PROJECTS

CONTRACTORS HANDBOOK

Version 1.2, November 20, 2020

Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS)
Synthesis of Programmatic Endangered Species Act (ESA) Section 7 Consultation

National Marine Fisheries Service **U.S. Fish and Wildlife Service**

TABLE OF CONTENTS – Required If Checked Below

CHANGES in the Contractors' Handbook from Version 1.1 to 1.2

The following updates were made to the Contractors' Handbook

The following summarizes updates made to the Contractors' Handbook Version 1.2

Note: For 2020, the new text within the handbook is green.

PDC 2: Stream Channel Enhancement (Large Wood, Boulder, and Gravel Placement)

- Tree Removal for Large Wood Projects. Clarification was added to the sections. Clarification was needed to distinguish between actions outside of versus within Northern Spotted Owl and Marbled Murrelet Habitats. The new text was developed consistent with ARBO. Species-specific conservation measures for NSO and MaMu were also updated to reflect the changes in PDC 2 and ensure consistency.

PDC 8: Reduction/Relocation of Recreation Impacts

- Text was added to clarify that this action could also occur in prairie, meadow and upland habitats. Existing text did not include these areas, which was an oversight.

Streaked Horned Lark, Species-specific conservation measures

- Removed requirement for additional review of projects affecting SHL under PDC 6.c.

Streaked Horned Lark and Herbicides, Species-specific conservation measures

- The herbicides allowed in occupied SHL habitats were updated to reflect additional analysis conducted by USFWS (J.Buck) for the HIP4 consultation.

Oregon Silverspot Butterfly, Species-specific conservation measures

- Multiple updates were provided to the OSB conservation measures, given the status of OSB and the need to improve and streamline conservation efforts.
- The changes were reviewed by a variance process in 2019. Given declines in OSB, Anne Walker requested that these updates be incorporated to improve/streamline conservation efforts in order to rapidly implement restoration efforts.

Lamprey & Freshwater Mussel Conservation Recommendations

- These were updated to reflect the completion of new Best Management Guidelines for these species.

INTRODUCTION

This document summarizes the design and construction requirements of two programmatic biological opinions (BOs; BiOps) issued by the U.S. Fish and Wildlife Service's (Service) and the National Marine Fisheries Service (NMFS) on the effects of Service's and NOAA Restoration Center's (NOAA RC) habitat restoration actions on federally listed species. Jointly, the BO's are called "*Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services*" or PROJECTS.

The Service and NMFS will periodically review and recommend revisions as appropriate to General Conservation Measures (GCMs), Project Design Criteria (PDCs), Species-Specific Conservation Measures (SSCMs), and other specific implementation guidelines in PROJECTS. These changes, that are agreed to and approved by NMFS and/or the Service, will be incorporated into this Contractor Handbook annually. Updates within this Contractor Handbook are incorporated in blue text to differentiate from the original language. This handbook will also contain clarifications and recommended best pratices. The original BO's for PROJECTS will not be updated until there is a reinitiation trigger as identified in the respective biological opinions. It is therefore essential to use the most recent version of this handbook.

Updated Staff and Contractors Handbooks, and PROJECTS BOs can be downloaded at: http://www.fws.gov/oregonfwo/ToolsForLandowners/OtherResources.asp, or on our Sharepoint site: https://connect.doi.gov/fws/Portal/ppbonmfs/SitePages/Home.aspx

The categories of actions presented in this handbook represent design and construction-related activites in nearly every ecosystem in Idaho, Oregon, and Washington. If at any time there are uncertainties in implementing a GCM, PDC, or SSCM, or doubts about which one applies, the project manager will coordinate with the Service and/or NMFS to address those concerns and resolve any outstanding issues before proceed with project implementation.

Contacts for questions related to PROJECTS
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Projects that cannot meet the GCMs, PDC's or SSCM's presented in this handbook will require a project specific minor variance or separate, individual Section 7 consultation. Failure to fully implement GCMs, PDCs and SSCMs contained in this handbook, or agreed to through a written minor variance, can result in loss of ESA coverage for the project. If you determine that you maynot be able to meet any of the enclosed criteria, contact the Service or NMFS Project Manager immediately.

Project Categories

1. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation and Screen Installation/Replacement) (PDC 33)
2. Stream Channel Enhancement (Large Wood (LW), Boulder, and Gravel Placement; Engineered Logjams (ELJ); Constructed Riffles, Porous Boulder Step Structures and Vanes; Gravel Augmentation; Tree Removal for LW Projects) (PDC 34)
3. Dam and Legacy Structure Removal (PDC 35)
4. Fluvial Channel Reconstruction/Relocation (PDC 36)
5. Off- and Side-Channel Habitat Restoration (PDC 37)
6. Streambank Restoration (PDC 38)
7. Set-Back or Removal of Existing Berms, Dikes, and Levees (PDC 39)
8. Reduction/Relocation of Recreation Impacts (PDC 40)
9. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering (PDC 41)
10. Piling, Marine Debris, and other Structure Removal (PDC 42)
11. Shellfish Bed/Nearshore Habitat Restoration (PDC 43)
12. In-channel Nutrient Enhancement (PDC 44)
13. Road and Trail Erosion Control and Decommissioning (PDC 45)
14. Juniper Removal (PDC 46)
15. Native Fish Protection (PDC 47)
16. Beaver Habitat Restoration (PDC 48)
17. Wetland Restoration (PDC 49)
18. Tide/Flood Gate Removal, Replacement, or Retrofit (PDC 50)
19. Native Vegetation Restoration and Management (PDC 51)
20. Upland Silvicultural Treatments (PDC 52)
21. Install Wildlife Structures (PDC 53)

GENERAL CONSERVATION MEASURES

These measures are applicable to all projects.

