FINDING OF NO SIGNIFICANT IMPACT
SALMON HABITAT ENHANCEMENT AND BRIDGE REPLACEMENT PROJECT
MUIR WOODS NATIONAL MONUMENT

National Park Service
Golden Gate National Recreation Area
July 2018

1.1 Introduction

This Finding of No Significant Impact (FONSI) has been prepared in accordance with the National Environmental Protection Act (NEPA) for the Salmon Habitat Enhancement and Bridge Replacement Project at Muir Woods (Project).

An Environmental Assessment (EA) was prepared for the Project in accordance with NEPA and the National Park Service (NPS) Directors Order 12 (NPS's NEPA implementing regulations). As part of NPS's informed decision on this Project, impacts that were documented in the EA, both adverse and beneficial, were carefully considered. This FONSI, along with the EA and Response to Comments, comprise the complete record of environmental impact analysis for this Project, and approves this federal action to be implemented on NPS property as well as on adjacent State Parks land.

1.2 Purpose and Need

The purpose of this action is to enhance habitat for juvenile Coho salmon and natural stream processes, as well as to replace four aging pedestrian bridges across Redwood Creek. Although some trail realignment or removal may occur as part of the Proposed Action, the Project is not intended as a comprehensive master trail plan for Muir Woods National Monument (MWNM). Future trail adjustments may be made that would reduce impacts on channel function, but those trail modifications would not entail in-stream actions. All proposed trail relocations are those needed to meet the goals of the Proposed Action.

The Project is needed to address low juvenile Coho abundance in Redwood Creek and bridges that are deteriorating. Coho salmon are at risk of extirpation within Redwood Creek. Data collected over some 15 years by NPS demonstrates that the in-stream action is most likely to support the Coho salmon population consists of improving juvenile Coho salmon habitat within MWNM. There are two critical life stage weak points for Coho in Redwood Creek: the number of returning spawning adults and the survival rate of fry to juveniles. The Proposed Action addresses the survival rate of fry to juveniles.

In addition, pedestrian bridges in MWNM (Bridges 1 through 4 crossing Redwood Creek) are reaching the end of their useful life due to degrading structural integrity. The bridges, particularly Bridges 2 and 3, are restricting natural stream flow and have been damaged by woody debris and high water. The bridges' abutments constrain the channel, and the ability to pass large woody debris (LWD) is limited. Replacement of the bridges with longer spans, higher elevations, and a rustic design would enhance and support habitat restoration goals, improve visitor safety and accessibility, ensure long-term structural integrity and decrease maintenance needs, and enhance the rustic character of the monument through bridge design. Longer spans are needed to meet the flood-flow conveyance and trail-rerouting is

needed to meet pedestrian accessibility goals. MWNM is committed to meeting Architectural Barriers Act Accessibility Standard (ABAAS) for outdoor areas in the bridge designs.

1.3 Alternatives

NPS analyzed the No Action Alternative and alternatives for the various elements of the Proposed Action (Creek Restoration and Bridge Replacement) consistent with the purpose of, and need for, action. As the different Project elements are somewhat independent of one another, they are described as element alternatives.

No Action Alternative

Under the No Action Alternative, no actions would be taken to improve habitat for salmonids or to encourage more natural geomorphic processes. No riprap would be removed, no LWD would be installed, and the four pedestrian bridges would either not be replaced or be replaced in-kind (same location, same material, same size). Under this scenario, it could be assumed that some trees may still fall in the channel intermittently. The trails network within MWNM would not change.

Creek Restoration Alternatives

Because all of the creek restoration alternatives focus on restoring habitat complexity within Redwood Creek, all would be guided by the same strategy, and all would have certain key Project elements in common, including revegetation of disturbed areas, installation of grade control in an incised tributary, excavation of pools at wood jams, and protection of existing boardwalk infrastructure. To reduce potential erosion after riprap removal, banks where riprap has been removed would be treated based on conditions at each specific location. Bank treatments include regrading to a 1V:1:5H slope, covering with erosion control fabric, and aggressively replanting. Banks with substantial mature root structures behind existing riprap, which can be very effective at resisting erosion, are not anticipated to need erosion-control treatments.

Creek Restoration Alternative 1

This alternative consists of in-stream actions mostly upstream of Bridge 3, with some actions upstream of Bridge 1 to enhance Coho habitat by removing riprap and installing LWD. This includes riprap segments most suitable for removal, with the goal of improving juvenile rearing habitat for Coho as well as improving overall forest and riverine ecology. This alternative includes removal of 1,019 linear feet (LF) of riprap (30 percent of total riprap) over approximately 1 mile of channel and relocation of approximately 32 to 50 existing downed trees from upland areas into the channel at 17 locations. This alternative would result in an increase in summer habitat of approximately 15 percent and an increase in winter/spring Coho habitat of approximately 24 m^2/100m.

The upstream half of riprap segment L11 (L11A) would be re-stabilized, with its downstream end keyed into the bank well. This would provide long-term protection to the trail while allowing riprap removal at the downstream end of this segment (L11B). Segment L11A would be re-stabilized using typical hand/mechanical methods to recreate a wall as it originally appeared. It will not consist of newly engineered bank stabilization.

Creek Restoration Alternative 2

This alternative consists of all actions in Creek Restoration Alternative 1, plus additional habitat enhancement through riprap removal at the Plaza and removal of a portion of trail and an additional riprap segment in Cathedral Grove. This alternative includes removal of

1,357 LF (40 percent) of riprap, representing an increase of 338 LF compared to Creek Restoration Alternative 1. The 140 LF segment riprap (L7) in Cathedral Grove would be removed. As part of this action, the western side of the asphalt loop trail (approximately 350 LF) on the top of bank at Cathedral Grove would be removed prior to riprap removal.

With an existing split trail through Cathedral Grove, the main (eastern) leg of the trail would remain in place. A new trail configuration and gathering area in Cathedral Grove would be planned and implemented as part of a separate planning process. This alternative expands the geographic area of improvements to Coho habitat throughout more of the Project reach, and would increase both summer and winter/spring Coho habitat.

Creek Restoration Alternative 3

This alternative consists of all actions in Creek Restoration Alternative 2, plus additional habitat enhancement through terracing of the right floodplain and installation of three engineered log jams in the channel adjacent to the Plaza. Approximately 5,400 square feet would be terraced at two elevations, with a low terrace at about a 1-year flood elevation and a higher terrace at about a 1.5- to 3-year flood elevation. The existing landscape on the right bank consists of a high bench that does not function as floodplain. These elements of the alternative are intended to address some of the channel incision in this reach by reconnecting a channel with its floodplain and encouraging storage of sediment on both the new floodplain and in the channel. The added cover, low-velocity refuge, and formation of scour pools and secondary channels would enhance habitat for juvenile salmonids.

Creek Restoration Alternative 4

This alternative consists of all actions in Creek Restoration Alternative 2, plus additional habitat enhancement via installation of three engineered log jams near the Plaza, excavation of an alcove and installation of LWD in the vicinity of the small footbridge referred to informally as “footbridge 1.5,” and additional riprap removal that would require modification of two trail segments as follows. This alternative would result in removal of 1,627 LF (48 percent) of riprap, representing an increase of 608 LF compared to Creek Restoration Alternative 1, and an increase of 270 LF compared to Creek Restoration Alternatives 2 and 3. These actions provide more complex habitat for Coho as well as increased summer and winter/spring habitat.

The implementation of the actions specific to Creek Restoration Alternative 4 is dependent upon completion of new trail segments routed through the forest further from the channel. All of the forested areas proposed for new trail segments are flat, extend more than a channel width from the top of the bank, can avoid impacts to redwood trees, and present good options for smooth connections to the existing trail alignment.

Portions of riprap segments would be removed on the west side of Redwood Creek upstream of Bridge 1. Approximately 60 to 80 LF of asphalt trail on the top of the west bank, including footbridge 1.5, would also be removed. A drainage area at footbridge 1.5 would be enhanced as an alcove. The relocated trail segment would extend up to 440 LF.

Creek Restoration Alternative 5 (Preferred Alternative)

Creek Restoration Alternative 5 includes all actions in Creek Restoration Alternative 4, plus the floodplain terracing described in Alternative 3. This alternative provides the maximum amount of improvements to Coho habitat. It includes the maximum extent of riprap removal that can be conducted without affecting infrastructure, existing grade controls, or existing LWD structures. Infrastructure that is protected includes the sewer line under the entrance boardwalk, trails not modified, and a water line along some areas of the left bank up to Fern

Creek Trail. Several riprap segments are not proposed for removal because of the risk of the channel outflanking existing grade control, including two cascades and six historic channel-spanning log grade controls.

Pedestrian Bridge Replacement Alternatives

Four existing pedestrian bridges in MWNM are deteriorating due to age, and would be replaced with bridges that would be designed to provide improved flood conveyance while enhancing the rustic and historic character of MWNM. Designs for Bridges 2 and 3 would require trail rerouting, while designs for Bridges 1 and 4 would not. All alternatives would have certain key elements in common. All of the forested areas proposed for new trail segments are flat, extend more than a channel width from the top of the bank, can avoid impacts to redwood trees, and present good options for smooth connections to the existing trail alignment.

Actions Common to All Pedestrian Bridge Replacement Alternatives

- NPS would replace Bridges 1 and 4 to pass a 100-year storm flow. This action would require minor increases to bridge span to ensure passage of a 100-year storm flow with 18 inches of freeboard. Bridge 1 would have an approximately 50 LF span, and Bridge 4 would have an approximately 45 LF span.
- Bridge 2 would have an approximately 52 LF span, and Bridge 3 would have an approximately 45 LF span. The height for these bridges would vary depending upon the alternative.
- Bridges would be of a clear span design over the stream channel, able to accommodate from 25- to 100-year flood flows (based on existing channel conditions). New abutments would be relocated farther from the creek but still in the 100-year floodplain.
- The approaches to all new bridges would be designed to connect the existing trail network with the new bridges.
- Existing abutments for Bridges 1 through 4 would be removed. Historic riprap surrounding the Bridge 1 abutments and riprap in the vicinity of the Bridge 2 left bank abutment would not be removed. Non-historic riprap surrounding the Bridges 2, 3, and 4 abutments would be retained, replaced in-kind, or replaced with other bank protection measures. Additional site investigations are needed to determine specific bank protection designs. Depending on whether riprap is retained or the design of other bank protection measures, the modeled flood elevations used in the EA could be affected. NPS will strive to meet the stated objectives of passing the 100-year or 25-year flood flow to the maximum extent possible. Riprap or bank protection would only affect local flood elevations in the vicinity of the particular bridge and immediately upstream, and would not worsen existing flood issues.
- Bridge designs and associated redesigned trail approaches would meet ABAAS for outdoor areas and all grades will aim to be less than 5 percent.
- Bridges would be a steel stringer design with wood decking and guardrails. Guardrails are needed to comply with current safety codes. Bridges 1 and 4 would include a minor arched camber. Bridges 2 and 3 would include a more significant arched camber.
- New/rerouted trails would either be boardwalk or flexible paving, which could include asphalt, compacted shale, or other materials. The lengthened boardwalks/transitions between bridge and trails may require piers placed within the 100-year floodplain.

