management Response

The AMR will be based on objectives, relative risk, external influences and management boundary defensibility and may include one or some combinations of the following:

- Initial Attack. A planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the spread of the fire and put it out at least cost. This is an action where an initial response is taken to suppress wildfires consistent with firefighter and public safety and values to be protected.
- Wildfire suppression with multiple strategies. This action categorizes wildfires where a combination of tactics such as direct attack, indirect attack and confinement by natural barriers are used to accomplish protection objectives as directed in the Wildland Fire Situation Analysis (WFSA).
- Control and extinguishment. These actions are taken on a wildfire when the selected WFSA alternative indicates a control strategy. Sufficient resources are assigned so that control of the fire can be achieved with a minimum of acres burned.

3.6.3 Response Time Frames

The GGNRA road system is in relatively good condition with most areas in the park accessible by vehicle and thus, response times to fires by engines would be relatively short.

Cal Fire maintains several fire stations in San Mateo County within close driving range of Sweeney Ridge, Milagra Ridge, the Phleger Estate and Mori Point. The Cal Fire stations can provide rapid response to these areas.

Aerial delivery of firefighters by helicopter is an alternative to walk-in if speed to an incident is necessary.

Cal Fire maintains nearly all aerial tactical firefighting resources in the San Francisco Bay Area. No federal aerial resources are stationed in this part of the state. The closest Cal Fire helicopter capable of delivering and supporting firefighters are:

- Copter 104 (Boggs Mountain) for response to GGNRA lands in Marin and San Francisco Counties.
- Airtanker 85 (Sonoma) for response to GGNRA lands in Marin and San Francisco Counties.
- Copter 106 (Alma) for response to GGNRA lands in San Mateo County.
- Airtankers 82 and 83 (Hollister) for response to GGNRA lands in San Mateo County.

3.6.4 Restrictions and Special Concerns

As a unit of the NPS, there are sensitive resources requiring special protection throughout GGNRA. During the NEPA process which preceded the preparation of this FMP, NPS staff and the public considered the potential impacts to the park and general area resources from wildland fire, fire suppression actions and more routine fire management projects. After reviewing the level of adverse and beneficial effects that could result from implementation of the FMP, staff, regulatory agencies and the public contributed to the development of a series of mitigation measures to be applied to FMP actions in order to minimize or avoid the predicted potential effects. These mitigation measures were adopted by the NPS through the signature of the Record of Decision (ROD) for the FMP Final EIS by the Pacific West Region Deputy Director. Prior to and during suppression actions, appropriate mitigation measures from Appendix D should be implemented to the degree feasible while ensuring the protection of life, property and resources. The following mitigation measures pertain to preparation for suppression and active suppression of wildland fire.

Preparedness

- FMP-2** GGNRA staff will meet with representatives of local fire agencies that could respond to wildfires in GGNRA lands in Marin, San Francisco, and San Mateo counties. The purpose of the meeting will be to provide information to fire agencies on the location and preferred strategies for suppression actions that will minimize damage or afford protection to important park resources in the event of a wildfire. The information exchanged between the NPS and local fire agencies will include notification procedures, new or modified facilities in the park, updated information on cultural and natural resources, low-impact suppression techniques, or potential protection techniques for certain locales in GGNRA.
- FMP-3** GGNRA cultural and natural resources staff will work with the fire management staff in preparing and updating maps and other data sources showing areas of the park with sensitive resources such as National Register properties; archaeological sensitivity; cultural landscapes; plant communities of special management concern (e.g., wetlands, riparian areas, dunes, and

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Special Ecological Areas identified in the park's Natural Resource Management Plan); habitat of federal, state, and locally listed species; and other important natural and cultural resources.

FMP-6 The superintendent of GGNRA will appoint members of GGNRA staff to act as resource specialists to consult with operations crews in the event of wildland fire and during planning and execution of prescribed fire. The resource specialists will meet with local fire agencies likely to command wildland fire suppression actions on GGNRA lands and develop strategies for implementing flexible suppression to protect important resources.

AIR-2 The NPS will develop a Smoke Communication Strategy to guide management of smoke events during prescribed fires, managed wildland fires, suppression actions, and fires occurring outside the park.

SS-24 (And Suppression) During the information meeting with local fire agencies, the location of mission blue butterfly habitat will be identified. During this meeting and when providing information at an active wildland fire as a resource advisor, natural resources staff will advise the local fire agency of the following guidelines:

1. Avoid staging fire suppression actions in or directly adjacent to mission blue butterfly habitat;
2. Construct fire lines outside of mission blue butterfly habitat to the greatest extent possible;
3. Use wet lines wherever feasible, or narrow, hand-constructed fire lines where water is not available to help contain the spread of the fire; and
4. Avoid using saltwater or retardant on habitat of the mission blue butterfly.

SS-30 (And Suppression) During the information meeting with local fire agencies, the location of San Bruno elfin butterfly habitat will be identified. During the meeting and when advisors are called to provide information at an active wildland fire, natural resources staff will advise the local fire agency of the following guidelines:

1. Avoid staging fire suppression actions in or directly adjacent to San Bruno elfin butterfly habitat;
2. Construct fire lines outside of San Bruno elfin butterfly habitat to the greatest extent possible;
3. Use wet lines wherever feasible, or narrow, hand-constructed fire lines where water is not available to help contain the spread of the fire; and
4. Avoid the use of saltwater or retardant drops on San Bruno elfin butterfly habitat.

SS-32 (And Suppression) During information meetings with local fire agencies and on the scene of active suppression actions, natural resource advisors will

inform responding fire agencies that Rodeo Lagoon shall not be used for water drafting unless needed to protect life and property and no other feasible water source is available.

Suppression Actions

- FMP-7** Natural and cultural resources staff will be notified of wildland fires as soon as possible so that appropriate staff can advise the lead fire agency on the location of sensitive resources and preferred suppression techniques and begin planning for rehabilitation of the burned area. Natural and cultural resource advisors will be assigned to the incident as needed.
- FMP-8** For any multi-day fire suppression event, a local or regional Burned Area Emergency Response team will be requested to facilitate development, in conjunction with park staff, of the emergency suppression stabilization and rehabilitation proposals.
- SW-1** Planned and unplanned fire actions will include strategies to minimize impacts from erosion, such as avoiding steep slopes and highly erosive soils, timing burns to minimize erosion potential, avoiding scraping or burning to bare mineral soil (layer below duff), or using erosion control techniques during or after burns.
- WET-1** Fires will be allowed to back into, around, or through wetlands and meadows to avoid suppression damage. Wetlands will be avoided to the greatest extent possible while constructing fire lines and breaks during wildfire suppression. Where wetlands are used as a natural boundary to help contain a fire, the control line will be sited outside the wetland area. Trample lines (rather than dug lines) may be used if it is necessary to site the control line in the wetland.
- WET-2** Foams, saltwater or other fire retardants will not be used on or near wetlands to the greatest extent possible.
- VEG-2** Soil disturbance during mechanical treatments, prescribed burns, and suppression fires will be minimized to the greatest extent possible to reduce the potential for introduction or spread of nonnative plant species, to protect topsoil resources, and to reduce available habitat for new nonnative plant species.
- SS-1** When emergency actions must be taken to prevent imminent loss of human life or property and these actions would result in a taking of listed species or adverse modification of critical habitat not covered under existing FMP biological opinion, the NPS will respond to the situation in an expedient manner to protect human health and safety. After the incident is under control, the NPS will initiate emergency consultation procedures with the appropriate agency(ies).
- SS-4** To avoid the spread of highly nonnative animal species (e.g., bullfrogs) and protect the habitat of federally listed threatened or endangered species, GGNRA resource advisors and fire management staff will advise local fire

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agencies responding to wildland fires in the park and vicinity of the following guidance:

1. Drawing water from freshwater bodies in GGNRA and Rodeo Lagoon should be avoided unless there are no alternative sources available. If freshwater is drawn or scooped from water bodies in the park, it should be used on wildfires within the same watershed whenever possible.
2. Ocean and bay waters are preferred water sources for fighting wildfires in the park and vicinity. Habitats of sensitive aquatic species and mission blue butterflies should be avoided when saltwater is used.

SS-11 Except in emergency situations, water drafting from park streams and creeks that support salmonids must be halted when water levels drop to a level that could result in disconnected pools of water in the channel. Any water pumping from salmonid streams will require measures to prevent injury to fish, such as using offstream sumps, restricting approach velocities to less than 0.8 foot per second, and screening at intake with openings no greater than 0.25 inch.

SS-19 No heavy equipment will be used off of existing fire roads or developed features in areas of known San Francisco garter snake habitat. If use of heavy equipment and trucks is required during emergency situations or for work that would improve San Francisco garter snake habitat, mitigation measures to avoid mortality will be incorporated into the project schedule.

SS-37 To avoid disturbance of western snowy plovers, aircraft assisting the NPS in the implementation of FMP projects will avoid flying directly over and parallel to the beach to the greatest extent possible.

SS-38 To avoid disturbance to the California brown pelican from late spring to early winter:

1. Avoid operating aircraft below and within 500 feet of Rodeo Lagoon, Bird Island, and Bolinas Lagoon to the greatest extent possible.
2. Avoid drafting water from Rodeo Lagoon, the ocean near Bird Island, or Bolinas Lagoon.

3.6.5 Extended Attack and Large Fire Suppression

The Incident Command System (ICS) provides for a management/organizational structure on incidents that evolve in complexity or increase in size, whether within a few hours or over several days. While the criteria for incident complexity vary by local conditions, a fire that has escaped initial attack is considered in extended attack (Type 3 incident) when it:

1. Has not been contained by the initial attack resources dispatched to the fire.
2. Will not have been contained within management objectives established for that unit or area.