1. **Site Access.** The Action Agencies will retain the right of reasonable access to each project site to monitor the use and effectiveness of these conditions.

2. **On-Site Documentation.** The following documentation will be posted at the project site or accessible in the area of work if not feasible to post:
    a. Name(s), phone number(s), and address(es) of the person(s) responsible for oversight will be posted at the work site.
    b. A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site.
    c. Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities, will be readily available on-site.
    d. A standing order to cease work in the event of high flows (above those addressed in the design and implementation plans) or exceedance of water quality limits will be posted on-site.

3. **Project Design Process.** In addition to specific conservation measures below, it is expected that project managers will use the best available scientific information regarding the likely effects of climate change on resources in the project area, including projections of local stream flow and water temperature, and/or sea level rise and sediment transport processes, to ensure that the project will be adaptable to those changes.

    The following general design considerations will be applied for all actions completed under the PROJECTS program:
    a. Obtain all applicable regulatory permits and official project authorizations before beginning construction.
    b. Design the project to minimize the extent and duration of earthwork, *e.g.*, compacting, dredging, drilling, excavation, noise, and filling, including the following concerns:
        i. Minimize use of heavy equipment, vehicles or power tools below bankfull elevation to the extent possible project specialists determine such work is necessary, or will result in less risk of sedimentation or other ecological damage than work above that elevation.
        ii. Complete earthwork in wetlands, riparian areas, and stream channels as quickly as possible.
        iii. Specify that the construction contractor is to cease project operations when high flows or high tides may inundate the project area, except for efforts to avoid or minimize resource damage.
    c. Project designs for a specific species should include review/input from a biologist at the local Service office with appropriate knowledge of the particular species, such as the Service state species lead for affected species. The biologist has the discretion to adjust disturbance and disruption distances, based on site-specific conditions and known biology of the species.
    d. Hollow pipes, such as those used for signs, fences and gates, will be capped to prevent trapping small birds and mammals.

4. **Site Contamination Assessment.** Pursuant to Service policy, project managers will conduct a site contamination assessment as part of the design process to determine whether there is a likelihood of hazardous materials being present at the site, and include measures in the design to prevent release of such materials as a result of the project and to handle and dispose of them according to applicable regulations.
    a. The level of detail and resources committed to such an assessment will be commensurate with the level and type of past or current development at the site. Assessments may include the following:
        i. Review available records, such as former site use, building plans, and records of any prior contamination events.
        ii. If the project site was used for industrial processes (*i.e.*, mining or manufacturing with chemicals), inspect to determine the environmental condition of the property.
        iii. Interview people who are knowledgeable about the site, *e.g.*, site owners, operators, and occupants, neighbors, or local government officials.
    b. Retain contaminant survey information in the project file. Discuss with NMFS and the Service if ground disturbance or other activities to accomplish the proposed project has substantial potential to release contaminants into habitats that support listed fish and wildlife species to determine if additional consultation is needed.

5. Site Layout and Flagging

a. Before any significant ground disturbance or entry of mechanized equipment or vehicles into the construction area, clearly flag, mark with survey paint, or other obvious boundary marker, the following areas as appropriate:
    i. Sensitive areas, *e.g.*, wetlands, water bodies, ordinary high water, spawning areas, appropriate buffer zones for listed plant and animal species and their habitats, as identified in the proposed conservation measures.
    ii. Equipment entry and exit points.
    iii. Road and stream crossing alignments.
    iv. Staging, storage, and stockpile areas.
b. Before the use of herbicides, clearly flag no-application buffer zones if possible.

6. Staging, Storage, and Stockpile Areas

a. Designate and use staging areas to store hazardous materials, or to store, fuel, or service heavy equipment, vehicles and other power equipment with tanks larger than 18.9 l (5 gallons), that are at least 45.7 m (150 feet) from any natural water body or wetland, or on an established paved area, such that sediment and other contaminants from the staging area cannot be deposited in the floodplain or stream.
b. Natural materials that are displaced by construction and reserved for restoration, *e.g.*, LW, gravel, and boulders, may be stockpiled within the 100-year floodplain.
c. Dispose of any material not used in restoration and not native to the floodplain outside of the functional floodplain.

d. After construction is complete, obliterate all staging, storage, or stockpile areas, stabilize the soil, and revegetate the area.[1]

7. Erosion Control

a. Use site planning and site erosion control measures commensurate with the scope of the project to prevent erosion and sediment discharge from the project site.
b. Before significant earthwork begins, install appropriate, temporary erosion controls downslope to prevent sediment deposition in the riparian area, wetlands, or water body.
c. During construction, if eroded sediment appears likely to be deposited in the stream, install additional sediment barriers as necessary.
d. Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
e. Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious weed-free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
f. Remove sediment from erosion controls if it reaches 1/3 of the exposed height of the control.
g. Whenever surface water is present, maintain a supply of sediment control materials and an oil-absorbing floating boom at the project site.
h. Stabilize all disturbed soils following any break in work unless construction will resume within four days.
i. Remove temporary erosion controls after construction is complete and the site is fully stabilized.
j. For projects involving near- and in-water construction, complete and record the following water quality observations to ensure that any increases in suspended sediment do not exceed background levels:
    i. Take a turbidity sample using an appropriately and regularly calibrated turbidimeter, or a visual turbidity observation, every 4 hours when work is being completed, or more often as necessary to ensure that the in-water work area is not contributing visible sediment to water, at a relatively undisturbed area approximately 100 feet upstream from the project area, or 300 feet from the project area if it is subject to tidal or coastal scour. Record the observation, location, and time before monitoring at the downstream point.
    ii. Take a second visual observation, immediately after each upstream observation, approximately 50 feet downstream from the project area in streams that are 30 feet wide or less, 100 feet from the project area for streams between 30 and 100 feet wide, 200 feet from the discharge point or nonpoint source for streams greater than 100 feet wide, and 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour. Record the downstream observation, location, and time.
    iii. Compare the upstream and downstream observations. If more turbidity or pollutants is/are observed downstream than upstream, the activity will be modified to reduce pollution. Continue to monitor every 4 hours.