- Areas of existing trail removal would be decompacted, restored, and revegetated with native plants.

Pedestrian Bridge Replacement Alternative A

Under this alternative, spans for Bridges 2 and 3 would be lengthened and the clearance under the bridge would be raised to pass a 25-year storm event. Bridge 2 would have 15 inches of freeboard at the peak of the arch in a 25-year storm event, while Bridge 3 would have 12 inches of freeboard at the peak of the arch in the same event. Existing abutments would be removed and new abutments would be placed farther from the creek channel.

For Bridge 2, this alternative replaces the asphalt trail on either side of the bridge with a boardwalk to connect to the main trail network to improve visitor experience, safety, and reduce maintenance needs. Approximately 120 LF of new boardwalk would be installed on the east side of the creek, and approximately 20 LF of new boardwalk on the west side of the creek. Approximately 80 LF of asphalt trail on the east side of the trail would be removed and restored. The existing large paved area on the east side of the bridge would be removed and areas closest to the creek would be restored. Bridge 2 would have a small approximately 20-by-20-foot gathering area on the east side of Redwood Creek.

For Bridge 3, this alternative replaces the asphalt trail with a new boardwalk and flexible paving trail to connect to the main trail network. Approximately 120 to 160 LF of new trail and approximately 30 LF of boardwalk would be installed on the east side of the creek, and approximately 35 LF of new boardwalk on the west side of the creek. This would result in new disturbance for re-alignment of trail, but also restoration where the approximately 130 LF of existing asphalt trail would be removed.

Pedestrian Bridge Replacement Alternative B

Under this alternative, spans for Bridges 2 and 3 would be the same length as under Pedestrian Bridge Replacement Alternative A, but would be raised 9 inches. Replacement bridges would be designed to pass a 100-year storm event. Bridge 2 would have 14 inches of freeboard at the peak of the arch in a 100-year storm event, while Bridge 3 would have 13 inches of freeboard at the peak of the arch in the same event. Existing abutments would be removed and new abutments would be placed farther from the creek channel.

For Bridge 2, approximately 140 LF of new boardwalk would be installed on the east side of the creek and approximately 40 LF of new boardwalk would be installed on the west side of the creek. This would result in new disturbance for re-alignment of the trail, but also restoration where approximately 80 LF of existing asphalt trail and the informal gathering area would be removed. The rerouted trail would be outside of the 100-year floodplain. This alternative would require approximately 10 LF of guardrail on the boardwalk approaches to Bridge 2 for safety and accessibility reasons, and would not include a gathering area at Bridge 2.

For Bridge 3, this alternative would require trail rerouting involving approximately 120 to 160 LF of new trail and installation of approximately 50 LF of boardwalk installation on the east side of the creek and approximately 50 LF of new boardwalk on the west side of creek. As with Pedestrian Bridge Replacement Alternative A, approximately 130 LF of existing asphalt trail would be removed and restored. This would require an area of new disturbance for the rerouted trail, but would allow the trail to be pulled back from the stream with restoration of existing paved trail area. This would also provide different visitor experience through a wooded area, which is not generally provided on the valley floor.

Pedestrian Bridge Replacement Alternative C (Preferred Alternative)

Under this alternative, the span of Bridge 2 would be lengthened and designed to pass a 25-year storm event and Bridge 3 would be lengthened and designed to pass a 100-year storm event. Bridge 2 would have 15 inches of freeboard at the peak of the arch in a 25-year storm event, while Bridge 3 would have 13 inches of freeboard at the peak of the arch in a 100-year storm event. Under this alternative, the gathering area at Bridge 2 is retained. Habitat benefits of the longer span at Bridge 3 are significantly greater than habitat benefits for the longer span at Bridge 2. Additionally, this alternative requires less rerouting and replacement of existing trails at Bridge 2 than Alternative B.

For Bridge 2, this alternative would have the same design as described in Pedestrian Bridge Replacement Alternative A. For Bridge 3, this alternative would have the same design as described in Pedestrian Bridge Replacement Alternative B.

Selected Alternatives

The selected alternative for the Creek Restoration action is Alternative 5 because it presents the most benefits to Coho salmon within Redwood Creek when compared to the other action alternatives. This alternative would result in the maximum increases to Coho habitat of the alternatives considered, including maximum installation of LWD, maximum riprap removal, and special habitat features such as the alcove and floodplain grading near the Plaza. For cultural resource protection, this alternative has the same amount of visible riprap removal as Alternatives 2 through 4, and the same total amount of riprap removal as Alternative 4.

Pedestrian Bridge Replacement Alternative C is the selected alternative for Pedestrian Bridge actions. This alternative provides greater habitat benefits compared to Alternative A, and requires less rerouting and replacement of existing trails compared to Alternative B.

Public Involvement

Public scoping for the EA began with a public meeting on September 20, 2016. A public meeting to review the Draft EA was held on April 11, 2017, at the Tam Valley Community Center in Mill Valley, California. The Draft EA was publically available on the NPS Planning, Environment & Public Comment website.

NPS received 10 comments on the EA. Comments covered topics such as cumulative impacts, threatened and endangered species impacts, impacts on visitor experience, and potential modifications to the alternatives. The comments and NPS responses are included in the Response to Comments section of the Final EA. In response to public comments, changes were made to various portions of the Draft EA, as reflected in the Final EA. Also, in a commitment to thoroughness, the NPS incorporated several minor, self-initiated project additions/clarifications into the Final EA. These clarifications do not alter the significance conclusions or any considerable portion of the Project itself.

1.4 Agency Consultation

U.S. Fish and Wildlife Service

The Endangered Species Act of 1973 requires that each federal agency, in consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS), ensure that proposed agency actions do not jeopardize the continued existence of a listed species or result in destruction or adverse impact to designated critical habitat. A list of listed threatened and endangered species in the general area was obtained through the

USFWS website. NPS initiated informal consultation with the USFWS on August 30, 2017. USFWS was provided a copy of the Draft EA for their review. NPS sought concurrence that the Project may affect, but is not likely to adversely affect, federally listed species under their jurisdiction. NPS received concurrence from USFWS on October 4, 2017.

NPS requested reinitiation of formal consultation with the USFWS on February 15, 2018 for the MWNM Water and Sewer Line Rehabilitation, Salmon Habitat Enhancement, and Bridge Replacement and the MWNM Sustainable Access project to allow construction work to begin on June 1 during the breeding seasons for the northern spotted owl and marbled murrelet. The memorandum also added to the proposed project in-channel construction activities to repair an emergency stabilization of a 2015 culvert blowout on a tributary to Redwood Creek. On July 9, 2018 the USFWS concurred in its Biological Opinion that the proposed projects are not likely to adversely affect the California red-legged frog, the northern spotted owl, and marbled murrelet.

National Marine Fisheries Service

NPS initiated formal consultation with NMFS regarding listed species under their jurisdiction on June 30, 2017. NMFS was provided a copy of the Draft EA for their review. A representative from NMFS visited the Project site on December 1, 2016. NPS sought an opinion from NMFS that the Project may affect, but is not likely to adversely affect, federally listed species under their jurisdiction. NPS received the biological opinion stating that the Project is unlikely to jeopardize the continued existence or destroy or adversely modify designated critical habitat of species under their jurisdiction as well as an incidental take permit from NMFS on September 20, 2017.

On April 12, 2018 NPS informed NMFS of proposed changes to the Salmon Habitat Enhancement Project that would consist of burying riprap in Redwood Creek instead of off-hauling riprap by driving small loads of rock down the dewatered channel as originally proposed. NPS concluded that the proposed change to the Project would not lead to new impacts to ESA –listed fish or designated critical habitat, and requested NMFS concurrence that based on that conclusion, re-consultation is not warranted. On May 2, 2018 NMFS concurred that re-consultation is not warranted because new impacts to ESA-listed species or habitat are unlikely to occur.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) administers a permitting program under Section 404 of the Clean Water Act to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. A wetland delineation was prepared and submitted to the USACE in February 2017. After a USACE site review, minor revisions to the delineation were made in April 2017 and resubmitted. Additional areas were added to the wetland delineation in October 2017. The USACOE conducted an additional site review and on April 24, 2018 provided written concurrence on the extent and location of wetlands and other waters of the U.S. identified in the delineation.

California State Historic Preservation Officer and the Advisory Council on Historic Preservation

A copy of the EA was sent to the State Historic Preservation Officer (SHPO) requesting review and soliciting input on the Proposed Action. The NPS initiated consultation with the SHPO and Advisory Council on Historic Preservation on March 23, 2017 by letter. On June 29, 2018, SHPO executed a Memorandum of Agreement (MOA) with the NPS that the selected alternatives will have adverse effects on individual cultural resources, but will not

adversely affect the historic district at MWNM. Furthermore, NPS agrees to implement all of the MOA stipulations (see Attachment A, Table 1) to resolve adverse effects prior to partial removal of the Redwood Creek Revetment, bridge replacement, and trail realignment.

Native American Consultation

NPS solicited scoping input on the Project from the Federated Indians of Graton Rancheria (FIGR) on June 6, 2016. Additionally, NPS initiated consultation with the FIGR by letter. As a Concurring party to the MOA between SHPO and the NPS, FIGR executed the MOA on July 16, 2018, with the implementation of all MOA stipulations, that the selected alternatives will have adverse effects on individual cultural resources, but will not adversely affect the historic district at MWNM.