3. Has not been contained within the first operational period and there is no estimate of confinement or control.

When complexity levels exceed initial attack capabilities (Type 4 and 5 incidents), the appropriate ICS positions should be added commensurate with the complexity of the incident. The Incident Complexity Analysis and the WFSA assist the Superintendent in determining the appropriate management structure to provide for safe and efficient fire suppression operations. When an Incident Management Team is ordered to manage a fire, a Superintendent In-Briefing Package and Delegation of Authority as well as a draft WFSA will be prepared and presented to the team upon arrival at GGNRA. A unified command structure will be a requirement in all multi-jurisdictional incidents.

As safety allows, initial attack Incident Commanders will assess the complexity of the fire to determine their capacities to manage the incident. If the initial attack Incident Commander (IC) is unable to initiate action due to the management complexity of the incident, forces will be staged in a safe location or modified tactics will be used until a fully qualified Type 3 Incident Commander arrives on scene. Qualified IC's from those local fire agencies that have a Cooperative Fire Agreement with GGNRA (i.e., Marin County Fire Department, Cal Fire, etc.) may fill the Type 3 Incident Commander role if a qualified federal IC is not available or until federal oversight can be provided.

Qualified local agency personnel may be used to fill ad-hoc Type 3 incident positions. The decision to transition to a Type 2 or 1 complexity incident will be made by the Park Superintendent in consultation with the FMO and the Type 3 Incident Commander.

All wildland fires (with the exception of GGNRA lands under CalFire DPA) that meet Type 2 or 1 complexity levels will require a federal Type 2 or 1 Incident Management Team

A Delegation of Authority will be prepared for all incidents involving federal lands which transition to a federal Type 1 or 2 Incident Management Team. Mendocino NF ECC will be the ordering point for all Type 1 or Type 2 complexity fires and any extended incident beyond one or two operational periods.

A Delegation of Authority will be prepared for the Cal Fire Incident Commander at any complexity level on GGNRA lands in San Mateo County which is within the Cal Fire DPA. Inherent in DPA Agreements, Cal Fire can call upon its Type 1 Incident Management Teams to manage a complex fire incident. Felton ECC will be the ordering point for all incidents on GGNRA managed lands within the Cal Fire DPA.

An Incident Complexity Analysis (NIFC 2006, Chapter 10, Appendices 10-4 or 10-5) will be used as a guide for IC's, fire managers and Agency Administrators to evaluate emerging fires in order to determine the level of management organization required to meet agency objectives. This will assist in identifying resource, safety, and strategic issues that will require mitigation.

The WFSA is a decision-making process in which the Superintendent or representative describes the situation, compares multiple strategic wildland fire management alternatives, establishes objectives and constraints for the management of the fire, selects the preferred alternative, and documents the decision. The format and level of detail required depends on the specific incident and its complexity. When a wildland fire

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cannot be controlled during the initial suppression response action or a prescribed fire has exceeded its parameters and been declared both unsuccessful and a wildfire, a WFSA will be initiated and a new strategy selected *Interagency Standards for Fire and Fire Aviation Operations*, Chapter 10-E (NIFC 2006).

3.6.5.1 *The Wildland Fire Situation Analysis (WFSA) Development*

The WFSA is a decision making process in which the Superintendent (or designee) describes the situation, compares strategy alternatives, evaluates expected effects of each alternative, establishes objectives and management constraints, selects the preferred alternative, and documents the decision. It serves as a contingency to undesirable outcomes. If the selected alternative does not accomplish objectives, the WFSA can be amended.

The Superintendent or designee and the FMO and/or Incident Commander prepare the WFSA. Required elements to be addressed in a WFSA are:

- Current Situation
- Evaluation Criteria
- Alternatives
- Analysis of Effects
- Record of Decision
- Review/Evaluation/Update
- Probability of Success
- Consequences of Failure

3.6.5.2 *Complexity Decision Process for Incident Management Transition.*

GGNRA has developed a unit-specific Incident Complexity Analysis for Type 4 and 5 fires and criteria for transitioning to a Type 3 incident command structure. See further information in Section 3.3.4, Extended Attack, and Appendix E, Part 12, GGNRA Incident Complexity Analysis for Type 5, Type 4 and Transition to Type 3 Incidents.

3.6.5.3 *Delegation of Authority for IC*

The Delegation of Authority for IC form permits the Superintendent to delegate the responsibility for all incident suppression efforts to another qualified individual. The newly delegated IC may be from another park unit, another federal agency or a state or local agency. The person has to be qualified for the complexity level of the incident as determined by the previous IC. See further information in Section 3.3.4, Extended Attack, and Appendix E, Part 14, Example of Delegation of Authority Form.

3.6.6 REHABILITATION GUIDELINES AND PROCEDURES

While many wildfires cause only limited damage to the land and pose few threats to fish, wildlife and people downstream, some fires create conditions that require proactive

efforts to prevent further damage from occurring. Loss of vegetation exposes soil to erosion; runoff may increase and cause flooding, sediments may move downstream and damage houses or fill reservoirs, and put endangered species and community water supplies at risk. The Burned Area Emergency Response (BAER) program addresses these situations with the goal of protecting life, property, water quality, and deteriorated ecosystems from further damage after the fire is out.

There are four complementary parts to the BAER Program:

1. Suppression Activity Damage (SAD) are those repairs necessitated by damage resulting from the suppression activity rather than a result of the wildfire. The repairs are planned and implemented primarily by the incident command organization prior to demobilization. Suppression Activity Damage repairs are charged to the incident account.
2. Emergency stabilization (ES) actions are set out in the Burned Area Emergency Response Plan completed within 7 days of the containment of the fire by an interdisciplinary Burned Area Emergency Response Team. The Team surveys the burn area, identifies where repairs are needed and how the repair will be conducted. The goal of ES is to minimize threats to life and property or to stabilize and prevent unacceptable degradation to natural and cultural resources. ES repairs are to be implemented within one year of containment of the wildfire. ES is part of the Emergency Operations appropriation
3. Burned Area Rehabilitation (BAR) requires the preparation of a Rehabilitation Plan identifying projects that are in need of repair or improvement on a landscape scale resulting from direct damage by the wildfire. The goal of the rehabilitation plan is to rehabilitate and establish healthy, stable ecosystems in the burn area, prioritizing relative values to be protected, commensurate with rehabilitation costs. The plan is developed with public participation and describes projects and follow-up actions occurring up to three years after containment. BAR is a separate non-emergency appropriation.
4. Long-term (>3 years) Restoration are those rehabilitation actions occurring beyond the initial three years or after the repair or replacement of major facilities damaged by the fire.

Interior Department Guidance on the BAER program is found in Departmental Manual 620, Chapter 3. An Interagency Burned Area Emergency Response Handbook, Version 4.0 can be found at <http://fire.r9.fws.gov/ifcc/esr/Policy/es%20handbook%202-7-06.pdf>. The Burned Area Rehabilitation Handbook is currently in Draft form and circulating for review. Specific best management practices for implementing ES and BAR actions at GGNRA should consider the following recommendations:

- Burn area seeding may be considered, depending on specific local impacts. All seed applications must be approved by the GGNRA Resource Advisor prior to purchase and application.

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- To the greatest extent possible, waterbars shall be hand-placed. No mechanical equipment will be used in wilderness areas unless such action is in response to an immediate threat to watershed stability.
- A post-burn watershed assessment will be made for fires affecting sensitive watersheds.
- Rehabilitation actions may require consultation with the FWS and the NMFS. See Endangered Species Act (ESA) Section 7 Handbook, Chapter 8 for further guidance. Consultation shall be coordinated through the BAER Team in conjunction with local GGNRA staff. If a BAER Team is not assigned to the incident, an ESA Coordinator will be assigned to this duty.
- NHPA compliance may be required prior to implementation of ES or BAR projects. A determination should be made as to whether the actions meet the requirements for NHPA compliance under emergency conditions described in the NHPA regulations, provision 800.12.
- Emergency stabilization funds can be used to control nonnative invasive plants within burned areas when it can be documented that the invasive may spread quickly and can out-compete emergency stabilization relying on seedings or reestablishment of native vegetation. Options for treatment may include chemical, biological or mechanical methods to control aggressive invasives, post-fire detection and monitoring which may be funded for up to one year following containment of the fire.
- If herbicides are prescribed for emergency stabilization actions, they will be applied according to strict specifications using detailed Material Safety Data Sheets. Any application requires the approval of the GGNRA's Integrated Pest Manager and the Washington Office coordinator for herbicide application. No applications would occur in riparian or wetland areas.
- Monitoring intensity should be commensurate with the complexity of the emergency stabilization treatments, level of concern or controversy associated with the emergency stabilization treatment. See Appendix F, Wildland and Prescribed Fire Monitoring and Research Plan. Monitoring of rehabilitation treatments will be coordinated with the GGNRA Fire Ecologist and Bay Area Network Fire Effects Monitoring Program.

3.6.7 Records and Reports

Quality, long-term documentation records for all actions taken on a wildland fire is critical. All decision documents, monitoring data, supporting documentation, and operational documents (Incident Action Plans, maps, unit logs, etc.) will be assembled and organized during and following a wildland fire management action.

Specifically, the fire report and file should contain:

- Any written policies, guidelines or authority statements signed by the Superintendent.

- Copy of the NPS WFSAs.
- ICS-209's (Incident Status Report) for fires over 100 acres in Timber or over 300 acres in Grass.
- Copies of purchase orders, personnel request orders, etc. associated with the fire.
- All situation maps.
- Personnel rosters.
- Press releases, clippings, videotapes.
- Accident reports.
- All monitoring data, spot weather forecasts, Internet printouts.
- Documentation of financial charges made against the assigned account number.
- Narratives and unit logs.
- Burned Area Rehabilitation plan.
- DI-1202 Fire Report (completed within 10 working days after fire has been declared out).

It is particularly important to include IC narratives (see above) regarding effectiveness of planned strategies, trigger points, holding actions, and other pertinent factors encountered during the fire.

3.7 PRESCRIBED FIRE

For purposes of the FMP and as defined by federal Wildland Fire Management Policy, prescribed fire is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan (burn plan) must exist prior to ignition. This burn plan contains a prescription defining goals, weather and fire behavior parameters, monitoring, and treatment methods used to achieve project specific objectives, while prioritizing firefighter and public safety. All prescribed fire projects also require an approved Smoke Management Plan filed with BAAQMD.