[1] Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface, and reshaping to match the original contour.

iv. If the exceedance continues after the second monitoring interval (after 8 hours), the activity will stop until the levels returns to background.
v. Results of turbidity monitoring and sampling will be summarized and submitted to NMFS in the Action Implementation Form within 60 days of end of construction.

8. Hazardous Material Spill Prevention and Control

a. At the project site:
   i. Post or have available on site, written procedures for notifying environmental response agencies, including an inventory and description of all hazardous materials present, and the storage and handling procedures for their use.
   ii. Maintain a spill containment kit, with supplies and instructions for cleanup and disposal, adequate for the types and quantity of hazardous materials present.
   iii. Train workers in spill containment procedures, including the location and use of the spill containment kits.
b. Temporarily contain any waste liquids under an impervious cover, such as a tarpaulin, in the staging area until the wastes can be properly transported to, and disposed of, at an approved receiving facility.

9. Equipment, Vehicles, and Power Tools

a. Select, operate and maintain all heavy equipment, vehicles, and power tools to minimize adverse effects on the environment and noise disturbance to listed species, *e.g.*, low pressure tires, minimal hard-turn paths for track vehicles, use of temporary mats or plates to protect wet soils.
b. Before entering wetlands or working within 150 feet of a waterbody, replace all petroleum-based hydraulic fluids with biodegradable products.[2]
c. Take appropriate measures necessary for invasive species prevention and control:
   iv. Before entering and leaving the project site, power wash all heavy equipment, vehicles and power tools, allow them to fully dry, and inspect them to make certain no plants, soil, or other organic material is adhering to their surface.
   v. Before entering and leaving the water, inspect any watercraft, waders, boots, or other gear to be used in or near water and remove any plants, soil, or other organic material adhering to the surface.
   vi. Ensure all vehicles, equipment, and tools are as clean as possible and free from any seeds or vegetative matter.
d. Inspect all equipment, vehicles, and power tools for fluid leaks before they leave the staging area.

[2] For additional information and suppliers of biodegradable hydraulic fluids, motor oil, lubricant, or grease, see Environmentally Acceptable Lubricants by the U.S. EPA (2011); *e.g.*, mineral oil, polyglycol, vegetable oil, synthetic ester; Mobil® biodegradable hydraulic oils, Total® hydraulic fluid, Terresolve Technologies Ltd.® bio-based biodegradable lubricants, Cougar Lubrication® 2XT Bio engine oil, Series 4300 Synthetic Bio-degradable Hydraulic Oil, 8060-2 Synthetic Bio-Degradable Grease No. 2, *etc*. The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Interior or USFWS of any product or service to the exclusion of others that may be suitable.

e. Before operation within 150 feet of any waterbody, and as often as necessary during operation, thoroughly clean all equipment, vehicles, and power tools to keep them free of external fluids and grease and to prevent leaks and spills from entering the water.
f. Generators, cranes or other stationary heavy equipment operated within 150 feet of any waterbody will be maintained and protected as necessary to prevent leaks and spills from entering the water.

10. Temporary Access Roads and Paths

a. Whenever reasonable, preferentially use existing access roads and paths.
b. Minimize the number and length of temporary access roads and paths through riparian areas and floodplains.
c. Minimize removal of riparian vegetation.
d. When it is necessary to remove vegetation, cut at ground level (no grubbing).
e. Do not build temporary access roads or paths where grade, soil, or other features suggest slope instability.
f. Any road on a slope steeper than 30% will be designed by a civil engineer with experience in steep road design.
g. After construction is complete, obliterate all temporary access roads and paths, stabilize the soil, and revegetate the area.
h. Temporary roads and paths in wet areas or areas prone to flooding will be obliterated by the end of the in-water work window. Decompact road surfaces and drainage areas, pull fill material onto the running surface, and reshape to match the original contours.

11. Dust Abatement

a. Employ dust abatement measures commensurate with soil type, equipment use, wind conditions, and the effects of other erosion control measures.
b. Sequence and schedule work to reduce the exposure of bare soil to wind erosion.
c. Maintain spill containment supplies on-site whenever dust abatement chemicals are applied.
d. Do not use petroleum-based products.
e. Do not apply dust-abatement chemicals, *e.g.*, magnesium chloride, calcium chloride salts, ligninsulfonate, within 25 feet of water body, or in other areas where there may be runoff into a wetland or water body.
f. Do not apply ligninsulfonate at rates exceeding 2.26 l/m^2 (0.5 gallons per square yard) of road surface, assuming a 50:50 solution of ligninsulfonate to water.

12. Temporary Stream Crossings

a. No stream crossing may occur where listed amphibians are present.
b. No stream crossing may occur at active spawning sites when holding adult listed fish are present, or when eggs or alveins are in the gravel.
c. Do not place temporary crossings in areas that may increase the risk of channel re-routing or avulsion, or in potential spawning habitat, *e.g.*, pools and pool tailouts.
d. Minimize the number of temporary stream crossings; use existing stream crossings whenever reasonable.
e. Install temporary bridges and culverts to allow for equipment and vehicle crossing over perennial streams to access construction areas.

f. Wherever possible, vehicles and machinery will cross streams at right angles to the main channel.
g. Equipment and vehicles may cross the stream in the wet only where the streambed is bedrock, where the streambed is naturally stable, or where mats or off-site logs are placed in the stream and used as a crossing.
h. Obliterate all temporary stream crossings as soon as they are no longer needed, and restore any damage to affected stream banks or channel.