Regional Water Quality Control Board

Section 401 of the Clean Water Act requires that an applicant pursuing a federal permit to conduct an activity that may result in a discharge of a pollutant to a water of the State to obtain a Water Quality Certification (or waiver), verifying that the discharge will not violate state water quality standards. Water Quality Certifications are issued by Regional Water Quality Control Boards (RWQCBs) in California. As defined by CEQA, the Lead Agency for the project is the California Regional Water Quality Control Board, San Francisco Bay Region (Water Board), and the Responsible Agency is California State Parks, Bay Area District. In accordance with Section 15221 of the CEQA Guidelines, the Water Board For this Project, the San Francisco Bay RWQCB will adopt this FONSI as CEQA compliant in lieu of a Negative Declaration because the EA demonstrates Project compliance with both CEQA and NEPA by including additional environmental analysis and discussion required by CEQA to evaluate potential impacts from greenhouse gases and growth-inducing impacts. NPS will apply to the San Francisco Bay RWQCB for a 401 Certification under the Clean Water Act. The 401 would be issued after CEQA compliance is completed.

1.5 Finding of No Significant Impact

The NPS used the following NEPA criteria and factors defined in 40 CFR §1508.27 to evaluate whether the Selected Alternative would have a significant impact on the environment.

Impacts that may have both beneficial and adverse aspects and which on balance may be beneficial, but that may still have significant adverse impacts that require analysis in an EIS

Whether taken individually or as a whole, the impacts of the Project do not reach the levelof significance requiring an environmental impact statement (EIS). Most of the adverse impacts would be temporary and occur during construction. Long-term or cumulative impacts generally would not exceed negligible to minor adverse, and many are considered beneficial.

Degree of effect on public health or safety

Adverse impacts on Public Health and Safety would be negligible. In addition, pedestrian bridges would be constructed to comply with applicable fire and life safety standards, and would reduce the Public Health or Safety issues associated with the existing deteriorating bridges.

Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas

The Project does not contain prime farmland, farmland of local or statewide importance, or wild and scenic rivers. The effects of the Selected Alternatives on cultural resources within MWNM would be direct long term minor adverse impacts due to permanent removal of historic riprap and trails, but would not render MWNM ineligible for its current status as a resource listed on the National Register of Historic Places. Fifty-two percent of all historic riprap and 50 percent of visible historic riprap would remain. Potential impacts on Mount Tamalpais State Park from use of the Alice Eastwood Road and Alice Eastwood Group Camp would be temporary and any Project-related impacts on the road or group camp would be repaired prior to the end of the Project. Removal of historic riprap on State Parks land would be a direct and long-term impact. The Project would not impact wetlands. The Project would result in major beneficial impacts on conditions for salmonids within Redwood Creek.

Degree to which effects on the quality of the human environment are likely to be highly controversial

Effects on the quality of the human environment have not generated public controversy and are not expected to be highly controversial.

Degree to which the possible effects on the quality of the human environment are highly uncertain or involve unique or unknown risks

The potential impacts are well defined and analyzed in the Final EA. The degree or possibility that the effects on the human environment will be highly uncertain or will involve unique or unknown risks is remote.

Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration

The Selected Alternatives will not predetermine or establish a precedent for future actions with significant effects at the site or within MWNM and do not represent a decision in principle about a future consideration. Future actions and decisions at MWNM not evaluated in the EA will be reviewed in an independent NEPA analysis. The targeted removal of riprap, improvement of salmonid habitat, and replacement of pedestrian bridges are consistent with the Golden Gate National Recreation Area 2014 General Management Plan.

Whether the action is related to other actions with individually insignificant but cumulatively significant impacts

The Final EA considered the cumulative impacts of the Selected Alternative with relevant past, present, and future projects and the analysis for all impact topics indicated that the Selected Alternative could result in minimal effects, and in combination with the other identified projects, would collectively not have significant cumulative adverse effects.

Degree to which the action may adversely affect districts, sites, highways, structures, or objects listed on National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources

Under the Selected Creek Restoration Alternative, impacts on historic riprap and trails that are contributors to the Muir Woods Historic District would be direct long term minor adverse impacts. Historic riprap would be permanently destroyed by habitat restoration activities, and a leg of the trail in Cathedral Grove would be destroyed; therefore, the

Selected Creek Restoration Alternative adverse impacts cannot be fully mitigated. Impacts of the Selected Pedestrian Bridge Replacement Alternative would result in impacts on trails that are contributors to the historic district that would be direct, long term, and minor adverse impacts. Trails that are contributors to the historic district would be permanently altered by bridge lengthening and alterations to approaches, therefore, the Selected Pedestrian Bridge Replacement Alternative's adverse impacts cannot be fully mitigated. However, because the trails and erosion-control rock revetments are among many cultural landscapes, buildings, and structures that are considered contributors to the historic district, impacts to historic resources would be long term minor adverse impacts. The Proposed Action would not render Muir Woods Historic District ineligible for its current listing on the National Register of Historic Places. Per the June 29, 2018 MOA between the NPS and SHPO, the NPS will ensure the Stipulations and Minimization Measures in the MOA (listed in Table 1) are carried out to resolve adverse effects prior to the partial removal of the Redwood Creek Revetment, bridge replacement, and trail realignment.

Degree to which the action may adversely affect an endangered or threatened species or its critical habitat

Implementation of the Selected Alternatives could result in temporary construction-related adverse effects on Coho salmon, steelhead, and northern spotted owl. Adverse effects on marbled murrelet or California red-legged frog are not anticipated. The Selected Alternatives would have long-term beneficial effects on listed species and habitat. Potential adverse effects on these species would be minimized by the implementation of the best management practices (BMPs) listed in Attachment A, Table 1, and any mitigation measures required by USFWS and NMFS. Additionally, NPS received concurrence from the USFWS and NMFS that the Selected Alternatives may affect, but are not likely to adversely affect, these federally listed species.

Whether the action threatens a violation of federal, state, or local environmental protection law

Implementing the Selected Alternatives would not violate any federal, state, or local environmental protection laws. Assessment of the Proposed Action has been performed pursuant to the NEPA, which requires consideration of environmental protection laws and regulations.

1.6 Best Management Practices and Regulatory Requirements

Best Management Practices (BMPs) and Regulatory Conservation Measures are required as a key component of the Selected Alternatives, and will be implemented by NPS, its contractors, and volunteers as described in Tables 1, 2 in Attachment A and Attachment B.

1.7 Conclusion

Implementation of the Selected Alternatives for the Salmon Habitat Enhancement and Bridge Replacement Project at Muir Woods (Project) would not have significant impacts on the human environment. The determination is sustained by the analysis in the EA, agency consultations, and the inclusion and consideration of public review. Adverse environmental impacts that could occur are generally negligible to moderate in intensity, duration, and context and less than significant. As described in the EA, there are no highly uncertain or controversial impacts, unique or unknown risks, significant cumulative effects, or elements of precedence. There are no previous, planned, or implemented actions, which in combination with the Selected Alternatives would have significant effects on the human environment. Requirements of the NEPA have been satisfied and preparation of an

environmental impact statement is not required. NPS will implement the Selected Alternatives as soon as practical.

Recommended:

C. Fiveash 8/1/18

For Laura E. Joss, General Superintendent — Date
Golden Gate National Recreation Area
National Park Service

Approved:

Stan Austin 8/7/18

Stan Austin, Regional Director — Date
Pacific West Region
National Park Service

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ATTACHMENT A

BEST MANAGEMENT PRACTICES (BMPs) AND REGULATORY REQUIREMENTS

Table 1 below includes all of the General BMPs, U.S. Fish and Wildlife Service (USFWS) **informal** consultation conservation measures, National Marine Fisheries Service (NMFS) **formal** consultation requirements, and other regulatory requirements that were published in the Final EA for the Selected Alternative. They will all be implemented by the NPS, its contractors, and volunteers prior to or during construction, as applicable.

TABLE 1
Channel Bed
• The work zone and the potential area of dewatering will be defined. • Following implementation of measure BIO-5 below, the work zone will be dewatered. Dewatering entails setting up a pump and piping along the work zone. The pump must operate continuously. A noise-attenuated diesel pump will be used to reduce noise. Supplemental methods of attenuating noise will be added as necessary, such as surrounding the pump with rice straw bales. All water will be piped to the downstream channel to maintain instream flows there throughout the work. • A set of strict BMPs will be implemented to ensure that no turbid water is piped into the channel (or enters the downstream area through other means.) These may include the use of desiltation devices at the terminal end of the discharge pipe, the use of sandbags to disperse the outflow so it does not stir up turbidity, avoiding foot traffic in the intake zone that would stir up turbidity, construction of a cofferdam at the downstream end of the dewatered zone to prevent turbid water from infiltrating upstream, and taking daily turbidity measurements to evaluate effectiveness and modify measure as necessary to eliminate any observed turbidity due to construction activities. If an auxiliary fuel tank is needed for the dewatering pump, NPS will work with the contractor to identify a suitable location and identify site-specific BMPs. • The small number of existing channel pools will be lined with fabric and then gravel will be placed on top of them. The gravel and fabric will be removed following the completion of construction, re-exposing the pool. This allows the form of the pool to be completely reoccupied after construction. • Rocks buried in the channel bed will be placed to retain about 3 feet of native bed material at the surface to allow for development of deep pools in the future, with the exception of areas that are dug out for pools. Trenching will be conducted mid-channel at significant distances from the toes of banks and will avoid good pools, existing grade control logs or similar features. Fine bed material will be packed around placed rocks, and with subsurface zones of the natural bed will be placed between segments of buried rock to prevent the development of subsurface voids. Only native, rounded rock will remain at the surface of the bed. • All vehicles and equipment will be kept clean and in proper working order. Excessive build-up of oil and grease will not be accepted. • NPS through the applicant will maintain all construction equipment to prevent leaks of fuels, lubricants, or other fluids. All equipment used for in-channel work will be inspected for leaks each day prior to initiation of work. Action will be taken to prevent or repair leaks, prior to use. • Incoming equipment will be checked for leaking oil and fluids. Leaking equipment will not be allowed on site. Additionally, equipment and vehicles will be free of soil prior to entering MWNM to avoid the spread of pathogens or invasive species. • Site staging and storage areas for construction vehicles, equipment, materials, and soils will occur in previously disturbed or paved areas approved by the NPS. These areas will be outside of high visitor use areas and clearly identified in advance of construction.