For the foreseeable future, the prescribed fire program will be aimed at restoring fire as a natural ecological process and reducing hazard fuels concentrations. Many areas subject to first entry treatment may require subsequent treatment(s) in order to achieve hazard fuels reduction objectives, rather than attempting to meet all objectives on the first treatment and risk costly escape and/or unacceptable resource damage.

The range of possible beneficial outcomes of prescribed burning projects includes an increase in firefighter and public safety, protection of real property and natural and cultural resources, reduced risk of high intensity wildland fires, avoidance of savings property damage costs and the restoration of fire to fire-adapted landscapes.

The late fall wildfire season is one of the primary constraints limiting the number of days available in the project area during which prescribed burns can be conducted each year. Other constraining factors are air quality and disruption of wildlife breeding periods.

3.7.1 Annual Planning, Review and Documentation for Prescribed Burning

Prescribed fire project prioritization for GGNRA is determined as part of the five year implementation plan update that occurs annually in early winter. Project priorities are set for the coming year based on actual accomplishments during the prior year and



target goals of the FMP. Projects scheduled but uncompleted for the prior year and re-evaluated in light of the current years project list and some project rescheduling normally occurs. The effects of rescheduling the current year ripples through the five year plan causing some reshuffling in the project schedule. The following actions and dates structure the planning process:

- Prepare annual program priority list based on projects listed in the multi-year implementation plan.
- Prepare map of archaeological/biological survey before January 15 for anticipated projects to be conducted during the following fiscal year.
- Submit prioritized listing of projects through NFPORS database by March 10.
- Regional fire staff informs GGNRA FMO of the final list of selected projects by mid-summer.

3.7.1.1 *Prioritizing and Review the Annual Implementation Plan*

The five-year fuels treatment plan will be updated annually as target units are burned and fuel reduction projects completed. [The GGNRA Five Year Fuels Treatment Plan will be developed in 2008 for the FMP update.] Fire Management staff at the PWR office have established a process for the annual review of the five year fuels treatment plan *vis-à-vis* ensuring that actions conform to the findings and commitments agreed to in the NEPA process for the FMP. In addition to NEPA conformance, the annual review process provides a framework for ensuring continued conformance with the requirements of the ESA consultations and NHPA programmatic mitigation measures. The review of the five year fuels treatment plan will be undertaken by a multi-disciplinary team representing the range of expertise of the fire staff.

For the specific process to follow for the annual review of the fire management program and FMP, please see FMP Section 4.6.

To update the annual implementation plan for the coming fiscal year, the fire management branch developed priorities based on their professional expertise, input from outside fire agencies, and hazard mapping such as Marin County's Fuel Ranking and Hazard maps and the Park's Wildland Fire Hazard Maps. Sites for prescribed burning are initially proposed based on the risk factors, fuel conditions and resource management issues identified in the GGNRA FMP for each project area.

Project selection and prioritization involve a conglomerate of multi-divisional staff members including but not limited to: Vegetation, Wildlife, Cultural Resources, Fire Ecology, Fire Suppression Operations, Environmental Compliance, and Interpretation and Education.

Based on the relative strength of the justification, projects are further considered for potential effectiveness in addressing critical needs and feasibility of implementation. The FMUs and project areas have goals and objectives, and the development and prioritization of projects must be based on the reasoned expertise of fire staff. Though NPS fire staff is not bound by the strategies in the Marin CWPP or the Cal Fire annual plan, these preventive plans are seriously considered when prioritizing NPS projects as are NPS efforts to coordinate, cooperate, and plan with our local fire agencies and land managers to ensure efficiency, and that overall fire management goals and strategies can be achieved in unison.

All these disciplines gather and are able to bring new ideas to the table and to discuss and provide input for projects that are developed by the FMO office.

New projects for resource enhancement, vegetation management, and urban interface protection are presented to the group. These projects are prioritized base on the likelihood of funding, difficulty of operations, actual benefits from project completion, and the safety of the public and park staff. An additional key ranking criteria is how future projects relate to previous ones. Projects that are a continuation of work begun on long-term fuel reduction zones carry a high ranking. This ensures that previous efforts are maximized.

Another reality facing fuels and prescribed fire management decisions is the lack of funding. This reality must also be included in project decision criteria. Some of the highest ranked priorities based on fuel ranking and hazard maps would also be the most costly based on their proximity to private property. These projects require smaller acres to minimize public impacts and require more resources to ensure protection of property. The likelihood of these projects being funded by the regional office is diminished by the associated high cost per acre.

There is no set formula for determining and prioritizing projects. Park staff needs to remain very flexible to address and react to changing management goals and budget realities. All projects that are approved have the complete involvement and support from the various management disciplines within the park.

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Once verified, the annual FMP review can be conducted. The finalized list of projects is presented at the beginning of the fiscal year to the Division Chief and Superintendent for review and comment. At that point, it is appropriate to conduct NEPA project review on the finalized list. As FPA comes on-line, the annual FMP review may be tied to the FPA schedule changing the annual review period to each January.

3.7.1.2 *Review of Projects for NEPA Conformance*

Requirements set forth in RM #18, Chapter 10, Part VIII, Prescribed Fire (revised 9/26/06), will be followed. These revised guidelines conform to the Interagency Prescribed Fire Policy Planning and Implementation Guide (NIFC 2006). The following information should be included in project-level plans involving prescribed fire:

- Develop project objectives and site-specific treatment methods to accomplish objectives into a comprehensive project description for the NEPA assessment.
- Input project information into the Planning, Environment and Public Comment (PEPC) database system, implemented agency-wide for all levels of NEPA review. Burn plans for areas that were sufficiently assessed through the FMP FEIS will be reviewed by the IDT and the conformance with the FEIS documented through a Memo to the File of the FEIS. The project impacts and mitigation measures must conform to the formal consultations conducted as part of the FMP and the findings of the FMP Record of Decision. If a proposed project does not conform, additional consultation may be warranted. Upon completion of annual review process, any additional written documentation will be filed as part of the FMP EIS NEPA process as a Memo to File.
- If, due to proposed burn location or burn intensity, sensitive resources could be directly or indirectly affected in a manner not anticipated and addressed in the FEIS, the burn will require a separate NEPA review and perhaps additional ESA or NHPA consultation. NEPA conformance for these projects will be conducted per DO-12, RM-12 and GGNRA SOP-601 for NEPA Compliance. Conformance would be achieved by an EIS or EA if there is potential for significant adverse effect or exceptional circumstances; projects without potential for significant adverse effect may meet the requirements for a categorical exclusion for prescribed burning (categorical exclusion G.1).
- Following mitigating actions, an original copy of the burn plan will be routed with attached clearances by the FMO/Burn Boss.

3.7.1.3 *Developing Burn Plans*

All NPS prescribed fire programs will adhere to the following requirements for planning, reporting and documenting prescribed burns:

1. All prescribed fire projects will be coordinated in a collaborative process involving adjacent neighbors and local governments.
2. A Delegation of Authority for all off-Park Burn Bosses will be prepared and signed by the Agency Administrator or acting.

3. An Incident Action Plan will be developed for each operational period of a prescribed fire. It is permissible to develop a multishift IAP to cover a period of several days. The 215A (Incident Safety Analysis) process will be utilized in the development of the IAP. Required components of the IAP include:
 - a) Organization Assignment (ICS-203)
 - b) Medical Plan (ICS-206)
 - c) Safety Message (or ICS-215A)
 - d) Division Assignment List (ICS-204)
 - e) Communication Plan (ICS-205)
 - f) Project Map
 - g) Weather Forecast (preferably spot weather)
 - h) Aviation Operations Summary (if applicable) (ICS-220)
4. Resources listed as “contingency” must be available to respond to the incident within a specified timeframe. If the contingency resource becomes unavailable to respond to the prescribed fire, it must be replaced immediately, as the burn is now out of prescription.

Other actions which should be considered by the FMO or assigned Burn Boss in implementing a prescribed fire are the following:

- Reconnaissance (GPS) and burn unit layout and compliance (involve resources staff as needed to identify values to be protected, etc.).
- On-site documentation, fire effects monitoring, Job Hazard Analysis (JHA) elements, logistics, and identified mitigation work; complete complexity rating.
- Analyze potential ignition patterns with prescriptions, weather, fuels, and topography.
- Coordinate all burns w/grazing permit holders, cooperators, and media.
- Smoke management considerations, monitoring, modeling, and consultation with the Bay Area Air Quality Management District.
- Pre-burn notifications.
- Briefings, logistics, contingencies.
- Go/No-Go decision process.
- Organization, implementation plans.
- Follow-up coordination, evaluations, cost summaries, record keeping, reporting requirements (a DI-1202 will be completed for each burn and submitted via input through relevant agency channels within 10 working days after declared out date).
- Submit data for GIS addition to prescribed fire thematic map.

3.7.1.4 *Long-Term Strategy*

The long-term strategy for the prescribed fire program is to employ prescribed fire as a tool to reduce hazardous fuel buildups and restoring fire as a key ecosystem process, while ensuring public safety and protection of property or resource values. Consideration should be made such that prescribed fire treatments should be implemented in a manner that simulates the natural ecosystem function of fire as determined through fire ecology and historic research to restore fire as a keystone natural process.

Goals and Objectives for the GGNRA FMP were developed during the initial stages of the FMP NEPA process. These goals and objectives, along with the principles of federal wildland fire management policy and NPS fire management guidelines, constitute the long-term strategy of the FMP. Goals and objectives are found in FMP Section 2.1. Federal and agency fire management policies are summarized in FMP Chapter 1.

3.7.1.5 *Personnel*

All prescribed fire personnel assigned to prescribed fires will meet all national requirements for training and experience in NWCG 310-1. The Burn Boss assigned to prescribed fires will be certified according to complexity and fuel type of the treatment unit.