13. Surface Water Withdrawal and Construction Discharge Water

a. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
b. Diversions may not exceed 10% of the available flow and will have a juvenile fish exclusion device that is consistent with NMFS's criteria (NMFS 2011 or the most recent version).[3]
c. Treat all construction discharge water using BMPs to remove debris, sediment, petroleum products, and any other pollutants likely to be present (*e.g.*, green concrete, contaminated water, silt, welding slag, sandblasting abrasive, grout cured less than 24 hours, drilling fluids), to ensure that no pollutants are discharged to any perennial or intermittent waterbody.

14. Temporary Fish Passage

a. Provide fish passage for any adult or juvenile listed fish likely to be present in the action area during construction, unless passage did not exist before construction. Stream isolation and dewatering is required during project implementation, unless the stream is naturally impassable at the time of construction.
b. After construction, provide fish passage that meets NMFS's fish passage criteria for any adult or juvenile listed fish (NMFS 2011 or the most recent version), for the life of the action.

15. Timing of In-Water Work

a. The in-water work window will limit in-water construction to the times specified in the project notification form. The construction schedule will conform to the most up-to-date guidelines on in-water work windows established in Oregon, Washington, and Idaho by the Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and Idaho Department of Fish and Game, respectively, and the Service for bull trout. For nearshore projects in Puget Sound, no in-water work is allowed in bull trout foraging, migration and overwintering habitat from February 16 to July 15, and near the Duwamish River from February 16 to September 30. Any exceptions to in-water work windows recommended by ODFW, WDFW, or IDFG will be approved by NMFS and the Service, as appropriate.
b. Hydraulic and topographic measurements and placement of LW, boulders, or gravel may be completed anytime, provided there is no excavation in areas occupied by adult fish congregating for spawning, or in areas where redds are occupied by eggs or pre-emergent alevins.

[3] National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region.

16. Fisheries, Hydrology, Geomorphology, Wildlife, Botany, and Cultural Surveys in Support of Habitat Restoration

This includes assessments and monitoring projects that are associated with planning, implementation, and monitoring of restoration projects covered by this Opinion. Such support projects may include surveys to document the following aquatic, riparian, coastal and upland attributes: habitat, hydrology, channel geomorphology, water quality, fish spawning, species presence[4], macroinvertebrates, riparian vegetation, wildlife, and cultural resources (including excavating test pits less than 1 m^2 (~1.2 square yard) in size). This also includes effectiveness monitoring associated with projects implemented under this Opinion, provided the effectiveness monitoring is limited to the same survey techniques described in this section.

a. Project sites will be surveyed for presence of any listed plant or animal species that may occur within the project area. Surveys will take place prior to initiation of the project and during the appropriate time frames. If no surveys occur or are available, occupancy for listed animal species will be assumed in all suitable habitat in proximity to known occupied habitat (distance is defined on a species by species basis within the conservation measures), and listed plant occupancy will be assumed in all suitable habitat where the species is known to occur, unless absence can be confirmed by a Service species lead.
b. Train personnel in survey methods to prevent or minimize disturbance of fish and wildlife and plants. Contract specifications should include these methods where appropriate.
c. Avoid impacts to fish redds. When possible, avoid sampling during spawning periods.
d. Avoid trampling and/or stepping on listed species, their nests and their forage plants when completing surveys, assessments, and monitoring activities.
e. Do not walk through vernal pool habitats, especially during the wet season, unless absolutely necessary to complete required surveys, assessments, and monitoring activities.
f. Complete surveys, assessments, and monitoring activities during non-critical life history periods for a listed species (e.g., not during spawning and breeding periods), unless the activity objective(s) requires this level of timing.
g. Coordinate with other local agencies to prevent redundant surveys.
h. Locate excavated material from cultural resource test pits away from stream channels. Replace all material in test pits when survey is completed and stabilize the surface.

17. Work Area Isolation

a. Isolate any work area within the wetted channel from the active stream whenever listed fish are reasonably certain to be present, or if the work area is less than 91.44 m (300 feet) upstream from known spawning habitats. However, work area isolation may not always be necessary or practical in certain settings; e.g., dry streambeds and tidal zones, respectively.
b. Engineering design plans for work area isolation will include all isolation elements. Final site specific plans by contractors will be approved by project sponsor and biologist.

[4] Enumeration by non-lethal techniques that do not require handling, *i.e.,* snorkeling, ocular surveys, *etc.*; not hooking or electrofishing for fish species.

c. Dewater the shortest linear extent of work area practicable, unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species.[5]
    i. Use a coffer dam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch to divert flow around the dewatered area. Dissipate flow energy to prevent damage to riparian vegetation or stream channel and provide safe downstream re-entry for fish, preferably into pool habitat with cover.
    ii. Where gravity feed is not possible, pump water from the work site to avoid re-watering. Maintain a fish screen on the pump intake to avoid juvenile fish entrainment (NMFS 2011 or the most recent version).
    iii. Pump seepage water to a temporary storage and treatment site, or into upland areas, to allow water to percolate through soil or to filter through vegetation before reentering the stream channel. The water treatment site should have a treatment system comprised of either a hay bale basin or other sediment control device.
    iv. Monitor water levels below the construction site to prevent stranding of aquatic organisms.
    v. When construction is complete, re-water the construction site slowly to prevent loss of surface flow downstream, and to prevent a release of suspended sediment.
d. Whenever a pump is used to dewater the isolation area and listed fish may be present, a fish screen will be used that meets NMFS's fish screen criteria (NMFS 2011 or the most recent version). NMFS approval is required for pumping that exceeds 3 cfs.