- No heavy equipment will operate in a live stream.
- No equipment servicing will be done in the channel or immediate floodplain, unless equipment stationed in these locations cannot be readily relocated (i.e., pumps and generators).
- Spill kits will be maintained on site at all times during construction operations and/or staging or fueling of equipment.
- If necessary, all servicing of equipment done at the job site will be conducted in a designated, protected area to reduce threats to water quality from vehicle fluid spills. Designated areas will not directly connect to the ground, surface water, or the storm drain system. The service area will be clearly designated with berms, sandbags, or other barriers. Secondary containment, such as a drain pan, to catch spills or leaks will be used when removing or changing fluids. Fluids will be stored in appropriate containers with covers and properly recycled or disposed of offsite.
- No large fuel storage containers will be allowed. Fuel will be delivered to the site only in pick-up trucks designed for fuel hauling, but it will not be otherwise stored on site. Vehicle and equipment fueling and maintenance operations will be at least 50 feet away from water courses, except at established commercial gas stations or established vehicle maintenance facilities.
- If emergency repairs are required in the field, only those repairs necessary to move equipment to a more secure location will be conducted in the channel or floodplain.
- All on- and off-road vehicles, boots, equipment, and tools must be power washed to remove soil and plant fragments before entering GGNRA property to avoid spreading pathogens or exotic/invasive species. Equipment also must be cleaned when moving between work zones.
- Vehicle and equipment washing can occur on site only as needed to prevent the spread of sediment, pathogens, or exotic/invasive species and only in defined site which would be identified in the SWPPP. No runoff from vehicle or equipment washing is allowed to enter water bodies, including channels and storm drains, without being subjected to adequate filtration (e.g., vegetated buffers, hay wattles or bales, and silt screens).
- All boots, equipment, and tools must be disinfected using a 10% bleach solution, 70% isopropyl alcohol, or other NPS-approved disinfectant method prior to entering the site, as well as between work areas, to prevent pathogen spread.
- All tools, equipment, barricades, signs, and surplus materials will be removed from the project area upon completion of the proposed project.
- Biodiesel will be required to the extent possible.

Forest Floor

- Where feasible, downed wood slated for movement or in the travel path will be searched to remove and relocate any amphibians (excluding CRLF [*Rana draytonii*]). Worker and visitor safety is a preeminent concern, and searching for and relocating amphibians will not be conducted in instances where safety might be threatened.
- NPS will identify invasive plants, particularly panic veldt grass (*Ehrharta erecta*), within the work and access route areas prior to project implementation. Existing topsoil will also be evaluated for invasive, nonnative plant infestations. A qualified vegetation ecologist or botanist will plan treatments to prevent the spread of invasive species, and implementation of these treatments will be under the supervision of a qualified vegetation ecologist or botanist. The location of invasive species and the treatment plan will be documented in a plant protection plan. The final treatment prior to project implementation will occur close to initiation of project work. Topsoil heavily infested with invasive, nonnative plants will be removed. Non-infested topsoil will be salvaged, stored according to soil conservation guidelines, and replaced once construction is complete. Post-project monitoring and treatment for invasive plant species is expected to be on-going, with treatments at least 2 to 3 times per year for at least two to three years after construction or longer, as long as funding is available.
- Identify a route which avoids understory vegetation where possible and gives sufficient space to redwood trunks.

- Minimize disturbance to vegetation and soils.
- Place protective mats, if necessary, on the haul route to disperse the load.
- Tie back, trim, or remove vegetation (in order of preference) in the route prior to use, and replant after work is completed.
- Evaluate compaction both before and after work and de-compact using hand methods, if needed. Aerate any ground surface temporarily disturbed during construction and replant with native vegetation to reduce compaction and prevent erosion.
- Padding may be wrapped around trunks, if needed, for extra protection in areas where there is a risk of equipment hitting a trunk.

Bridge Construction

- Debris from demolition of existing bridges or construction of new bridges will not enter the channel. Bridge construction will follow channel bed BMPs outlined above.

Biological Resources

BIO 1

- All resource protection measures will be clearly stated in the construction specifications, and workers will be instructed to avoid conducting activities outside the project area.
- Prior to any construction-related activities, a training session will be required for all contractors, partners, and NPS staff participating in project-related activities in the project area. Training will be conducted by a qualified biologist to familiarize personnel about sensitive resources in the project area. Personnel will be provided with a brief life-history and physical description of Coho salmon, steelhead, northern spotted owl, marbled murrelet, CRLF, and other sensitive wildlife in the area. Training will include staff resource contact information, identification of sensitive resources, the limits of the work area, general BMPs, and appropriate actions to take upon encountering species status species or other wildlife. All attendees will sign an attendance sheet along with their printed name, company or agency, email address, and telephone number.
- Construction zones outside of existing disturbed areas will be delineated with flagging, and all surface disturbances confined to the construction zone.

BIO 2

- No construction activities will occur at night or during dawn or dusk to minimize impacts on wildlife that are most active during these times, such as the northern spotted owl, marbled murrelet, and CRLF. To the maximum extent practicable, earthmoving and construction activities will cease no less than 30 minutes before sunset and will not begin again prior to no less than 30 minutes after sunrise. Except when necessary for driver or pedestrian safety, to the maximum extent practicable, artificial lighting at the project site will be prohibited during the hours of darkness.

BIO 3

- The contractor will be required to keep all waste and contaminants contained and remove them daily from the work site. Wildlife-proof trash receptacles will be used. Uneaten human food and trash attracts crows, ravens, coyotes, and other predators of the CRLF. A litter control program will be instituted at each project site. All workers will ensure their food scraps, paper wrappers, food containers, cans, bottles, and other trash are deposited in covered or closed trash containers. The trash containers will be removed from the project site at the end of each working day.

BIO 4

- Access and/or construction below ordinary high water will be limited to June 15 to October 31, unless conditions to allow the start of salmon spawning do not occur by October 31 and continued work is approved by or otherwise permitted by regulatory agencies, to minimize potential adverse effects to salmonid spawning and movement. The actual work window could be adjusted slightly and will depend upon the current water year, creek conditions, and timing of salmonid migrations.
- NPS will notify NMFS two weeks prior to project construction to allow NMFS personnel the opportunity

to view weir construction.

- NPS and permittee must provide a written report to NMFS by January 15 of the year following construction of the proposed action. The report must be provided to NMFS Santa Rosa Area Office, Attention: Supervisor NMFS CCAO, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report must contain, at a minimum, the following information:
  - Construction-related Activities–The report must include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the Project Action; and photographs taken before, during, and after the activity from photo reference points.
  - Fish Relocation–The report must include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

BIO 5

- In areas to be dewatered, NPS will set up fish exclusion fences at the outer boundaries of the work zone and remove all fish and wildlife from the work zone as described below, although the details may be revised per guidance from NMFS.
  A. All pumps used to divert live stream flow, outside the dewatered work area, will be screened and maintained throughout the construction period to comply with the NMFS Fish Screening Criteria for Anadromous Salmonids (NMFS 2008). Pump intakes will be covered by mesh not larger than 5 mm with sufficient area to prevent impingement of fish and intake approach velocities less than 0.2 ft/s and to prevent CRLF from entering the pump system. Pump intakes will be checked periodically to ensure impingement is not occurring.
  B. The channel will be blocked by placing fine-meshed screens above and below the work area to prevent fish from entering the work area. Exclusion screening will be placed in low velocity areas to minimize impingement. Screening or nets will be oriented so that approach velocities do not exceed 0.2 ft/s (NMFS 2008). Screen mesh diameter will be 3/32-inch. The bottom edge of the net or screen will be secured into the channel bed to prevent fish from passing under the screen. Screens will be checked periodically and cleaned of debris to permit free flow of water.
  C. Fish Protection Measures:
     i. Fish relocation activities must be performed only by qualified fisheries biologists with experience with fish capture and handling. NPS will ensure that all biologists working on this project be qualified to conduct fish collections in a manner that minimizes all potential risks to salmonids. Electrofishing, if used, will be performed by a qualified biologist and conducted according to the NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act (NMFS 2000).
     ii. A qualified biologist will monitor the construction site during placement and removal of channel diversions and cofferdams to ensure that any harm or loss of salmonids is minimized and documented. The biologist will be on site during all dewatering events to ensure that all listed species are captured, handled, and relocated safely.
     iii. Captured fish will be handled with extreme care and kept in water to the maximum extent possible during relocation activities. All captured fish will be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation, the biologist will have at least two containers and segregate young-of-year fish

from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which habitat conditions are present to allow for adequate survival of transported fish and fish already present.

- If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Rick Rogers by phone immediately at (707) 578-8552 or the NMFS North Central Coast Office at (707) 575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length measured, and be frozen as soon as possible. Frozen samples will be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS North Central Coast Office without obtaining prior written approval from the North Central Coast Office. Any such transfer will be subject to such conditions as NMFS deems appropriate.
- Water shall be released or pumped downstream at an appropriate rate to maintain downstream flows during construction.
- All temporary fill, cofferdams, pumps, pipes and sheet plastic will be removed from the stream upon completion of each project phase, as well as upon project completion in a manner that would allow flow to resume with the least disturbance to the substrate; any clean native gravel used for the cofferdams will be left in the channel to augment available spawning habitat

BIO 6

- The following measures will be implemented to minimize potential adverse effects to northern spotted owls:
  - If construction commences between February 1 and July 31, NPS will conduct pre-construction surveys for northern spotted owls in suitable nesting habitat;
  - If northern spotted owl nests are detected during pre-construction surveys, no work that raises noise levels above ambient background levels at the nest site will be conducted;
  - Within northern spotted owl habitat, disturbance to native trees greater than 10 inches in diameter at breast height will be avoided where feasible

BIO-7

- The following measures will be implemented to minimize potential adverse effects to marbled murrelet:
  - Project activities (e.g., those that use chain saws or power equipment) that would raise noise levels above ambient conditions within suitable marbled murrelet breeding habitat would occur outside the core breeding season (March 15 to July 31). During the marbled murrelet's late breeding season (August 1 to September 15), these activities will be restricted to the daytime hours from two hours after sunrise to two hours before sunset (avoiding the time periods when marbled murrelets are most sensitive to noise disturbance) (i.e., allows for work during daytime hours).
  - Within marbled murrelet habitat, disturbance to native trees greater than 10 inches in diameter at breast height will be avoided where feasible

BIO-8

- The following measures will be implemented to minimize potential adverse effects to non-federally listed nesting birds.
  - To the extent feasible, vegetation removal would occur outside the landbird nesting season.
  - If vegetation clearing or ground disturbing activities commence between March 1 and July 31, a qualified biologist will conduct a survey for nesting birds within 5 days prior to starting work. If a lapse in project-related work of 1 week or longer occurs, another focused survey will be conducted before project work can be initiated. Surveys will cover a minimum of a 1/4-mile radius around the construction area.
  - If nesting birds are found, a buffer will be established around the nest and maintained until the young have fledged. Appropriate buffer widths are 300 feet for non-listed raptors and 100 feet for

non-listed passerines. A qualified biologist may identify an alternative buffer based on a site-specific evaluation. Work will not commence within the buffer until fledglings are fully mobile and no longer reliant upon the nest or parental care for survival.