3.7.1.6 *Fire Behavior and Fire Effects Monitoring*

Before the burn, fuels characteristics such as live and dead fuel moisture contents will be established to check prescription parameters and fire behavior calculations. Prior to ignition, a Spot Weather Forecast will be submitted and the results analyzed by the Fire Effects Monitor and the Burn Boss as a factor of the Go/No-Go decision making process. During ignition, on a timetable agreed upon by the Fire Effects Monitor and the Burn Boss, but not to exceed one hour, on-site weather, smoke, and fire behavior observations will be recorded on forms found in the Western Region Fire Monitoring Handbook.

The Bay Area Cluster Fire Effects Monitoring Crew has established plots in a representative number of prescribed burn units. After the burns, on a schedule established by monitoring protocols, the crew will record post-fire data and submit annual reports to the Fire Ecologist and resources division for evaluation of burn effectiveness.

3.7.1.7 *Reporting and Documentation*

For NPS, all prescribed fires will be documented with the following information, stored in an individual fire folder and maintained in the Seashore's files:

- Original signed Prescribed Burn Plan.
- Checklist of pre-Burn prescribed fire activities.
- All reviewer comments.

- All maps.
- Notification checklist.
- Permits such as burn, smoke, etc.
- Monitoring data.
- Weather forecasts.
- Superintendent Go/No-Go pre-ignition approval.
- Operational Go/No-Go checklist.
- Incident Action Plans.
- Unit logs, Daily Validation or other unit leader documentation.
- Press releases, public comments, and complaints.
- Smoke dispersal information.
- Post fire analysis.
- Fire Occurrence Report (DI-1202).
- NFPORS entry.

3.7.1.8 Prescribed Burn Plan Elements

For NPS, each plan shall include at the minimum, the elements listed below. An example of the outline of a Prescribed Fire Plan is in Appendix E, Part 17 of this FMP. The *Interagency Prescribed Fire Planning and Implementation Guide* lists the elements required for prescribed fire plans and briefly describes how to develop the contents for each element and the implementation policy that goes along with it. Prescribed fire plans must address the following 21 minimum elements and appendices in the following sequence (see the *Interagency Prescribed Fire Planning and Implementation Guide* for description and guidance):

1. Signature page
2. GO/NO-GO Checklists
3. Complexity Analysis
4. Description of the Prescribed Burn Area
5. Goals and Objectives
6. Funding
7. Prescription
8. Scheduling
9. Pre-burn Considerations
10. Briefing
11. Organization and Equipment
12. Communication
13. Public and Personnel Safety
14. Test Fire

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15. Ignition Plan
16. Holding Plan
17. Contingency Plan
18. Wildfire Conversion
19. Smoke Management and Air Quality
20. Monitoring
21. Post-burn Activities

Appendices

- Maps
- Technical Review Checklist
- Complexity Analysis
- Job Hazard Analysis
- Fire Behavior Modeling Documentation or Empirical Documentation (unless empirical documentation is included in the fire behavior narrative in the Element 7, Prescription)

Although not required, the following recommendations are offered in RM-18, Chapter 10, Section VIII:

1. An Executive Summary is not required in the burn plan, but highly recommended, especially for high complexity burns and omnibus plans. An informative summary is useful for the Agency Administrator and reviewers of complex burn plans.
2. The Implementation Guide states only three signatures are required (Agency Administrator, Plan Preparer and Technical Reviewer). It is recommended that Resource Management, the Fire Ecologist and the Fire Management Officer are also signatories as reviewers or for concurrence.
3. The *Adequate Holding Worksheet* is an optional tool for determining holding resources in Element 16. If it is not used, provide other rationale for determining holding resources.
4. For Element 20 (Monitoring) of the prescribed burn plan, follow direction in RM-18, Chapter 10 and in RM 18 Chapter 11.

3.7.2 Exceeding Existing Prescribed Burn Plan

If prescription parameters are exceeded during project execution, the Burn Boss will terminate ignition operations at a safe and appropriate location based on fire behavior, fuels, topography and weather conditions. If the project area comes back into prescription based on current and forecasted weather, ignition operations may continue. If not, the project area is put into a mop-up or patrol status. Holding actions will maintain control of the fire until a decision to continue, postpone or extinguish the prescribed fire is made and the Agency Administrator or their designee is notified. This decision making process will be articulated in the prescribed burn plan.

If the prescribed fire exceeds project boundaries and/or slopovers and spot fires are not contained within one burning period, suppression actions will be taken and the entire

prescribed fire project will be declared a wildfire. Once declared a wildfire, suppression is the only option. A wildland fire cannot be converted back to a prescribed fire.

If at any time the prescribed fire poses a threat to life, property, or high value resources, beyond those mitigated in the plan, suppression actions will be taken and the fire will be declared a wildland fire.

Once the prescribed fire is declared a wildland fire, all subsequent actions (i.e. operational needs, notification, strategies, resource orders, etc.) will be defined under a wildland fire transition plan, which is part of the prescribed fire plan until an initial Wildland Fire Situation Analysis (WFSA) is completed.

Parks are required to notify the Regional Fire Management Office within 24 hours of any of the following actions taken on a prescribed fire that has escaped or is a threat to escape:

- a) any prescribed fire converted to a wildfire.
- b) any prescribed fire requiring activation of the contingency plan specified in the burn plan.
- c) any prescribed fire that requires additional resources or operational time not accounted for in the Incident Action Plan.

If the burn is not an escape or a threat to escape, or is not and will not be declared a wildfire, regional notification is not required (RM #18, Chapter 10, Section VIII, A. 5, 9/26/06).

3.7.3 AIR QUALITY AND SMOKE MANAGEMENT

3.7.3.1 Regulatory Compliance and the Approval Process

Visibility and clean air are primary natural resource values in all NPS units. The protection of these resources must be given full consideration in fire management planning and operations.

GGNRA is a Class II air shed under the amendments to the Clean Air Act (CAA) adopted in 1977. Class I areas, such as Yosemite National Park and PRNS, are national parks established before 1977 with a total area greater than 6,000 acres where emissions of particulate matter, sulfur dioxide, and nitrogen dioxide would be restricted to control impacts to visibility at sensitive airsheds. In Class II area, some incremental increase in emission levels would be allowed based on the proximity of the park or monument to a population center.

The Federal Government has ceded responsibility and authority to establish air quality standards and regulations to the states (RM #18, Chapter 14). Therefore, GGNRA complies with the Clean Air Act by adhering to the requirements of the California Air Resources Board (CARB) and the BAAQMD.

The CARB is responsible for disseminating regulations about air quality, including state ambient air quality standards and area designation. Title 17 of the California Code of Regulations, entitled Smoke Management Guidelines for Agricultural and Prescribed

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Burning, provides direction to air pollution control and air quality management districts for the regulation and control of agricultural burning and prescribed burning. These guidelines are intended to allow the use of prescribed burning as a tool, while minimizing smoke impacts on the public.

BAAQMD is the air quality management district for GGNRA and has primary responsibility for control of air pollution from prescribed burning. BAAQMD has procedures that must be followed prior to implementation of a prescribed burn plan.

Prescribed burn plans must include a Smoke Management Plan that is to be submitted to BAAQMD a minimum 30 days in advance of the planned burn date. The Smoke Management Plan must include primary information about the proposed burn including smoke emission data. After reviewing and approving the Smoke Management Plan, BAAQMD issues a written approval to conduct the burn with specific conditions. The BAAQMD Application Form for Pile Burning is included as Appendix E, Part 18 to this FMP.

All fire management-ignited fires must be conducted on an “allowable burn day” unless the district has granted a variance in advance. Notice of an allowable burn day is posted by BAAQMD each afternoon for the burns planned for the following day

BAAQMD makes available a 96, 72, 48, and 24 hour burn forecast service to better assist fire agencies in determining their proposed burns dates. Final approval to burn is obtained by contacting BAAQMD the morning on the planned burn day. BAAQMD verifies the total acreage burning allocations in the district and if the fire agency's acres and/or tonnage to be burned that day would not exceed the total allocation for the area, final approval is granted.

Following the burn, the Fuels Management Specialist must submit information to BAAQMD on the fuel types and quantities or acres burned.

3.7.3.2 *Regional Air Quality Considerations for Prescribed Burning*

Marin County

In the winter, proximity to the ocean keeps the coastal regions relatively warm. Temperatures do not vary much over the year at these coastal areas, and are typically in the high 50s in the winter and low 60s in the summer. The warmest months are September and October, with temperatures into the mid- to upper 60s (BAAQMD 1998).

The eastern side of Marin County has warmer weather and less fog. This is due less to the blocking effect of the hilly terrain to the west, but more to the area's distance from the ocean. Although there are a few mountains above 1,500 feet, most of the terrain is only 800 to 1,000 feet high. Much of time, this is not high enough to block the marine layer, which averages 1,700 feet in depth. Because of the wedge shape of the county, areas to the north are farther from the ocean. This extra distance from the ocean allows the marine air mass to be heated before it arrives at eastern Marin County cities. In southern Marin County, the travel distance is short and the elevations lower, so there is a higher incidence of cool, unmodified, maritime air (BAAQMD 1998).

Cities next to the bay have their temperatures somewhat moderated. For example, San Rafael, being near the bay, experiences average maximum winter temperatures in the high 50s to low 60s, and average maximum summer temperatures in the high 70s to low 80s. Inland areas, such as Kentfield, experience average maximum temperatures two degrees cooler in the winter and two degrees warmer in the summer. Average minimum temperatures in San Rafael are in the low 40s in winter and low 50s in summer. Minimum temperatures farther inland in Kentfield are two degrees cooler all year (BAAQMD 1998).

Wind speeds are highest along the western coast of Marin, about 8 to 10 miles per hour. Although most of the terrain throughout central Marin County is not high enough to act as a barrier to the marine airflow, the complex terrain creates sufficient friction to slow the airflow. Downwind, at the former Hamilton Air Force Base in eastern Marin County, the annual average wind speeds are only 5 miles per hour. The prevailing wind directions throughout Marin County show less variation, and are generally from the northwest (BAAQMD 1998).