18. Fish Capture and Release

a. If practicable, allow listed fish species to migrate out of the work area or remove fish before dewatering; otherwise remove fish from an exclusion area as it is slowly dewatered with methods such as hand or dip-nets, seining, and trapping with minnow traps (or gee-minnow traps).
b. Fish capture will be supervised by a qualified fisheries biologist with experience in work area isolation and competence to ensure the safe handling of fish.
c. Conduct fish capture activities during periods of the day with the coolest air and water temperatures possible, normally early in the morning to minimize stress and injury of species present.
d. Monitor the nets frequently enough to ensure they stay secured to the banks and free of organic accumulation.
e. Electrofish during the coolest time of day, and only after other means of fish capture are determined to be not feasible or ineffective.
    vi. Follow the most recent version of NMFS (2000) electrofishing guidelines.
    vii. Do not electrofish when the water appears turbid, *e.g.*, when objects are not visible at depth of 30 cm (12 inches).
    viii. Do not intentionally contact fish with the anode.
    ix. Use direct current or pulsed direct current within the following ranges:
        1. If conductivity is less than 100 microsecond (µs), use 900 to 1100 volts.

[5] For instructions on how to dewater areas occupied by lamprey, see *Best management practices to minimize adverse effects to Pacific lamprey* (*Entosphenus tridentatus*) (USFWS 2010).

2. If conductivity is between 100 and 300 µs, use 500 to 800 volts.
3. If conductivity greater than 300 µs, use less than 400 volts.

x. Begin electrofishing with a minimum pulse width and recommended voltage, then gradually increase to the point where fish are immobilized.

xi. Immediately discontinue electrofishing if fish are killed or injured, *i.e.*, dark bands visible on the body, spinal deformations, significant de-scaling, fish are torpid or not able to maintain upright attitude after sufficient recovery time. Recheck machine settings, water temperature and conductivity, and adjust or postpone procedures as necessary to reduce injuries.

f. If buckets are used to transport fish:

xii. Minimize the time fish are in a transport bucket.

xiii. Keep buckets in shaded areas or, if no shade is available, covered by a canopy.

xiv. Limit the number of fish within a bucket; fish will be of relatively comparable size to minimize predation.

xv. Use aerators or replace the water in the buckets at least every 15 minutes with cold clear water.

xvi. Release fish in an area upstream with adequate cover and flow refuge; downstream release is acceptable provided the release site is below the influence of construction.

xvii. Be careful to avoid mortality counting errors.

g. Monitor and record fish presence, handling, and injury during all phases of fish capture and submit a fish salvage report to NMFS and the Service for any listed fish species that may be present, within 60 days of capture. The report must, document the date, time of day, fish handling procedures, air and water temperatures, and total numbers of each fish species handled, and numbers of listed fish injured or killed.

19. Invasive species and non-native plant control

Invasive species impacts are of concern to the Service and NMFS. Invasive species degrade, change, or displace native habitats and compete with native wildlife and are thus harmful to fish, wildlife, and plant resources. Preventing the introduction or spread of invasive and non-target species is the most effective strategy to avoid impacts to native species and ecosystems. Preventive measures typically offer the most cost-effective means to minimize or eliminate environmental and economic impacts due to invasive species.

Invasive Species Prevention Measures

a. Each project must clearly identify and implement invasive species prevention measures, including:

i. Generating a list of invasive species of concern for importing or exporting from the project site.

ii. Specifying methods to be used to reduce the risk of spreading invasive species.

iii. Monitoring that will occur to detect invasive species and;

iv. Identifying actions that will be implemented to control invasive species if identified and it is deemed necessary to take action.

b. Control or removal of invasive and non-native vegetation must be completed in a manner that minimizes the accidental dispersal of seeds or reproductive plant parts to other locations. Project personnel should complete the following tasks.

i. Shake out all work clothes worn before leaving a project site.

ii. Change work clothes (e.g., coveralls, gloves, and hats) and clean boots if workers will be going to a new location.
iii. Launder work clothes frequently.
iv. Properly dispose of all invasive and non-native plant materials removed during a treatment in a timely manner.
v. Clean all equipment, vehicles, and tools used at a project site before going to a new location.

Invasive Plant Treatment Measures

a. Herbicide methods.
    - For herbicide use in prairie restoration sites, see PDC 51 for additional information and restrictions on prairie, coastal and oak habitat restoration.
    - Herbicide Label. Herbicide applicators will comply with all label instructions.
    - Power equipment. Refuel gas-powered equipment with tanks larger than 19 liters (5 gallons) in a vehicle staging area placed 45.72 m (150 feet) or more from any natural waterbody, or in an isolated hazard zone such as a paved parking lot.
    - Maximum herbicide treatment area. In riparian habitat: Do not treat more than 10% of the acres of riparian habitat within a 6th-field HUC with herbicides per year.
    - Herbicide applicator qualifications. Herbicides may only be applied by an appropriately licensed applicator, or under the direct supervision of a licensed applicator. Only use an herbicide specifically targeted for a particular plant species that will cause the least impact.
    - Herbicide transportation and safety plan. The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, take remedial actions in the event of spills, and fully report the event. The following measures will be used to reduce the risk of a spill during water transport: a) No more than 9.5 l (2.5 gallons) of herbicide concentrate will be transported per person or raft, and typically it will be 3.8 l (1 gallon) or less; b) glyphosate will be carried in 3.8 l (1 gallon) or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a secondary watertight container. If transported by raft, the container will be secured to the watercraft.
    - Before applying herbicide, applicators must thoroughly review the site to identify and mark any required buffer areas.
b. All reasonable efforts will be made to determine adverse impacts to listed species following herbicide applications.
c. Notify the Service within 24 hours of any spill or misapplication.
d. Permitted Herbicides. The only herbicides allowed for use under this Opinion are divided into “Aquatic and Upland” and “Upland Use Only”. Herbicides and adjutants identified for "Upland Use Only," must not be used within 30.5 m (100 feet) (except Oryzalin which has a 297 m (975 feet) buffer) of aquatic habitats or where there is a reasonable likelihood that it will drift or leach into aquatic habitats. All BMPs for herbicide use and species specific conservation measures must be observed. The use of dyes is strongly encouraged when spraying near the 30 m (100 feet) buffer. Vegetation

control closer than 30 m (100 feet) may use "Aquatic" herbicides with associated buffers, or other control techiques removal.