BIO-9

- Prior to project-related activities, a qualified biologist will conduct pre-construction surveys for dusky-footed woodrat (*Neotoma fuscipes*). Identified woodrat houses will be avoided to the maximum extent practicable. If houses are unavoidable, NPS will implement informal NPS protocol of dismantling of woodrat houses.

BIO-10

- Prior to determining final trail reroute locations, a qualified bat biologist will conduct surveys of tree hollows adjacent to the proposed new trail location. If bat maternity colonies are detected adjacent to the proposed trail location, the trail location will be designed so the entrance to the hollow does not face the trail.

BIO-11

- Within 1 year prior to commencement of ground disturbing activities, a qualified botanist will perform surveys for special-status and locally rare plant species within areas that could potentially be disturbed by the Proposed Action. Floristic surveys will be performed according to the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California Department of Fish and Game 2009 or current version). If special-status or locally rare plants are detected within the construction zone or within a 50-foot radius of the construction zone, NPS will implement BIO-12. Additionally, any invasive plant species within or adjacent to the construction zone will be identified.

BIO-12

- If special-status plants are detected within the construction zone or within a 50-foot radius of the construction zone, NPS will adjust the construction footprint or establish an exclusion area to avoid impacts to the plants. Locations of special-status plant populations will be clearly identified in the field by staking, flagging, or fencing prior to the commencement of activities that may cause disturbance. A qualified botanist will determine whether direct and/or indirect impacts will occur. If the botanist determines that impacts will not be completely avoided, BIO-13 will be implemented.

BIO-13

- If avoidance is not feasible, NPS will implement measures to minimize the impact on the species. Minimization measures will be evaluated on a case-by-case basis for local rarity and extent of impacts. Minimization measures may include transplanting perennial species, seed collection and dispersal for annual species, and other conservation strategies that will protect the viability of the local population. If minimization measures are implemented, monitoring of plant populations will be conducted by a qualified botanist to assess the mitigation's effectiveness. The performance standard for the mitigation will be no net reduction in the size or viability of the local population.

BIO-14

- NPS will prepare a detailed plant protection plan based on specific areas potentially impacted by any proposed actions. NPS will thoroughly review areas of likely impact in advance and identify either any sensitive species or native species that will be protected or invasive species that will be controlled. Based on the potential impact and the species, a plan will be made to either (a) avoid the area if necessary to the presence of a sensitive species; (b) salvage plants if they are salvageable; (c) trim branches/leaves if the plants will easily resprout, (d) cover with plywood or other protective materials, or (e) other types of activities. Salvaged plants will be removed either immediately before impact or possibly up to 1 month in advance. They will be stored in area where there will be an easy water source (i.e.: such as the former nursery area) and replanted either immediately after work is completed in a specific zone or during the typical winter planting period.

BIO-15

- All areas where vegetation is disturbed by project work, including rip rap removal, log installation,

bridge replacement, trail re-routes and access, will be restored following project work with native plants propagated in the park nurseries, and the removal of invasive plants.

BIO-16

- A USFWS-approved biological monitor will be present during implementation of the creek restoration work. The biological monitor will ensure that any unanticipated impacts to natural resources are avoided.

BIO-17

- SWD will be collected outside of the bird nesting season (February 1 to July 31). SWD will be collected selectively to avoid removing valuable woody debris in other resource areas.

BIO-18

- The following measures will be implemented to minimize potential adverse effects to CRLF:
  - A reconnaissance-level survey for CRLF shall be conducted by a qualified biologist within 48 hours prior to starting work in areas where frogs would be seen if present that provide potentially suitable habitat. In areas where vegetation clearing is needed, surveys will be conducted.
  - If no CRLF are found within the work area during the survey, then the work may proceed. If CRLF are observed, NPS will re-initiate consultation with USFWS to determine appropriate avoidance and minimization measures. Any sightings and/or injuries of CRLF will be reported to USFWS within 24 hours.
  - Pipes, conduits, and other materials that could provide shelter for CRLF will be stored above ground level to reduce the potential for animals to climb into the conduits and other materials. Pipes or conduits may be left on ground level if capped at both ends.
  - If a CRLF is observed near the project area during construction activities, all work must stop and the CRLF be allowed to leave the work area on its own volition. NPS will notify USFWS immediately about the finding of any CRLF near the work area, and NPS will reinitiate consultation with the USFWS. Work will not resume until USFWS and the USFWS-approved biologist for the proposed project have determined that no CRLF will be harassed, injured, or killed by the proposed project.
  - To prevent inadvertent entrapment of CRLF during construction, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials. If this is infeasible, one or more escape ramps will be installed. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals.
  - Any erosion control materials used shall not entrap animals. Jute mesh, loose, open weave textile fiber netting, burlap or non-binded materials (e.g., rice straw) shall be used for erosion control or other purposes. Tightly woven fabric such as jute should have mesh size <1 cm while loosely woven materials should be > 6 cm to avoid entrapment. No plastic mono-filament matting shall be used for erosion control.
  - To the maximum extent practicable, no construction activities will occur during rain events or within 24-hours following a rain event. Prior to construction activities resuming, a USFWS-approved biologist will inspect the project area and all equipment/materials for the presence of CRLF. The animals will be allowed to move away from the project site of their own volition or be moved by the USFWS-approved biologist.
  - The USFWS-approved biologist(s) will permanently remove any aquatic exotic wildlife species, such as bullfrogs and crayfish from the project site, to the maximum extent possible.

Air Quality and Greenhouse Gas

To limit dust, criteria pollutants, and precursor emissions associated witl1 project construction, the following Bay Area Air Quality Management District-recommended Basic Construction Measures shall be required:

- Water all active construction areas with exposed soil surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads that have not been stabilized with soil binder, mulch, gravel, vegetation or other cover) sufficiently to prevent dust from becoming airborne.

- All trucks transporting soil, sand, or other loose material offsite shall be covered.
- Vehicle speeds on unpaved areas shall be limited to 15 miles per hour.
- Idling time of equipment when not in use will be avoided and low emission producing equipment will be used when feasible.

Alice Eastwood

- The location of an existing water line along the paved portion of Alice Eastwood Road will be marked prior to use of the road for construction access, as will any existing breaks in the water line. Upon completion of use of Alice Eastwood Road, NPS will repair any breaks in the water line and demonstrate full operation to California State Parks prior to demobilization.
- The Alice Eastwood Group Camp parking lot will be protected from heavy equipment impacts through use of protective materials such as plywood or plastic track mats and/or resealed with slurry as needed to restore to as good or better condition after use.

Water Quality

- SWPPPs and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of USACE. NPS will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and non-stormwater discharges. Protective measures will include, at a minimum, those listed below.
    - No discharge of pollutants from vehicle or equipment cleaning will be allowed into any storm drains or water courses.
    - Concrete waste and water from curing operations will be collected in washouts and will be disposed of and not allowed into water courses.
    - Erosion control measures will be implemented that provide for soil stability and prevent movement of soils during rain events (i.e., silt fences and tarps).

Noise

- Contractors will ensure that power equipment (vehicles, heavy equipment, and hand equipment such as chainsaws) are equipped with original manufacturer's sound-control devices. No equipment will be operated with an unmuffled exhaust.
- Except when required for safety or to ensure the integrity of a proposed project component, no work will be conducted on weekends or holidays. The hours specified in the Marin County noise ordinance will be adhered to as general guidance: general construction will be limited to the hours of 7 a.m. to 6 p.m. on Monday through Friday and 9 a.m. to 5 p.m. on Saturdays; loud noise generating equipment operation will be limited to 8 a.m. to 5 p.m. on Monday through Friday.
- Construction equipment will be properly maintained to minimize noise.

Cultural Resources

- Deep excavation (including bank terracing and potentially bridge construction) will be monitored by an archeologist who meets the U.S. Secretary of the Interior's professional qualification standards. If excavation occurs on Alice Eastwood Road or the Alice Eastwood Group Camp, the work will be monitored by an archeologist. Riprap removal and LWD installation will not be monitored by an archaeologist.
- Not all cultural resources are visible on the ground surface. If any cultural resources, such as structural features, unusual amounts of bone or shell, flaked or ground stone artifacts, historic-era artifacts, human remains, or architectural remains, are encountered during any project construction activities, work will be suspended immediately at the location of the find and within an appropriate radius of at least 50 feet, and the NPS archeologist will be notified immediately. The unanticipated discovery will be treated according to the guidelines outlined in 36 CFR 800.13.
- In the unlikely event that human remains are discovered during construction activities, all work will stop

within 50 feet of the discovery, and the NPS archeologist will be contacted immediately. Furthermore, as required by law, the requirements of California Health and Human Safety Code Section 7050.5 will be followed and the Marin County coroner will be notified. If the human remains are determined to be of Native American origin, NPS will follow the provisions outlined in the Native American Graves Protection and Repatriation Act (1990).