The mountainous terrain in Marin County has higher rainfall amounts than most parts of the Bay Area with the exception of the southern Santa Cruz Mountains. Areas near Mount Tamalpais have rainfall amounts twice as high as the rest of the Bay Area, with San Rafael reporting an average of 37.5 inches per year and Kentfield reporting 49 inches per year (BAAQMD 1998).

Smoke problems are likeliest on the eastern side of Marin County. This is where the semi-sheltered valleys and largest population centers are located. Most urban development is located along the bay, particularly in southern Marin. In the south, where distances to the ocean are short, the influence of the marine air will keep smoke levels low. Farther north where the valleys are more sheltered from the sea breeze, the potential for greater smoke accumulation is higher (BAAQMD 1998).

San Mateo County

The peninsula region of GGNRA extends from the Golden Gate south to the Phleger Estate in Woodside. The Santa Cruz Mountains extend up the center of the peninsula, with elevations exceeding 2,000 feet at the south end, and gradually decreasing to 500 feet near South San Francisco. Coastal towns such as Half Moon Bay and Pacifica experience a high incidence of cool, foggy weather in the summer. The larger cities on the eastern side of the peninsula experience warmer temperatures and few foggy days, because of the blocking effect of the 2,000-foot ridge to the west. At the north end of the peninsula lies San Francisco, where most elevations are less than 200 feet and the marine layer is able to flow across nearly all of the city, making its climate cool and windy (BAAQMD 1998).

The blocking effect of the Santa Cruz Mountains can be seen in the summertime maximum temperatures. For example, at Half Moon Bay and San Francisco, the maximum daily temperatures in June through August are 62 to 64 degrees Fahrenheit, F, while on the eastern side at Redwood City, the maximum temperatures are in the low 80s for the same period. Daily maximum temperatures throughout the peninsula during

the winter months are in the high 50s. Large temperature gradients are not seen in the minimum temperatures, which range from the 40s to 50s (BAAQMD 1998).

Annual average wind speeds range from 5 to 10 miles per hour throughout the peninsula. The tendency is for the higher wind speeds to be found along the western coast. However, winds on the eastern side of the peninsula can also be high in certain areas because low-lying areas in the mountain range, i.e., San Bruno Gap and Crystal Springs Gap, commonly allow the marine layer to pass across the peninsula (BAAQMD 1998). While prevailing winds are westerly along the peninsula's western coast, individual sites can show significant differences. For example, Fort Funston has a southwest wind pattern, while Pillar Point in San Mateo County has a northwest wind pattern. A rise in elevation of ridgelines by a few hundred feet will induce wind flow around that feature instead of over it during stable atmospheric conditions. This can change the wind pattern by as much as 90 degrees over short distances. On mornings without a strong pressure gradient, areas on the eastern side of the peninsula often experience eastern flow in the surface layer, induced by upslope flow on the east-facing slopes and by the bay breeze. The bay breeze is rarely seen after noon because the stronger sea breeze dominates the flow pattern (BAAQMD 1998).

Rainfall amounts on the eastern side of the peninsula are somewhat lower than on the western side. San Francisco and Redwood City report an average rainfall of 19.5 inches per year, while Half Moon Bay reports 25 inches per year. Areas to the south in the Santa Cruz Mountains have significantly higher rainfall, especially west of the ridgeline, due to elevation-induced condensation, close proximity to a moisture source, and fog drip.

Smoke accumulation potential is highest along the southeastern portion of the peninsula because this area is most protected from the high winds and fog of the marine layer, the emission density is relatively high, and smoke transport from upwind sites is possible. In San Francisco, wind speeds are generally fast enough to carry any smoke away before it can accumulate (BAAQMD 1998).

3.8 NON-FIRE TREATMENT APPLICATIONS

GGNRA uses two primary non-fire treatments to achieve FMP objectives: mechanical treatments and herbicide treatments. Grazing could also be used infrequently under special circumstances. Non-fire treatments allow fire managers to produce a desired change in vegetation based on values to be protected and fuel characteristics without the risks associated with applying fire.

The defensible space zone created around a structure is tactically located to increase the effectiveness of adjoining fuel breaks, prescribed burn control lines or to help alter future fire behavior or the event of a wildfire. Removed vegetation is chipped, piled and burned or moved to another area for reuse.

Mechanical treatments may involve the use of the following equipment: chainsaws, chippers, mowers, weed whackers, and heavy equipment such as bulldozers, front loaders or haul trucks. Based on the type of vegetation to be treated, some projects will require the use of approved herbicides to ensure that plants do not re-sprout. The non-

native, invasive plants most commonly treated with herbicide are eucalyptus, acacia, cotoneaster and broom. Herbicides are typically spot applied to the stump directly after the plants have been cut. All herbicide treatments will be approved through the park's IPM coordinator.

Defensible space around buildings within the park is accomplished annually. All efforts are made to conform to the California Fire Marshal's code pertaining to defensible space.

GGNRA will follow RM-18 and the requirements to prepare a Hazard Fuels Project Plan that includes specified elements for all mechanical treatments and the *Interagency Standards for Fire and Fire Aviation Operations*, Chapter 6. Prescribed fire follow-up treatments may or may not be employed.

Fuel break construction should be identified on an appropriate Geographic Information System (GIS)-compatible project location map (exact locations using GPS).

Fuel break planning will consider the following guidelines (see also mitigation measures below):

- Canopy thinned and feathered (or gradually opened) toward the area being defended, with spacing necessary to prevent crown fire and/or "wind tunnel" effect.
- Retaining a reasonable level of surface forbs and other plants to discourage exotic invasion.
- Fuel-break width is dependent on fuels conditions and other considerations.
- Photo-points installed to monitor vegetative recovery, exotic invasion, etc. Additional monitoring will be carried out as necessary.
- Levels of vegetation reduction will vary for each project based on the vegetation type, fuel loading levels, and surrounding vegetation types.
- All burn preparations involving pre-treatment with mechanical techniques will be reviewed through the park's project review process and described in the burn plan. This may include but is not limited to:
 1. Snag felling, bucking in and around the treatment perimeter.
 2. Reducing tree densities along the treatment perimeter.
 3. Pruning individual trees and brush along the treatment perimeter.
 4. Bucking and removal of logs near the control line only (through bucking into short lengths, piling and burning on site).
- Fuel break siting should take advantage of and expand upon clearings accomplished for defensible space around park buildings.

High priority mechanical fuel treatments will be sited strategically with the objective of meeting the goals and objectives of this FMP. Specific mechanical fuel reduction projects would fall under one of the following broad categories of project types:

1. Creation of Defensible Space Surrounding Park Structures and High Value Resources at Risk. GGNRA has over 700 historic structures and many non-historic structures used for housing and operations. Many of these buildings are located in areas with burnable vegetation and need to be protected. Once any potential negative impacts are mitigated, protection is accomplished by clearing vegetation around these structures to provide the minimum 100-foot radius of defensible space now recommended by the California Fire Code. The predominant fuel to be cleared around most of these structures is grass. The remaining herbaceous cover post treatment will be either low grass or a patchy continuity of taller grasses. The targeted completion date for annual defensible space is August 15th. Some structures need additional work to create adequate defensible space with tactics that might include, but are not limited to, tree trimming and removal, brush removal and herbicide application. The Division of Maintenance and Engineering is responsible for maintaining the defensible space around park structure. The Bay Area Network Hazard Fuels Reduction Crew or GGNRA fire management staff may be available to assist, depending on annual budgets, staffing levels and workloads. The term “defensible space” is typically used in reference to the protection of structures. For the purpose of this document and actions taken under the direction of the fire management office, this term and associated treatments may be applied to the protection of resources that are determined to be culturally, historically or ecologically significant.
2. Maintenance of Required Roadside Fuel Reduction and Overhead Roadway Clearance. Fire roads are maintained to allow for safe access by emergency vehicles in the event of a wildland fire or other emergency. The maintenance and clearing required is based on the minimum standard that would allow for the access requirements of a Type III fire engine. FMP actions may include grading of road surfaces, placement of erosion control measures, and vegetation thinning by mowing or cutting along the road corridor to a specified width based on fuel type, slope, and roadway composition.

Larger, native, roadside trees may be limbed up and smaller trees removed as needed to ensure emergency vehicle clearance is met. Thinning of vegetation will focus on the removal of non-native invasive species or non-native species when ever possible. Where roadside vegetation is predominantly native, natural resource staff will provide guidance on prioritizing plants to remove to achieve the desired result. Grass that grows within the roadway may be cut or mowed. Material that is removed would be cut up and broadcast in the immediate area, piled and burned, or chipped and hauled offsite.

In Marin County, there are approximately 44 miles of fire roads, amounting to 52 acres requiring treatment each year to keep clear and open from debris. In San Mateo County, there are 10 miles of fire roads, amounting to 16 acres of mechanical treatment each year. Roadside mowing may be accomplished by the Division of

Maintenance and Engineering with assistance from the GGNRA fire management staff for limbing or tree removal. A collaborative effort between local cooperating fire agencies and NPS fire management staff will determine the areas in need of treatment.

3. Creation of Fuel Reduction Zones in Areas of the Park Not Accessible by Road. Fuel reduction zones may be approved for areas along the park boundary or other interior locations not accessible by road in an effort to reduce hazardous fuels. An example would be a fuel break that removes dead and down fuels, limbing trees and removing selected trees and shrubs with minimal ground disturbance.



These semi-cleared areas will be

sited to take advantage of topography and naturally occurring areas of low fuels and may not necessarily be adjacent to structures. The Marin County CWPP proposes fuel breaks along much of the southern Marin boundary with GGNRA (see Figure 2 and Table 1 of this FMP). GGNRA will work with Marin County's fire agencies to implement the recommended fuel break system where possible, provided that conformance with the FMP EIS and ROD are assured and park resources or the visitor experience is not unduly impacted.