e. Permitted herbicides, common trade names[6], and allowable uses under this Opinion are as follows:

Aquatic and Upland Herbicides

- aquatic imazapyr (e.g., Habitat) – Aquatic and Upland, no T&E plants and butterflies
- aquatic glyphosate (e.g., AquaMaster, AquaPro, Rodeo) – Aquatic and Upland
- aquatic triclopyr-TEA (e.g., Renovate 3) – Aquatic and Upland, no T&E plants and butterflies
- chlorsulfuron (e.g., Telar, Glean, Corsair) – Aquatic and Upland
- clopyralid (e.g., Transline) – Aquatic and Upland
- imazapic (e.g., Plateau) – Aquatic and Upland
- imazapyr (e.g., Arsenal, Chopper) – Aquatic and Upland, no T&E plants and butterflies
- metsulfuron-methyl (e.g., Escort) – Aquatic and Upland
- picloram (e.g., Tordon) – Aquatic and Upland
- sethoxydim (e.g., Poast, Vantage) – Aquatic and Upland
- sulfometuron-methyl (e.g., Oust, Oust XP) - Aquatic and Upland
- glyphosate (nonaquatic formulation) – Upland Use Only, no vernal pool use.
- triclopyr (e.g., Garlon4Ultra) – Upland Use Only, no vernal pool use.
- fluazifop-p-butyl (e.g., Fusilade) – Upland Use Only, no vernal pool use.
- clethodim (e.g., Envoy) – Upland Use Only, no vernal pool use
- triclopyr +2,4-D ester (e.g., Crossbow) – Upland Use Only, no vernal pool use.
- diquat dibromide (e.g., Reward) – Upland Use Only, no vernal pool use
- 2,4-D amine, Cannot use on T&E plants and butterflies, no vernal pool use.
- oryzalin, Cannot use on T&E plants and butterflies, no vernal pool use.
- aminopyralid – Upland Use Only, no vernal pool use.

f. Permitted Herbicide adjuvants. When recommended by the label, an approved aquatic surfactant or drift retardant can be used to improve herbicidal activity or application characteristics. Adjuvants that contain alky amine etholoxylates, i.e., polyethoxylated tallow amine (POEA), alkylphenol ethoxylate (including alkyl phenol ethoxylate phosphate esters), or herbicides that contain these compounds are not covered by this Opinion. The following product names are covered by this Opinion:

- Agri-Dex
- AquaSurf
- Bond
- Bronc Max
- Bronc Plus Dry-EDT
- Class Act NG
- Competitor

[6] The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Interior or USFWS of any product or service to the exclusion of others that may be suitable.

- Cut Rate
- Cygnet Plus
- Destiny HC
- Exciter Fraction
- InterLock
- Kinetic
- Level 7
- Liberate
- Magnify
- One-AP XL
- Pro AMS Plus
- Spray-Rite
- Superb HC
- Tactic
- Tronic
- Activeate Plus – Upland use only
- Nufilm – Upland use only
- Other vegetable-based surfactants for which there is a demonstrated track record for use with Service ESA-listed species – Upland use only

g. Measures for handling herbicides are as follows.
    i. During transport, the applicator must secure herbicides containers to prevent movement within the vehicle or loss from the vehicle.
    ii. When spray equipment is not being used, the applicator must ensure that all valves and tanks covers are closed during movement of the vehicle.
h. The applicator must firmly secure any filled portable tanks used for herbicide applications to the frame of the vehicle.
i. Herbicide carriers. Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil. Use of diesel oil as an herbicide carrier is not covered by this Opinion.
j. Dyes. The presence of dye makes it easier to see where the herbicide has or has not been applied, as well as enabling applicator to immediately see if there are drift issues, spills, leaks or drips (SERA 1997).
    i. Dyes should be used for all applications to ensure complete and uniform treatment of invasive plants.
    ii. Use a non-hazardous indicator dye (e.g., Hi-Light or Dynamark) with herbicides within 30.5 m (100 feet) of water.
k. Measures for herbicide mixing.
    i. Mix herbicides and adjuvants, carriers, and/or dyes more than 45.7 m (150 feet) from any perennial or intermittent waterbody to minimize the risk of an accidental discharge.
    ii. Applicators must prepare spray mixtures in accordance with the label instructions and not exceed the amount of herbicide per acre as specified in the instructions.
    iii. Applicators must mix and load herbicides at least 45.7 m (150 feet) from any surface waters and residential wells and only in locations where accidental spills cannot flow into surface waters or contaminate groundwater. Required buffer

distances to listed species and sensitive resources must also be adhered to as addressed in the species conservation measures.

l. Tank Mixtures. The potential interactive relationships that exist among most active ingredient combinations have not been defined and are uncertain. Therefore, combinations of herbicides in a tank mix are not covered by this Opinion.

m. Spill Cleanup Kit. Provide a spill cleanup kit whenever herbicides are used, transported, or stored. At a minimum, cleanup kits will include Material Safety Data Sheets, the herbicide label, emergency phone numbers, and absorbent material such as cat litter to contain spills.

n. Herbicide application rates. Apply herbicides at the lowest effective label rates.

o. Herbicide application methods. Herbicides will only be applied by an appropriately licensed applicator or under the direct supervision of a licensed applicator, and application methods must comply with all label instructions. Apply liquid or granular forms of herbicides as follows:

    i. Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms.

    ii. Spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants.

    iii. Hand/selective – wicking and wiping, basal bark, fill ("hack and squirt"), stem injection, cut-stump.