- The project prioritizes retaining the most visible segments of CCC rock work. Actions to mitigate the loss of historic fabric may include an interpretive program at MWNM to highlight the work done by the CCC, as well as extensive documentation of historic features adversely affected by the project. In addition, trail features constructed by the CCC throughout Muir Woods will be thoroughly documented and treatment guidelines will be developed to preserve or rehabilitate as warranted and archeological surveys will be conducted to ensure identification of and proper treatment measures for any as-yet unknown resources.
- Per the June 29, 2018 MOA between the NPS and SHPO, the NPS shall ensure that the following Stipulations and Minimization Measures are carried out to resolve adverse effects prior to the partial removal of the Redwood Creek Revetment, bridge replacement, and trail realignment:
    - The Park has completed a view shed analysis to determine which segments of the CCC rock work are the most visible from the existing trails. The project has been designed to prioritize retaining the most visible, intact segments as defined in the viewshed analysis.
    - Four new bridges will replace four non-contributing modern laminated-wood bridges that were constructed in the mid-l 980s. The new bridges will be designed to be compatible with the rustic character of the CCC constructed features.
    - The Alice Eastwood Road, an unpaved road within the Alice Eastwood Camp (P-21-002913), is located within the direct APE. NPS will protect the road by placement of gravel during the construction phase. At the conclusion of the project, NPS will remove the gravel under the observation of an archaeological monitor.
    - Archaeological monitoring shall occur throughout the undertaking and especially during riprap removal and burying of riprap boulders in the creek bed, floodplain grading, bridge construction, and trail grading.
    - The Park will produce Historic American Building Survey (HABS)/Historic American Engineering Record (HAER)/ Historic American Landscape Survey (HALS) documentation for the resource in consultation with the NPS Pacific West Regional Office HABS/HAER/HALS coordinator to determine the type and level of HABS/HAER/HALS Documentation.
    - The Park shall ensure that all such documentation is completed and accepted by HABS/HAER/HALS within two years of the execution of this agreement and prior to demolition.
    - The Park will ensure that all recordation and documentation activities are performed or directly supervised by architects, historians, and/or other professionals meeting the qualification standards in the Secretary of Interior's Professional Qualification Standards (36 CFR 61,Appendix A).
    - The National Park Service Pacific West Regional Office will ensure that archival copies of all documents resulting from the documentation and recordation are transmitted to the SHPO and Library of Congress. The Park will ensure that non-archival copies are accessioned into the permanent collections of Golden Gate National Recreation Area and
        - Mill Valley Library.
    - The Park's Interpretation and Education Division shall lead the development and implementation of additional interpretation of the CCC at Muir Woods.
    - Additional interpretation will include information on the Park's "Golden Gate App," and on Park web sites.
    - The Park will implement the interpretation enhancements within two years of the execution

of this agreement and prior to the demolition of the riprap.

- The Park will document and develop treatment guidelines for trail features constructed by the CCC within MWNM.
- In the event that a previously unidentified resource is encountered during this undertaking, or if an unanticipated affect to a resource results from this undertaking, the Park will halt activities in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the resource. The Park shall notify SHPO and FIGR of the discovery within two (2) working days. Park notification to SHPO and FIGR will include a description of unanticipated affects, an eligibility recommendation or a proposed schedule for assessing eligibility, and if appropriate, a process to resolve potential adverse effects.
- The Park shall make reasonable efforts to avoid, minimize, or mitigate adverse effects on previously unidentified resources or newly identified historic properties as advised by the park's cultural resource staff and in consultation with SHPO and FIGR.
- The Park shall ensure that any FIGR burials or FIGR human remains, funerary objects, sacred objects and objects of cultural patrimony discovered during implementation of an undertaking, archeological fieldwork, or other actions, are treated with appropriate respect and according to federal law, including, but not limited to the Native American Graves Protection and Repatriation Act (NAGPRA) and its implementing regulations at 43 CFR 10. Actions described herein do not constitute compliance with provisions of NAGPRA. If objections are raised by FIGR regarding treatment of human remains or cultural items as defined under NAGPRA, the objection will be resolved in accordance with NAGPRA. The park shall notify SHPO and ACHP of any such dispute if so requested by FIGR.
- The Park shall report annually on the implementation of this agreement, concurrent with the annual report on the park programmatic agreement, until all stipulations have been met.

Table 2 below includes additional Biological Conservation Measures and Incidental Take Measures required as described in the USFWS July 9, 2018 Biological Opinion for the three current Muir Woods projects: 1. Water and Sewer Line Rehabilitation, 2. Salmon Habitat Enhancement and Bridge Replacement, and 3. Sustainable Access Project.

TABLE 2
Marbled Murrelet
• Implement a Service-approved five-year monitoring plan for marbled murrelet inventory work to better understand their status in and around MWNM. • During the first year of construction (2018), all proposed project work in or near marbled murrelet habitat will occur after July 31 (outside of the core breeding season (March 15 - July 31) but during the late breeding season (August 1 - September 15) for the marbled murrelet). All noise-generating activities conducted during the marbled murrelet's late breeding season in 2018 will be restricted to the daytime hours from two hours after sunrise to two hours before sunset (avoiding the time period at night and within two hours of sunrise and sunset when marbled murrelets are most sensitive to noise disturbance) (California Department of Parks and Recreation (State Parks) 2017). The Service-approved five-year monitoring plan for the marbled murrelet will be implemented during the following five years of construction (2019 - 2023). If any marbled murrelets are detected, the Service will be notified immediately, and all noise-generating activities during the marbled murrelet's breeding season (March 15 - September 15) will be restricted to the daytime hours from two hours after sunrise to two hours before sunset. • Within marbled murrelet habitat, disturbance to native trees greater than 10 inches in diameter at

breast height will be avoided where feasible. No large coniferous trees that could potentially support marbled murrelet nesting *(i.e.,* coniferous trees with greater than 18 inches diameter at breast height or trees with large cavities or deformities that enhance nesting substrate) will be removed.

- Corvid management: conduct an assessment of NPS and State Park's trash receptacles and picnic areas in the Redwood Creek watershed within two miles of MWNM. Based on the assessment, replace trash receptacles that are not wildlife proof. In addition, develop signage to reduce wildlife feeding and access to food and install signage where necessary in picnic areas.

Northern Spotted Owl

- A Service-approved biologist will conduct annual monitoring of northern spotted owls in and adjacent to MWNM to determine the location of their activity centers for avoidance and to better understand their status in and around MWNM. A Set-vice-approved biologist will continue annual monitoring of northern spotted owls occupancy and fecundity for territories in and adjacent to MWNM for a period of at least five years.
- Avoid all project actions that raise noise levels above ambient background levels at an active northern spotted owl nest site. The determination of whether a nest is active will be based on following the Service's 2011 northern spotted owl survey protocol (Service 2011). A nest will be considered no longer active once a Service-approved biologist has determined that the fledgling northern spotted owls have left the natal grove.
- For any unsurveyed areas, any work that would raise noise levels above ambient background levels within suitable northern spotted owl habitat will occur outside the owl's Febmary 1 - July 31 breeding season.
- No large coniferous trees that could potentially support nesting northern spotted owls *(i.e.,* coniferous trees with greater than 18 inches diameter at breast height or trees with large cavities or deformities that enhance nesting substrate) will be removed. Within northern spotted owl habitat, disturbance to native trees greater than 10 inches in diameter at breast height will be avoided where feasible.
- Conduct barred owl inventory work for potential habitat areas inside and within two miles of the MWNM boundary for five years. Coordinate with the Barred Owl Science Team.
- Implement BMPs to prevent the introduction and spread of the exotic plant pathogen *Pytophthora* that threatens northern spotted owl nest trees *(i.e.,* Working Group for Phytophthoras in Native Habitats 2016 (Appendix B)).

California Red-legged Frog

- Storm Water Pollution Prevention Plans (SWPPPs) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the U.S. Army Corps of Engineers. The applicant will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and non-stormwater discharges. Protective measures will include, at a minimum, those listed below.
  - No discharge of pollutants from vehicle or equipment cleaning will be allowed into any storm drains or water courses.
  - Vehicle and equipment fueling and maintenance operations will be at least 5O feet away from water courses, except at established commercial gas stations or established vehicle maintenance facilities.
  - Concrete waste and water from curing operations will be collected in washouts and will be disposed of and not allowed into water courses.
  - Spill containment kits will be maintained onsite at all times during construction operations and/ or staging or fueling of equipment.
- If a work site is to be temporarily dewatered by pumping, intakes shall be completely screened with wire mesh not larger than five millimeters to prevent California red-legged frogs from entering the pump system. Water shall be released or pumped downstream at an appropriate rate to maintain downstream flows during construction. Upon completion of construction activities, any barriers to flow shall be

removed in a manner that would allow flow to resume with the least disturbance to the substrate.

- NPS through the applicant will maintain all construction equipment to prevent leaks of fuels, lubricants, or other fluids.
- Uneaten human food and trash attracts crows, ravens, coyotes, and other predators of the California red-legged frog. A litter control program will be instituted at each project site. All workers will ensure their food scraps, paper wrappers, food containers, cans, bottles, and other trash are deposited in covered or closed trash containers. The trash containers will be removed from the project site at the end of each working day.
- To the maximum extent practicable, no construction activities will occur during rain events or within 24 hours following a rain event. Prior to construction activities resuming, a Service-approved biologist will inspect the action area and all equipment/ materials for the presence of California red-legged frogs. California red-legged frogs will be allowed to move away from the project site of their own volition. NPS will contact the Service to reinitiate consultation if any California red-legged frogs are observed within the work area.
- To the maximum extent practicable, night-time construction will be minimized or avoided by NPS. Because dusk and dawn are often the times when the California red-legged frog is most actively moving and foraging, to the maximum extent practicable, earthmoving and construction activities will cease no less than 30 minutes before sunset and will not begin again prior to no less than 30 minutes after sunrise. Except when necessary for driver or pedestrian safety, to the maximum extent practicable, artificial lighting at a project site will be prohibited during the hours of darkness.
- The Service-approved biologist(s) will permanently remove any aquatic exotic wildlife species, such as bullfrogs and crayfish from the project site, to the maximum extent possible.
- A reconnaissance-level survey for California red-legged frog shall be conducted by a Service approved biologist within 48 hours prior to starting work in areas where frogs would be seen if present and that provide potentially suitable habitat. In areas where vegetation clearing is needed, sutveys shall be conducted concurrent with vegetation removal.
- If no California red-legged frogs are found within the work area during the sutvey, then the work may proceed. If California red-legged frogs are observed, NPS will reinitiate consultation with the Service to determine appropriate avoidance and minimization measures. Any sightings and/ or injuries of California red-legged frogs shall be reported to the Service within 24 hours.
- Pipes, conduits, and other materials that could provide shelter for California red-legged frogs shall be stored above ground level to reduce the potential for animals to climb into the conduits and other materials. Pipes or conduits may be left on ground level if capped at both ends.
- If a California red-legged frog is observed near the action area during construction activities, all work must stop and the California red-legged frog be allowed to leave the work area on its own volition. The Service will be notified immediately about the finding of any California red-legged frogs near the work area, and NPS will reinitiate consultation with the Service. Work will not resume until the Service and the Set-vice-approved biologist for the proposed project have determined that no California red-legged frogs will be harassed, injured, or killed by the proposed project.
- To prevent inadvertent entrapment of the California red-legged frog during construction, steep-walled holes or trenches more than 2 feet deep will be covered at the close of each working day by plywood or similar materials; if this is infeasible, one or more escape ramps will be installed. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals.
- Any erosion control materials used shall not entrap animals. Jute mesh, loose, open weave textile fiber netting, burlap or non-binded materials (e.g., rice straw) shall be used for erosion control or other purposes. Tightly woven fabric such as jute should have mesh size <1 centimeter while loosely woven materials be > 6 centimeters to avoid entrapment. No plastic mono-filament matting shall be used for erosion control.