4. Whole Tree Removal to Reduce Hazardous Fuels and Contain the Spread of Non-Native Trees on NPS Lands. Projects that remove non-native evergreen trees, such as eucalyptus or Monterey cypress and pine, are strategically located to help protect adjacent communities or sensitive resources from wildfire and also to break up the continuity of fuels within a large stand. Projects are often sited to take advantage of similar actions being implemented in the nearby WUI by community organizations. The removal projects focused on containing the spread of existing stands, reducing ladder fuels, and providing breaks in the canopy to help limit the ability of fire to spread from tree crown to tree crown. The projects typically involve the felling of eucalyptus trees with chain saws, which can then be piled, burned onsite, cut into lengths and loaded on haul trucks for removal, or chipped and spread evenly over the project area. Eucalyptus wood removed from the park can be recycled as firewood, landscaping chips, used in stream restoration projects, or possible commercial reuses. The projects are conducted by park staff or private contractors.

3.8.1 Annual Review

The five-year fuels treatment plan will be updated annually as target units are burned and fuel reduction projects completed. [The Five Year Fuels Treatment Plan will be developed in 2008 for the FMP update.] Fire Management staff at the PWR office have established a process for the annual review of the five year fuels treatment plan *vis-à-*

CHAPTER 3 – FIRE MANAGEMENT PROGRAM COMPONENTS

vis ensuring that actions conform to the findings and commitments agreed to in the NEPA process for the FMP. In addition to NEPA conformance, the annual review process provides a framework for ensuring continued conformance with the requirements of the ESA consultations and NHPA programmatic mitigation measures. The update of the five year fuels treatment plan will be undertaken by a multi-disciplinary team representing the range of expertise of the fire staff. More information on the Annual Review process can be found in FMP Section 4.6.

3.8.2 Equipment and Seasonal Use Restrictions

Project equipment will be selected for effectiveness and the potential to avoid or minimize impacts to park resources. The process is the same as described for prescribed burning. Please refer to Section 3.3.3.4.

3.8.3 Effects Monitoring

For non-fire treatments, treatment prescriptions and locations will be documented and photo-monitoring will take place. Monitoring of non-fire treatments will be carried out by the Fire Effects Monitoring Crew according to the protocols found in Appendix F, Wildland and Prescribed Fire Monitoring and Research Plan.

3.8.4 Reporting and Documentation

All mechanical treatment projects will be listed in the GGNRA five year fuels treatment plan and subject to the FMP annual review process. Individual projects will be assessed for potential effect and conformance with federal regulations through the Planning, Environment and Public Comment (PEPC) database system. Site specific projects that have been sufficiently assessed through the FMP FEIS will be reviewed by the IDT and the conformance with the FEIS documented through a Memo to the File of the FEIS.

Projects proposing types of activities or an intensity of impact or type of impact not anticipated in the FEIS will require separate NEPA review. NEPA conformance for these projects will be conducted per D.O 12, RM-12 and GGNRA SOP-601. Conformance may be satisfied with a Memo to File to the FMP FEIS or, if there are new environmental effects not addressed in the FEIS, by a separate NEPA process.

3.8.5 Annual Planned Projects

All fire management projects, including mechanical treatments and prescribed burns, will be scheduled in the GGNRA Five Year Implementation Plan. Where projects will require recurring maintenance on a predictable interval or several initial re-treatments, these actions will also be scheduled in advance on the five year plan.

3.9 FIRE COMMUNICATION AND EDUCATION

Public information and education are essential components of a successful fire management program. Informed and supportive agency staff, local community, visiting public, and partner organizations, will contribute greatly to the effectiveness of the fire program and the resources that it is designed to benefit.

Based on the ecological principles and operational procedures of the Fire Management Plan, the goals for the fire communication and education program are:

Goal 1: Offer year- round educational opportunities focusing on fire ecology, fire history, and fire management, which communicates how fire and fuels management activities meet natural resource management goals, and accomplish the mission of the National Park Service.

Goal 2: Work with local communities, park residents, and park permittees to promote fire safety, fire prevention, defensible space, firewise community planning, and fuels management. Provide fire safety messages with campfire permits.

Goal 3: Develop and maintain interagency, educational, and community partnerships to improve and expand fire education activities.

Goal 4: Provide accurate and timely incident information for local, regional, and national fire operations as needed.

Goal 5: Support regional and national fire management program activities through information and education.

Strategies for the public information and education program include:

- Establish a network of contacts and develop a proactive process that disseminates current and accurate fire information to multiple audiences.
- Incorporate the principles of fire's role in the ecosystem and the importance of fire as a resource management tool into interpretive programs, exhibits, video, interpretive trails through burned areas, publications, and special group presentations.
- Use national and local websites to promote prevention/mitigation and wildland fire education objectives.
- Report wildland fire activity through the NPS Fire News website.
- Forward all fire-related press releases to the respective Agency Administrator or Public Information Officer (PIO) for approval and keep members of the administrative staffs well informed of fire activity.
- Develop public information programs that promote the benefits of firewise community planning, defensible space, mechanical fuel reduction, and fire safe recreation.
- Establish relationships with local media representatives, and accommodate requests for information and access in order to promote the fire program.
- Conduct outreach to owners of adjacent lands and/or groups with traditional cultural concerns in conjunction with planning fire education, and fire management activities.

A detailed Fire Communication and Education Plan is in FMP Appendix G.

3.10 FIRE ECOLOGY AND FIRE EFFECTS MONITORING PROGRAMS

3.10.1 Programmatic and Policy Direction

The NPS is committed to monitoring fire management activities to determine whether management goals and objectives are being met and to facilitate adaptive management. The authority for fire management monitoring in the NPS is found in Director's Order #18, Wildland Fire Management, Section 5.2 Fire Management Plans and Section 5.8 Prescribed Fire Monitoring. The NPS Fire Ecology Strategic Plan: 2004-2008 (http://www.nps.gov/fire/ecology/program_direction/strategic_plan.htm) provides programmatic direction and Reference Manual #18, Chapter 11, provides policy direction for fire management monitoring (http://www.nps.gov/fire/download/fir_wil_rm18_ch11.pdf).

3.10.2 Current Program

GGNRA is served by the San Francisco Bay Area Network Fire Ecologist and the Southern and Central California Fire Effects Monitoring Crew. The Fire Ecologist is stationed at PRNS and serves Pinnacles National Monument and PRNS in addition to GGNRA. The Fire Effects Monitoring Crew is also stationed at PRNS and serves six California parks in addition to GGNRA. The goal of the Fire Ecology and Fire Effects Monitoring program at GGNRA is to determine whether prescribed fire and mechanical fuels treatments objectives are being met and to help refine projects and objectives based on monitoring data.

The primary ecosystems at GGNRA include coastal scrub and chaparral, grassland, Douglas-fir forest, redwood forest, non-native pine/cypress/eucalyptus forest, hardwood forest, riparian woodland, and herbaceous wetlands. However, the fire management program is currently actively managing only the coastal scrub and chaparral, redwood forest, grassland, and non-native eucalyptus forest ecosystems. GGNRA has 117 fire effects monitoring plots in 13 different monitoring types: northern coastal scrub, northern coastal scrub (southern phase), chaparral, non-native annual grassland (*Bromus diandrus* dominated), non-native annual grassland (*Brachypodium distachyon* dominated), non-native annual thistle, eucalyptus, non-native tall perennial grassland (*Festuca arundinacea* dominated), non-native tall perennial grassland (*Phalaris aquatica* dominated), non-native summer mustard, northern coastal prairie, redwood forest, and mixed broadleaf evergreen forest. All of the monitoring types follow the protocols described in the FMH Monitoring Handbook (NPS 2003).

3.10.3 Monitoring Levels

Fire effects monitoring occurs at a variety of levels. The most basic of these, Level 1, is the monitoring of environmental conditions including weather, fuel conditions, fire danger rating, etc. The fire effects program will coordinate with the Bay Area Network Inventory and Monitoring program to coordinate Level 1 monitoring efforts. Both programs will work together to ensure that monitoring efforts are not duplicated and to determine the most efficient way to accomplish Level 1 monitoring.

Monitoring Level 2 is fire observation, including fire behavior, smoke volume and movement, fire location and size, etc. Data will continue to be collected at levels 1 and

2 to satisfy the requirements for a Post-Fire Report for prescribed fires or a Wildland Fire Report for wildfires. Protocols for Level 2 post-wildfire monitoring will be included in Appendix F. Additionally, burn severity assessments will be completed for all fires greater than 500 acres and CBI plots will be installed in association with the burn severity assessment. For mechanical projects, treatment prescriptions and locations will be documented and photo-monitoring will take place. Protocols for monitoring non-fire treatments will be included in Appendix F.

Levels 3 and 4 are the monitoring of short-term (≤ 2 years) and long-term (> 10 years) change. Variables monitored at these levels of change include fuel loading and vegetation composition among others. Level 3 and 4 monitoring will take place in all monitoring types that are being actively managed by the fire management program through either prescribed fire or non-fire treatments. The monitoring effort must be sufficient to evaluate whether fire management objectives are being met.

3.10.4 Data Management and Analysis

Fire effects data will be maintained by the fire ecologist and lead fire effects monitor in both paper and digital form. Data will be analyzed by the fire ecologist on an ongoing basis. Data analysis will be presented to park fire management and resource staff annually as part of the annual review/update process. This analysis will be used to determine whether fire management projects are meeting their objectives, to adjust and refine fire management objectives if necessary, to adjust how and where fire management projects are carried out, and to identify fire research needs.

3.10.5 Wildland and Prescribed Fire Monitoring and Research Plan

The Wildland and Prescribed Fire Monitoring and Research Plan describes in detail how monitoring is to be conducted at GGNRA. The Fire Monitoring and Research Plan presents ecological models for each of the monitoring types within GGNRA and outlines the management and monitoring objectives for each. It also details the methods, locations, and frequency of monitoring. The format for the Plan will follow the guidelines provided by the NPS Fire Ecology Steering Committee. Appendix F will be added to the FMP coincident with the 2009 annual FMP update.