n. Measures for spot spraying

    i. Keep the spray nozzle within 1.2 m (4 feet) of the ground when applying herbicide less than 4.6 m (15 feet) from high water mark (HWM). If spot or patch spraying tall vegetation more than 4.6 m (15 feet) away from the HWM, keep the spray nozzle within 1.8 m (6 feet) of the ground.

    ii. Apply spray in swaths parallel towards the project area, away from the creek and desirable vegetation, i.e., the person applying the spray will generally have their back to the creek or other sensitive resource.

o. Measures for wick and wipe applications

    i. The appropriate type and size of equipment will be used to apply herbicides onto the target foliage and stems.

    ii. Herbicide applications will be made in a manner that prevents herbicide runoff onto the ground.

p. Measures for basal bark applications

    i. Applicators will avoid unnecessary run-off when applying herbicide to stems of target vegetation. A dryer is recommended to establish coverage and prevent runoff.

    ii. Herbicide applications will be applied using the lowest nozzle pressure that will allow adequate coverage.

q. Measures for spot and patch applications

    i. Herbicides applications may be used with hand applicators or an all-terrain vehicle with low mounted boom sprayers.

    ii. Herbicide will be applied in a manner where the spray is directed towards the application area and away from listed plants.

r. Measures for cut surface and hack and squirt/injection applications

i. Herbicide applications will be made in a manner that prevents herbicide runoff onto the ground.

s. Measures for spot applications of dry granules, pellets, and dust
   i. A 3 m (10 feet) buffer will be maintained between listed plants and application areas to prevent exposure to listed plants.

t. Measures for tractor-based broadcast applications
   i. Nozzles and pressures will be adjusted to minimize fine particle size so that the spray does not drift off the application area, while still providing for reasonable herbicide coverage.
   ii. Drift control agents will be used if necessary to prevent any spray from drifting off the application area.

u. Washing spray tanks. Wash spray tanks 91.4 m (300 feet) or more away from any surface water.

v. Avoid the use of any irrigation waters that are contaminated with herbicides. Do not use these waters in any area that contains a listed plant species.

w. Minimization of herbicide drift and as follows:
   i. Do not broadcast spray when wind speeds exceed 16.1 km (10 miles) per hour, or are less than 3.2 km (2 miles) per hour. Do not spot spray when wind speeds exceed 16.1 km (10 miles) per hour. Winds less than 3.2 km (2 miles) per hour are acceptible for spot spraying.
   ii. Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
   iii. Keep boom or spray as low as possible to reduce wind effects.
   iv. Use minimum effective nozzle height recommended by nozzle manufacturer.
   v. Increase spray droplet size whenever possible by decreasing spray pressure to lowest effective nozzle pressure recommended by nozzle manufacturer, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents.
   vi. Do not apply herbicides during temperature inversions, or when air temperature exceeds 27 ºC (81 ºF). Do not apply herbicides when the soil is saturated or when a precipitation event likely to produce direct runoff to salmon/bull trout bearing waters from the treated area is forecasted by the NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides may follow label instructions. Do not conduct hack-squirt/injection applications during periods of heavy rainfall. For all other cases: Herbicide applications will be delayed if precipitation is forecast to occur within 24 hours, except for pellet based applications. At upland prairie sites, chemical applications will not occur within 24 hours of predicted precipitation. At wet prairie sites, chemical applications will only be conducted if the 7-day weather forecast indicates no significant rainfall.
   vii. Wind and other weather data will be monitored and reported for all broadcast applications.

A. Herbicide buffer distances. Table 1 outlines required no-application buffer-widths, measured in feet, as map distance perpendicular to the bankfull elevation for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Widths are based on herbicide formula, stream type, and application method during herbicide applications. Before herbicide application

begins, flag or mark the upland boundary of each applicable herbicide buffer to ensure that all buffers are in place and functional during treatment.

Table 1. Herbicide buffer distances by herbicide formula, stream type, and application method for aquatic habitat restoration projects. Upland Use Only herbicides must be used at least 30.5 m (100 feet) from any aquatic habitat, except for Oryzalin, which requires a 297 m (975 feet) buffer from aquatic habitats. Check species-specific conservation measures for additional restrictions for each listed species at each project site.

Herbicide	**No Application Buffer Width (feet)**					
	Streams and Roadside Ditches with flowing or standing water present and Wetlands			Dry Streams, Roadside Ditches, and Wetlands (no standing water present)		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
Aquatic Glyphosate	100	waterline	Waterline	50	None	None
Aquatic Imazapyr	100	15	Waterline	50	None	None
Aquatic Triclopyr-TEA	**Not Allowed**	15	Waterline	**Not Allowed**	None	None
Low Risk to Aquatic Organisms						
Imazapic	100	15	bankfull elevation	50	None	None
Clopyralid	100	15	bankfull elevation	50	None	None
Metsulfuron-methyl	100	15	bankfull elevation	50	None	None
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
Sulfometuron-methyl	100	50	50	50	15	bankfull elevation
Chlorsulfuron	100	50	bankfull elevation	50	15	bankfull elevation
High Risk to Aquatic Organisms						
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50
Upland Use Only Herbicides						
Triclopyr - BEE	100	100	100	100	100	100
Glyphosate	100	100	100	100	100	100
2, 4-D amine	100	100	100	100	100	100
Clethodim	100	100	100	100	100	100
Fluazifop-P-butyl	100	100	100	100	100	100
Oryzalin	**Not Allowed**	975	975	**Not Allowed**	975	975
Aminopyralid	100	100	100	100	100	100
diquat dibromide (e.g., Reward)	100	100	100	100	100	100
triclopyr +2,4-D ester (e.g., Crossbow)	100	100	100	100	100	100