General BMPs
• Clearly state all resource protection measures in the construction specifications, and instruct workers to avoid conducting activities outside the project area. • Hold a preconstruction meeting to inform contractors about sensitive areas, including natural and cultural resources. • Delineate construction zones outside of existing disturbed areas with flagging, and confine all surface disturbances to the construction zone. • Require contractors to properly maintain construction equipment to minimize noise, and do not allow construction vehicle engines to idle for extended periods. • Remove all tools, equipment, barricades, signs, and surplus materials from the project area upon completion of the proposed project. • Vehicles and equipment entering the MWNM will be inspected for leaking oil and fluids. Any leaking vehicles or equipment will be required to be fixed before entering
Geology and Soils
• Avoid or minimize disturbance to soils as much as possible. • Evaluate existing topsoil for invasive, nonnative plant infestations. • Remove topsoil heavily infested with invasive, nonnative plants. Salvage non-infested topsoil, store according to soil conservation guidelines, and replace once construction is complete. • Implement erosion control measures that provide for soil stability and prevent movement of soils during rain events (i.e., silt fences and tarps). • Aerate any ground surface temporarily disturbed during construction and replant with native vegetation to reduce compaction and prevent erosion. • All BMPs from the SWPPP will be implemented as required by the Construction General Permit. Erosion control and sedimentation BMPs will be implemented per the SWPPP.
Noise
• Idling times for construction equipment (including vehicles) shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 30 seconds as noted in the Air Quality BMPs in Table 1.
Water Resources and Hydrological Processes
• BMPs for drainage and sediment control, as identified and used by NPS, will be implemented to prevent or reduce nonpoint source pollution and minimize soil loss and sedimentation in drainage areas. These practices may include, but are not limited to, silt fencing, filter fabric, temporary sediment ponds, check dams of pea gravel-filled burlap bags or other material, and/ or immediate mulching of exposed areas to minimize sedimentation and turbidity impacts as a result of construction activities. The placement and specific measures used will be developed in coordination with a qualified SWPPP developer. • Any erosion control materials used shall not entrap animals. Jute mesh, loose, open weave textile fiber netting, burlap or non-binded materials *(e.g.,* rice straw) shall be used for erosion control or other purposes. Tightly woven fabric such as jute should have mesh size <1 centimeter while loosely woven materials be > 6 centimeters to avoid entrapment. No plastic mono-filament matting shall be used for erosion control. • Erosion control measures will be left in place at the completion of construction to avoid adverse impacts on water resources, after which time MWNM will be responsible for maintenance and removal once vegetation is established. • Wetlands will be identified by qualified MWNM staff or certified wetland scientists and clearly marked before const1uction work. Const1uction activities will be performed with caution to prevent damage caused by equipment, erosion, siltation, or pollutant discharges.

• To the maximum extent practicable, no construction activities will occur during rain events or within 24 hours following a rain event.
Vegetation
• MWNM will develop a detailed revegetation and rehabilitation plan for enhancing areas disturbed by the proposed project. The primary objective of the plan will be to reestablish a self-sustaining native plant community and ensure soil stability. Disturbed area treatments will include grading to natural contours; replacing stockpiled topsoil; and mulching, replanting, or reseeding with native vegetation. Planted areas will be monitored annually after construction for a minimum of five years to determine whether revegetation efforts were successful and if remedial actions such as erosion control; invasive, nonnative plant species control; or replacement plantings are necessary. BMPs will be implemented to prevent the • introduction and spread of the exotic plant pathogen *Phytophthora (i.e.,* Working Group for • Phytophthoras in Native Habitats 2016 (Attachement B)). • Disturbance to particular species such as coast redwood, California bottlebrush grass, leopard lily, and California buckeye will be avoided to the greatest extent possible. • Prior to construction, NPS will survey for rare California plants in areas where they may occur in vegetated construction zones. Surveys for state and locally (California Native Plant Society) listed plants that may occur in the proposed project area will be conducted at appropriate times. If state or locally listed plants are found and cannot be avoided, seeds will be collected and propagated before revegetating disturbed areas. Revegetated areas with rare plants will be monitored for up to three years, and remedial actions will be taken to ensure that rare plants are reestablished. • The contractor will prevent or minimize establishment and spread of nonnative vegetation and noxious weeds by: minimizing soil disturbance; pressure washing vehicles; covering haul vehicles; limiting vehicle and equipment parking to the project area; obtaining all fill, rock, or additional topsoil from the project area or obtaining weed-free material from approved sources outside the MWNM.
General Biological Resources BMPs
• Access and/or construction below ordinary high water will be limited to June 15 to October 31, unless conditions to allow the start of salmon spawning do not occur by October 31 and continued work is approved by or otherwise permitted by regulatory agencies, to minimize potential adverse effects to salmonid spawning and movement. The actual work window could be adjusted slightly and will depend upon the current water year, creek conditions, and timing of salmonid migrations. • All temporary fill, cofferdams, pumps, pipes and sheet plastic will be removed from the stream upon completion of each proposed project phase, as well as upon project completion. • A Service-approved biological monitor will be present during implementation of the creek restoration work. The biological monitor will ensure that any unanticipated impacts to natural resources are avoided.

Table 3 below describes Incidental Take measures and requirements for all three projects, including the Salmon Habitat Enhancement and Bridge Replacement Project. The measures and requirements described are non-discretionary, and must be undertaken by the NPS so that they become binding conditions of any grant or permit issued to the contractor.

TABLE 3
Incidental Take
• Amount or Extent of Take: The harm of two adult marbled murrelets and harm and injury of one juvenile marbled murrelet during one of the five years of construction during the marbled murrelet's core breeding season. • Effect of the Take: The Service determined that this level of anticipated take is not likely to result in jeopardy to the marbled murrelet.

- All necessary and appropriate measures to avoid or minimize effects on the marbled murrelet resulting from implementation of this project have been incorporated into the project's proposed conservation measures as described in the Biological Assessment. Therefore, the Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the marbled murrelet.
- The NPS shall include full implementation and adherence to the conservation measures as a condition of any permit or contract issued for the proposed project.
- The NPS shall have the five-year inventory plan for the marbled murrelet reviewed and approved by the Se1vice by December 2018 and prior to any proposed project construction during the core breeding season (March 15 - July 31) for the marbled murrelet.
- The NPS shall immediately contact the Service's Sacramento Fish and Wildlife Office (SFWO) to report direct encounters between listed species and project workers and their equipment whereby incidental take in the form of harassment, harm, injury, or death occurs. When injured or killed individuals of the listed species are found, the NPS shall follow the steps outlined below:
    - Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as the Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen.
- Monitor northern spotted owls, invasive barred owls, and marbled murrelets at GGNRA and other NPS lands. Coordinate with the Barred Owl Science Team.
- Manage corvids within all suitable marbled murrelet habitat on NPS lands.
- Implement phytosanitary BMPs (Working Group for Phytophthoras in Native Habitats 2016 (Attachement B) for all restoration projects in northern spotted owl habitat to minimize the risk of the introduction and spread of exotic Phytophthora species.
- In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.
- Reinitiation of formal consultation is required and shall be requested by the federal agency or by the Service where discretionary federal agency involvement or control over the action has been retained or is authorized by law and:
    - If the amount or extent of taking specified in the incidental take statement is exceeded;
    - If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
    - If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or
    - If a new species is listed or critical habitat designated that may be affected by the identified action.

ATTACHMENT B

GUIDELINES TO MINIMIZE *PHYTOPHTHORA* CONTAMINATION IN RESTORATION PROJECTS BY THE WORKING GROUP FOR PHYTOPHTHORAS IN NATIVE HABITATS

OCTOBER 2016

These guidelines aim to avoid contamination of restoration sites with exotic pathogenic *Phytophthora* species or other plant pathogens during planting and related activities.

Contents

Definitions:

Holding facility or nursery: A facility where nursery stock is maintained for a short to extended period of time prior to planting. Plant maintenance activities may include irrigation, fertilization or light pruning, as necessary. Nurseries involved in most other activities, including propagation or repotting are considered production nurseries.

Job site: The job site includes areas for planting, soil stockpiling, parking, and access roads within and leading to the site.

Nursery stock: All types of nursery grown plants.

Planting area: Area being planted for habitat restoration, erosion control, or other purposes.

Planting site: An individual planting basin or other spot, typically no larger than one square yard, where an individual plant or several grouped plants will be installed.

Sanitize: Clean and treat with a sanitizing agent or via a lethal heat exposure to kill plant pathogens present as external contamination.

Sanitizing agent: Materials such as bleach (sodium hypochlorite solutions), alcohol, quaternary ammonium compounds, and peroxides that can directly kill exposed propagules of *Phytophthora* or other plant pathogens when used properly. Most sanitizing agents can also kill a wide variety of bacteria and deactivate many viruses. Note that most materials referred to as fungicides are applied to plants to suppress disease but may not kill the pathogens and are not sanitizing agents.

I. Construction projects

In an effort to minimize the spread of plant pathogens the exterior and interior of all equipment and tools must be clean and free of debris, soil and mud (including tires, treads, wheel wells and undercarriage) prior to arrival at a new job site.