3.11 FIRE RESEARCH

The NPS is committed to supporting fire research to promote sound fire management decisions. The policy direction for fire research within the NPS is found in RM #18, Chapter 15 (http://www.nps.gov/fire/download/fir_wil_rm18_ch11.pdf). It is the goal of the fire program at GGNRA to increase in-park research efforts and to recruit high caliber research from outside organizations.

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Several fire-related research projects are currently under way at GGNRA. These include using fire and other methods to enhance habitat for the Mission blue butterfly and examining fire as a potential tool for restoring two rare plant species, *Presidio clarkia* and Marin dwarf flax.

A fire research plan for GGNRA will be developed and added to Appendix F of this FMP during the first months of 2009. High priority topics for future fire research include fire in redwood forests; the effects of fire on invasive species; the effects of fire on rare chaparral plants; the effects of fire on the spread of Sudden Oak Death; and the reconstruction of historical vegetation patterns.

4. ROLES, FUNDING AND REVIEW

4.1 NPS ORGANIZATIONAL STRUCTURE, ROLES, AND RESPONSIBILITIES

The Organizational Chart for the Golden Gate National Recreation Area Division Resource & Visitor Protection, Branch of Fire Management outlines the current structure for this program (See Figure 20, GGNRA Fire Management Branch Organizational Chart).

The overall fire program responsibility rests with the Bay Area Network Fire Management Officer (Network FMO). The Network FMO oversees the daily operations and reports directly to the Chief Ranger. The Chief Ranger, in turn, reports to the Superintendent, who retains ultimate responsibility for all Park programs.

The Fire Ecologist plays a key role in the overall fire management program by overseeing long-term fire ecology planning for GGNRA and fire ecology strategies for the Bay Area Parks Network.

The Fire Communication and Education Specialist is stationed at PRNS and reports to the Chief of the Division of Interpretation and serves the Bay Area Parks Network.

The Fire Planner primarily serves GGNRA and PRNS, providing compliance guidance and documentation for fire-related projects. Both the Fire Ecologist and Fire Planner report to the Supervisory Plant Ecologist at PRNS in the Division of Resource Management.

4.1.1 GGNRA Positions

4.1.1.1 *Park Superintendent*

1. Ensures safe implementation of wildland fire management program at GGNRA.
2. Ensures program supports Service-wide initiatives.
3. Approves wildland fire management plan and updates, interagency agreements and operating plans, delegations of authority, prescribed burn plans, and management of wildland fire incidents, through daily updates of the WFSA.
4. Ensures compliance of Section 106 of NHPA, NEPA, NPS Organic Act and other relevant laws and policy.
5. Works to maintain Network relationships with PRNS and East Bay Parks.

4.1.1.2 *Chief Ranger*

1. Ensures safe implementation of wildland fire management program at GGNRA.

4.1.1.3 *Bay Area Network Fire Management Officer*

1. Sets goals and objectives for the wildland fire program, including staff supervision.

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2. Ensures GGNRA has the capability and skills to safely implement wildland fire programs as identified in the fire management plan.
3. Establish liaison with cooperating agencies, and coordinates and maintains cooperative agreements.
4. Monitors fire danger and recommends fire restrictions in concert with neighboring agencies.
5. Coordinates with PRNS and PINN staff on fire management actions and issues.
6. Monitors actions taken on wildland fires, and ensures proper and adequate documentation.
7. Approves Fire Report ensuring proper preparation and submission to WFMI.
8. Initiates taskbooks for wildland fire positions and certifies completion.
9. Formulates and directs the budget accountability program for preparedness, hazard fuels operations, emergency fire accounts and approves all FirePro expenditures.
10. Prepares WFSAs as needed.
11. Reviews all burns plans for prescribed fires.
12. Reviews procedures for off-unit dispatches of park personnel.

4.1.1.4 *Fire GIS*

1. Maintains Bay Area Network fire related GIS files.
2. Produces fire- and fuels-related GIS products.
3. Coordinates Network Resource Advisors.

4.1.1.5 *Senior Engine Captain*

1. Ensures personnel and equipment readiness and capability for safe initial response.
2. Ensures fire engines apparatus are maintained in a state of readiness.
3. Leads annual refresher training.
4. Leads GGNRA fire crews in daily readiness activities, including fire safety briefings.
5. Supervises temporary fire technicians.
6. Supervises Assistant Engine Captain.
7. Implements signing and fire prevention activities.
8. Provides recommendations to Network FMO when Step-up Plan needs activation.

4.1.1.6 *Assistant Engine Captain*

1. Acts as assistant to the Senior Engine Captain.
2. Supervises seasonal engine crew.
3. Oversees fire cache inventory.
4. Prepares prescribed burn plan components as requested.
5. Involved in all aspects of wildland fire suppression.
6. Implements signing and fire prevention activities.

4.1.2 **Shared / Consulting Network Positions**

4.1.2.1 *Fire Program Planner*

1. Research and prepare NEPA documents for fire management program projects, participate in planning meetings and site visits, input projects into PEPC, ensure compliance of fire management projects with the respective FMP NEPA documents, and shepherd projects through the review and approval process.
2. Presents projects to GGNRA NEPA and NHPA review committees and ensures project conformance with findings of these committees.
3. Oversees the annual review process for the FMP and the update of the five year fuels treatment plan.
4. Prepares documentation necessary for federal regulatory compliance for entities receiving federal funding through the National Fire Plan.
5. Represent NPS at FireSafe Council meetings.
6. Review and comment on project proposals prepared by others in the San Francisco Bay Network.
7. Oversees contracts and contractors preparing environmental work products for compliance projects.
8. Provide regulatory assistance to regional fire staff.

4.1.2.2 *Fuels/Prescribed Fire Specialist*

1. Prepares prescribed burn plans and fuel reduction plans and inputs information to PEPC for units in the SF Bay Area Network.
2. Provides input into five-year fuels treatment plans for SF Bay Area Network.
3. Implements prescribed burns as Burn Boss.
4. Coordinates prescribed fire and mechanical hazardous fuels reduction operations for the Bay Area Parks Network.
5. Serves as Incident Commander on wildland fires

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6. Manages National Fire Plan Operating and Reporting System (NFPORS) data entries for all Bay Area Parks.
7. Develops and prioritizes projects, submits projects for funding and prepares compliance documentation.
8. Serves as acting FMO and GGNRA Fire Duty Officer as needed.
9. Coordinates, prioritizes and schedules the work of the Bay Area Network Hazardous Fuels Reduction Crew within the SF Bay Area Network and elsewhere as requested.
10. Coordinates project planning in consultation with other park divisions where necessary for resource protection and continuity of operations.

4.1.2.3 *Fire Communication and Education Specialist*

1. Responsible for the development, coordination, and dissemination of internal and external communication of fire management program activities in the Bay Area Network.
2. Works with community stakeholders and various local, state, and federal agencies to provide fire communication and education for the Bay Area Parks and surrounding communities.
3. Supports fire management program activities at the regional and national levels through fire education and information.
4. Responsible for developing and managing partnerships and projects which expand fire education capacity in the Bay Area Network.
5. Serves as Public Information Officer for prescribed fire and wildland fire in the Bay Area Parks and elsewhere as requested.
6. Serves as an interdisciplinary team member to integrate fire management, resource protection, and public education.

4.1.2.4 *Fire Ecologist*

1. Manages and analyzes fire effects data.
2. Manages and refines monitoring program including the communication of measurable objectives, monitoring schedules, protocols and data analysis procedures. Writes the fire monitoring plan.
3. Hires, trains, and supervises fire effects monitors.
4. Assist with writing prescribed fire objectives and prescriptions for burning.
5. Provides expertise on the role of fire in ecosystems and advice on how fire can be used to accomplish management objectives.
6. Oversees long-term fire ecology planning for GGNRA, PRNS and other parks in the Bay Area Network.

7. Identifies research needs, solicits researchers, writes proposals, and applies for funding for research projects.
8. Serves as a liaison between fire managers and resource management at host and cluster parks.
9. Contributes to and reviews compliance and other management documents.