General guidance - suggested standard operating procedures:

a. Vehicles need to stay on established roads unless infeasible.

b. In general, vehicles and equipment need to be maintained clean - interior and exterior free of mud, debris and soil especially during the wet season.
   1.
c. In general, work shoes need to be kept clean- inspect shoe soles and knock mud, debris and soil off treads before moving to a new job site.
   2.
d. To minimize the potential for spreading potentially contaminated soil and time required for decontamination, if possible, avoid vehicle traffic and field work when soils are wet enough to stick readily to shoes, tools, equipment and tires.

II. Planting at Field Sites

Overview: Three general routes for the spread of *Phytophthora* and other soilborne plant pathogens are addressed in these guidelines. These routes are (1) contamination of planting material, including clean nursery stock, and other materials installed at the site, (2) inadvertent introduction of pathogens to a job site from other outside sources (e.g., via contaminated equipment), and (3) potential movement of undetected contamination within the planting area.

These guidelines assume that all nursery stock was originally grown under phytosanitary conditions and tested as remaining free from disease in the nursery (refer to nursery guidelines). These guidelines address how to protect the planting area from subsequent contamination during the delivery, storage onsite, and installation of planting stock and materials.

1. Prevent contamination of clean nursery stock or other clean plant materials

- Planting stock shall be protected from potential contamination from the point that it leaves the production nursery or collection site until planting. Note that nursery stock has a high risk of infection by *Phytophthora* species if exposed to these pathogens. Excluding these pathogens provides the only viable option for maintaining outplanted nursery stock free of *Phytophthora*.

- Delivered nursery plants that will be held before planting shall be transferred to cleaned and sanitized raised benches and maintained as described in "Guidelines to Minimize *Phytophthora* Pathogens for holding (non-production) nurseries at restoration sites, Section 3."

2. Handling and transporting nursery plants at the job site

- Nursery plants shall be transported on or in vehicles or equipment that have been cleaned before loading the stock. Truck beds, racks, or other surfaces need to be swept, blown with compressed air and/or power washed as needed so they are visibly free of soil and plant detritus. More information on sanitizing surfaces are described in the Appendix.

- Keep plants in sanitized vehicles or on sanitized carts, trailers, etc. until delivered to their planting

sites.

- At the job site, plants shall be handled to prevent contamination until delivered to each planting site. Nursery stock shall not be placed on the soil or other potentially contaminated surfaces until they are placed at their specific planting sites.

- If it is necessary to offload plants at the job site, plants may be placed on clean waterproof plastic tarps or other clean, sanitized surfaces. lf tarps are used for holding plants, one surface needs to be dedicated for contact with nursery stock and will be cleaned and sanitized to maintain phytosanitary conditions.

3. Handling and transporting nursery plants at the job site

- Washing, soaking, or irrigation of plant material shall be conducted using clean water sources as specified in the Appendix below. Untreated surface waters should not be used for these purposes.

- On-site or off-site collection of plant materials, including seed and cuttings for direct planting, shall be conducted in a phytosanitary manner (see guidelines for collection practices at www.calphytos.org).

- Prior to delivery to the planting areas, mulch, compost, soil amendments, inoculants, and other organic products need to be examined and determined to be low-risk for pathogen introduction. Acceptable materials are those that are free of contamination by plant pathogens based on their composition or manufacturing conditions, or that have been exposed to an effective heat treatment to eliminate pathogens. Such materials must be handled and stored in a manner that prevents contamination. At the job site, delivered materials shall be handled to prevent contamination until delivered to each planting site in the same manner specified for nursery stock noted above.

- All other materials to be installed at the site shall be of new or sanitized material that has not been stored in contact with soil, untreated surface waters, or other potentially contaminated materials. This includes irrigation supplies (such as pipe, fittings, valves, drip line, emitters, etc,), erosion control fabrics, fencing, stakes, posts, and other planting site inputs.

4. Cleaning and sanitation required before entering planting area to prevent introducing contamination from other locations

- Equipment, vehicles and large tools must be free of soil and debris on tires, wheel wells, vehicle undercarriages, and other surfaces before arriving at the planting area. A high pressure washer and/or compressed air may be used to ensure that soil and debris are completely removed. Vehicles that only travel and park on paved roads do not require external cleaning.

- The interior of equipment (cabs, etc.) should be free of mud, soil, gravel and other potentially contaminated material. Interiors should be vacuumed, washed, and/or treated with sanitizing agents as needed to eliminate pathogen propagules that could be transferred to the planting area.

- Small tools and other small equipment (including hoses, quick couplers, hose nozzles, and irrigation wands) need to be washed to be free of soil or other contamination and sanitize (see Appendix).

- Hoses shall be new or previously used only for clean water sources (see Appendix).

- Soles and uppers of footwear need to be visibly free of debris and soil before arriving at the planting area. (See the Appendix for more details.)

- At the start of work at each new job site, worker clothing shall be free of all mud, soil or detritus. If clothing is not freshly laundered, all debris and adhered soil should be removed by brushing with a stiff brush.

- Gloves and non-porous knee pads must be new (if disposable) or laundered/sanitized at the start of each work day, and/or clean coveralls must be worn. Non-disposable gloves should be made of or coated with material, such as nitrile, that can be sanitized.

5. Prevent potential spread of contamination within planting areas

- Before entering the job site, field workers need to receive training that includes information on *Phytophthora* pathogens and how to prevent the spread of these and other soil borne organisms by following approved phytosanitary procedures. Workers should also be informed about any site-specific phytosanitary practices before work commences.

- Do not bring more vehicles into the planting area than necessary and keep vehicles on surfaced or graveled roads whenever possible to minimize potential for soil movement.

- Travel off roads or on unsurfaced roads should be avoided when soil and road surfaces are wet enough that soil will stick to vehicle tires and undercarriages.

- To allow for adequate decontamination of equipment, tools, gloves, and shoes, avoid planting under overly wet conditions or when soil is saturated.

5. Minimize unnecessary movement of soil and plant material within the planting area, especially from higher to lower risk areas

- Brush off soil from tools and gloves when moving between successive planting sites to prevent repeated collection and deposition of soil across multiple sites.

- Avoid contaminating clothing with soil during planting operations. Brush off soil accumulations before moving from one planting site to the next. Use nonporous knee pads that are cleaned between planting sites if kneeling is necessary.

- When possible, plant nursery stock from a given block in the same local area rather than spreading it widely. If a problem is associated with a given block of plants, it will be easier to detect and deal with it if the plants are spatially grouped.

- Phase work to minimize movement between areas with high and low risk of contamination. Where possible, complete work in low risk areas before moving to higher risk areas. Alternatively, assign personnel to working in either high or low risk areas exclusively to reduce the need for decontamination.

- Clean soil and plant debris from large equipment and sanitize hand tools, buckets, gloves, and footwear when moving from higher risk to lower risk areas or when moving between widely separated portions of the planting area.

- All non-plant materials to be installed at the site (irrigation equipment, erosion control fabric, fencing, etc.} shall be handled to prevent movement of soil within the site, especially movement from higher risk to lower risk areas. Materials should be kept free of soil contamination by maintaining them in clean vehicles or carts, trailers, etc., or stockpiling in elevated dry areas on clean tarps until used.

6. Clean water specifications

- Water used for irrigating plants needs to be uncontaminated. See Appendix for specifications.

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Appendix

A. Procedures for sanitizing tools, surfaces, and footwear

- Surfaces and tools should be clean and sanitized before use. Tools and working surfaces (e.g., plant carts) should be smooth and nonporous to facilitate cleaning and sanitation. Wood handles on tools should be sealed with a waterproof coating to make them easier to sanitize.

- Before sanitizing items, remove all soil and organic material {roots, sap, etc.) from their surfaces. If necessary, use a detergent solution and brush to scrub off surface contaminants. The sanitizing agent may also be used as a cleaning solution. Screwdrivers or similar implements may be needed to clean soil out of crevices or shoe treads. Brushes and other implements used to help remove soil must be visibly clean and sanitized after use.

- After surface soil and contamination are removed, treat the surface with one of the following sanitizing agents, allowing the appropriate contact time before rinsing. If surfaces are clean and dry, wet surfaces thoroughly and allow for the appropriate contact time listed. If the sanitizer has been used to help clean the surface, use fresh sanitizer to rinse off any dirty solution and then allow the required contact time. If treated surfaces are wetted with water, the sanitizing solution will become diluted. Apply enough sanitizer to completely displace the water film and then allow the required contact time. Sanitizing agents may be applied with spray bottles to thoroughly wet the surface. Observe all appropriate safety precautions to prevent contact with eyes or skin when using these solutions.

    - 70-90% ethyl or isopropyl alcohol - spray to thoroughly wet the surface and allow to air dry before use.

    - freshly diluted bleach solution (0.525% sodium hypochlorite, Table 1) for a minimum of 1 minute (due to corrosivity, not advised for steel or other materials damaged by bleach)

    - quaternary ammonium disinfectant - use according to manufacturer recommendations, making sure that the label indicates that the product is suitable for your use situation and has activity against *Phytophthora* when used as directed. Solution should be freshly made or tested to ensure target concentration.

Table 1. Dilutions of commonly available bleach products needed to obtain approximately 0.525% sodium hypochlorite concentrations (5000 ppm available chlorine)

Percent sodium hypochlorite in bleach	Parts bleach	Parts water	Diluted bleach percent sodium hypochlorite
5.25%	1	9	0.525%
6.00%	1	10.4	0.526%
8.25%	1	14.6	0.529%
8.30%	1	14.8	0.525%

For example, adding 100 ml of 5.25% bleach to 900 ml of water will make 1000 ml of 0.525 NaOCI solution. If using 8.3% bleach, add 100 ml of bleach to 1480 ml of water to make 1580 ml of 0.525% NaOCI.

B. Clean water specifications

- Water used for irrigation shall be from treated municipal water supplies or wells and delivered through intact pipes with backflow prevention devices. Tertiary-treated municipal recycled water is acceptable.

- If well water is used, wellheads shall be protected from contamination by surface water sources.

- Untreated surface waters and recycled nursery runoff shall not be used, and plants shall not be held where potential contamination from such sources is possible via splash, runoff, or inundation.

- Irrigation equipment must be kept free of contamination that could be transferred to irrigation water or plants. All hoses, wands, and nozzles, and hand irrigation equipment must either be new or sanitized before use. Drip irrigation and other sprinkler parts should be new or sanitized. Hose ends, wands, or nozzles that become contaminated with soil or mud during use should be cleaned and sanitized before being used further.