4.1.3 Shared Regional Positions

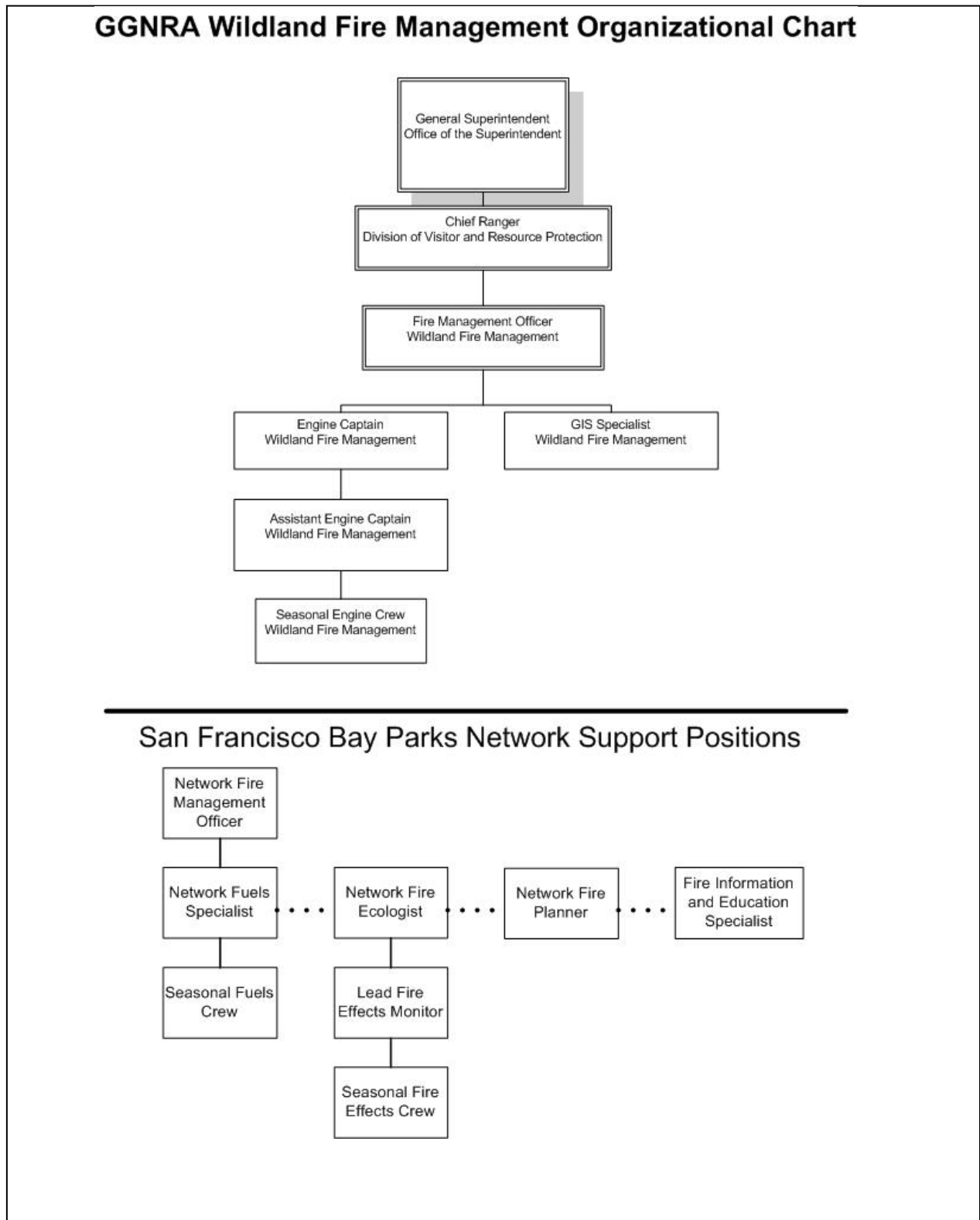
4.1.3.1 Lead Fire Effects Monitor

1. Leads the California Mediterranean Coast and San Francisco Bay Region fire effects monitoring program (PRNS, PINN, GGNRA, SAMO, CHIS, JOTR).
2. Collects scientific data on vegetation monitoring plots in order to determine the effectiveness in meeting prescribed fire objectives.
3. Hires, trains and supervises fire effects monitors.
4. Identifies plants to the species level in a variety of ecosystems.
5. Monitors fire weather and fire behavior during prescribed burns.
6. Manages fire effects database and ensures quality control.
7. Sets monitoring schedule and communicates schedule with host parks.
8. Collaborates with fire ecologist on planning and annual reporting documents.

4.1.3.2 Fire Effects Crew Members (biological science technicians)

1. Collect vegetation and fire effects monitoring data on monitoring plots.
2. Identify plants to the species level in a variety of ecosystems.
3. Enter data into databases.
4. Participate in wildland and prescribed fire operations.

Figure 20 – GGNRA Wildland Fire Management Organization Chart



4.2 FUNDING

The Fire Management Program Center (FMPC), National Interagency Fire Center, will issue an annual budget structure and allocation report to GGNRA. Allocated amounts will be entered in the Federal Finance System (FFS) at the allocation (ALCT) level by the FMPC for the following activities: Preparedness, Burned Area Rehabilitation, Hazardous Fuels Reduction, Wildland Urban Interface, and Rural Fire Assistance. GGNRA will stay within the line item spending authority for each activity until additional funding is requested and approved.

The WASO Budget Office covers Emergency Suppression, Wildland Fire Use and Emergency Stabilization obligations and expenditures at the regional allotment (ALOT) level at year-end. Expenditures in the Emergency Suppression and the Burned Area Rehabilitation Activities are be tracked through unique project accounts using the Fire Code guidelines.

The Fire Program Analysis System (FPA) will replace the existing NPS FIREPRO planning and budgeting program in the next few years. FPA will also replace the fire planning and budgeting systems in use by four other federal land management agencies.

4.3 INTERAGENCY COOPERATION AND CONTACTS

Table 12 – Contacts			
INTRA-AGENCY CONTACTS			
Bay Area Network/Point Reyes National Seashore	FMO Roger Wong 900	415-464-5232	[email address]
John Muir and Eugene O'Neill National Historic Sites	Deputy Supt Rick Smith	925-943-1531 x. 122	[email address]
Pacific West Regional FMO	FMO Sue Husari	510-817-1371	[email address]
INTER-AGENCY CONTACTS			
Marin County FD	Chief Ken Massucco 1500	415-499-6717	[email address]
Southern Marin Fire Department	Acting Chief Denis Walsh	(415) 388-8182	[email address]
Muir Beach Volunteer Fire Department	Chief John Sward 600	415-254-3479	[email address]
Stinson Beach Fire District	Chief Kenny Stevens 800	415-868-0622	unknown

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Inverness Public Utilities District	Chief Jim Fox	415-669-7151	[email address]
Bolinas FD	Chief Anita Brown 200	415-868-1566	[email address]
Nicasio Volunteer FD	Chief Joe Runyon	415-662-2201	[email address]
Marin Municipal Water District	Mike Swezy, Resource Specialist	415-945-1190	[email address]
Marin Open Space District	Brian Sanford Supervising Ranger	415-499-7473	[email address]
Mendocino NF	FMO Dave Sinclair	530-934-7734	[email address]
Northern California Coordination Center	Ed Duncan, DOI Coordinator	530-226-9710	[email address]
California Department of Forestry (Cal Fire) – San Mateo – Santa Cruz Unit	Unit Chief John Ferreira	831-335-5355	[email address]
Cal Fire CZU Felton ECC	Capt. Art Smith	831-335-6749	[email address]
National Weather Service Forecast Office, San Francisco-Monterey Bay.	Ryan Walburn, Fire Weather Forecaster	831-656-1710	[email address]
Bay Area Air Quality Management District	Doug Tolar, Enforcement and Compliance	415-749-5118	[email address]

4.4 INTERAGENCY AGREEMENTS

Table 13 – Interagency Agreements		
FIRE DEPARTMENT OR DISTRICT	AGREEMENT	DATE
Marin County Fire Department	in progress	
Cal Fire Santa Cruz/San Mateo Operational Unit	in progress	
Southern Marin Fire Department	in progress	

4.5 RECORDS AND REPORTS

Table 14 – Records and Reports			
FORM/REPORT	RESPONSIBLE PARTY	DISTRIBUTION	FREQUENCY
DI-1202 Fire Report	NPS Superintendent	Copy (1202 only) to Archives (SACS) within 10 work-days;	Per Incident
Interagency Fire Qualification Form and Card (IQCS card)	Fire Program Assistant Signed by FMO	Affected Personnel	Annually
Fire Weather/Indices (daily; see dates in Section 3.3.2.2)	Engine Foreman/Fire Program Assistant	Staffing levels (BI) to Law Enforcement Rangers and Dispatch	Daily
Daily Cost Accounting	IC/Burn Boss	As agreed	Schedule to be determined
WFSA	Park Superintendent	Agency-specific	Per Incident

4.6. ANNUAL REVIEW OF THE FIVE YEAR FUELS TREATMENT PLAN AND FMPAnnual Review Process of the Operational FMP and Five Year Fuels Treatment Plan (per PWR requirements.)

[The Five Year Fuels Treatment Plan will be developed in 2008 and added for the 2009 FMP update.]

1. Summarize the previous year's actions:

- Wildland fires, prescribed burns, mechanical fuel reduction projects,
- Education and information programs for the public,
- New or renewed agreements with other fire or land management agencies,
- Personnel information (number of positions, network location)

2. Assess Progress.

- Did we achieve what was anticipated in the five year fuels treatment plan?
- If the plan was not implemented as proposed, what were the budget or staffing challenges that kept you from being able to manage effectively?
- Are there unforeseen circumstances that came up which were limited by the program's goals, objectives or mitigations that should be considered for inclusion in the over all strategy to better meet goals and objectives?

3. Update FMP and Five Year Fuels Treatment plan.

- Is new background information available to the park that is relevant to fire management planning (i.e., data gathering, annual fire ecology report findings)? Are there changes to methodologies or procedures that should be incorporated into the FMP (i.e., modeling or analyses, of risk, ecological modeling, or new management policies)?
- Were there “lessons learned” from the past season that are important to note?
- Are there research or field observation results that indicate strategy should be modified?
- Were there outside (non-fire management) disturbance(s) (e.g., volcanic, windstorm, flood) that did or will affect the implementation of the FMP or five year fuels treatment plan?
- Are there modifications to the FMP or the five year fuels treatment plan to suggest? Do any of the issues reviewed support continuation, refinement, or reconsideration of the plan as written.
- Are there changes in DO-18 and RM-18 or other policy documents that require changes to the FMP or five year fuels treatment plan?

4. Identify Issues Raised.

In implementing the FMP, were issues of concern raised by park staff, staff of other agencies, or the public? How were issues resolved? If not yet resolved, how does the review team propose solving these issues?

5. Assess Conformance with NEPA and other Federal Regulations.

- Are there changes in the affected environment of GGNRA or Northern Lands GGNRA that could result in significant effects to the environment (i.e., change in species listing under the ESA, CNPS, etc., new cultural resources identified, change in air pollution emissions status for the air basin, change in water quality status, new water quality projects completed)?
- Were there projects or parts of projects that appear to be out of sync with the range of actions assessed in the FEIS?
- Were there impacts that differed from those anticipated by the EIS assessment?
- Was the NEPA documentation adequate to address the actions undertaken during the past season?
- Does the updated FMP or five year fuels treatment plan include actions that do not conform to the scope of the assessment in the EIS?
- Are modifications needed to the NEPA record to retain the program in conformance?

Determine the needs for further compliance and let the regional fire and compliance office know your intentions.

6. Proposed Changes to the Five Year Fuels Treatment Plan and FMP.

- Use the current version of the Regional Environmental Screening Form to determine if any proposed changes to the FMP need further compliance.
- Initiate changes to the plan using NEPA process if needed, if not, make the changes, and in either scenario send new version to the National Office and to Regional Office.

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