20. Piling Installation

a. Pilings may be concrete, steel round pile 60 cm (24 inches) in diameter or smaller, steel H-pile designated as HP24 or smaller, or untreated wood.[7]
b. When possible, use a vibratory hammer for piling installation.
c. When using an impact hammer to drive or proof steel piles, use one of the following sound attenuation methods to effectively dampen sound pressure waves in all areas to a single strike peak threshold of 206 decibels. For cumulative strikes, a 187 decibel sound exposure level (SEL) is allowed in areas and times where fish are larger than 2 grams; and a 183 decibel SEL is allowed in areas and times when fish are smaller than 2 grams.
d. Completely isolate the pile from flowing water by dewatering the area around the pile if dewatering is practicable.
e. If area cannot be dewatered, and water velocity is 0.5 m/s (1.6 feet per second) or less, surround the piling being driven by a confined or unconfined bubble curtain that will distribute small air bubbles around 100% of the piling perimeter for the full depth of the water column, as described in National Marine Fisheries Service and USFWS (2006).[8]
f. If water velocity is greater than 0.5 m/s (1.6 feet per second), surround the piling being driven by a confined bubble curtain (*e.g.,* a bubble ring surrounded by a fabric or non-metallic sleeve) that will distribute air bubbles around 100% of the piling perimeter for the full depth of the water column.
g. NMFS/Service review and approval. Provide NMFS/Service the following information: the timing of in-water work, the number of impact hammer strikes per pile and the estimated time required to drive piles; the hours per day pile driving will occur, the depth of water, the type of substrate, the hydroacoustic assumptions; and the pile type, diameter, and spacing of the piles.

21. Site Restoration

a. Restore any significant disturbance of riparian, wetland or upland vegetation, soils, stream banks or stream channel.
b. Remove all project related waste; *e.g.*, pick up trash, sweep roadways in the project area to avoid runoff-containing sediment and trash.
c. Obliterate all temporary access roads, crossings, and staging areas.
d. Loosen soil in compacted areas when necessary for revegetation or infiltration.
e. Although no single criterion is sufficient to measure restoration success, the intent is that the following features should be present in the upland parts of the project area, within reasonable limits of natural and management variation:
    i. Human and livestock disturbance, if any, are confined to small areas necessary for access or other special management situations.
    ii. Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.

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[7] An individual consultation and site-specific risk assessment are required for actions that propose the use of pilings made of treated wood, including chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), alkaline copper quaternary (ACQ-B and ACQ-D), ammoniacal copper citrate (CC), copper azole (CBA-A), copper dimethyldithiocarbamate (CDDC), borate preservatives, and oil-type wood preservatives, such as creosote, pentachlorophenol, and copper naphthenate.
[8] See also Wursig *et al*. (2000) and Longmuir and Lively (2001) for additional information on how to deploy an effective, economical bubble curtain.

iii. Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.
iv. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site; invasive plants are minimal or absent.
v. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
vi. Plant litter is well distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion ("litter dams").
vii. A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank/shoreline.

22. Revegetation

a. Plant and seed disturbed areas before or at the beginning of the first growing season after construction.
b. Native vegetation will planted on disturbed project sites and sites protected from further disturbance until new growth is well established. Do not use non-native species for site restoration with the exception of sterile seed for stabilization if native seed is not available.
c. Use an assemblage of vegetation species appropriate for long-term productivity of the site, including native trees, shrubs, and herbaceous species. Vegetation, such as willow (*Salix* spp.), sedge (*Carex* spp.) and rush (*Juncus* spp.) mats, may be gathered from abandoned floodplains, stream channels, and wetlands.
d. Planting techniques must not cause major soil disturbance at project sites.
e. Native vegetation should be salvaged, as appropriate, from areas where soil disturbance will be occurring on a project site and replanted later at the site. When feasible, use vegetation salvaged from other local areas scheduled for clearing due to development.
f. Use species that will achieve shade and erosion control objectives, including forb, grass, shrub, or tree species that are appropriate for the site and native to the project area or region. Short-term stabilization measures may include use of non-native sterile seed mix if native seeds are not available, weed-free certified straw, jute matting, and similar methods.
g. Do not apply surface fertilizer within 15.4 m (50 feet) of any wetland or water body.
h. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
i. Conduct post-construction monitoring and treatment to remove or control invasive plants until native plant species are well established.

PROJECT DESIGN CRITERIA

These criteria are only applicable to specific Restoration Activity Categories

Projects within the 21 restoration activity categories will be designed and implemented to help restore watershed, coastal, and upland processes. As such, these improvements may help address limiting factors of listed species. Aquatic habitat restoration and enhancement projects are conducted within stream channels, adjacent riparian/floodplain areas, wetlands, nearshore, coastal areas, and uplands. Upland projects will address habitat requirements of prairie, oak, forest, and dune species. The 21 types of Restoration Actions are listed in the beginning of Section 1.3.1 above.

1. **Fish Passage Restoration**
   Typical projects include the following: total removal, replacement, or resetting of culverts or bridges; stabilizing headcuts and other channel instabilities; removing, relocating, constructing, repairing, or maintaining fish ladders; and replacing, relocating, or constructing fish screens and irrigation diversions. Such projects will take place where fish passage has been partially or completely eliminated.
   a. Stream simulation culvert and bridge projects. All road-stream crossing structures shall adhere to the most recent version of NMFS fish passage criteria (NMFS 2011 or most recent version) located under at: http://www.westcoast.fisheries.noaa.gov/publications/hydropower/fish_passage_design_criteria.pdf. The Service in consultation with NMFS engineering review, if required, shall occur at the conceptual, post-modeling, and final design phases, which is approximated by 30%, 60%, and 90% designs.
   b. All road-stream crossing structures shall simulate stream channel conditions per industry design standards found in any one of the following:
      i. Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings (USDA-Forest Service 2008) or the most recent version, located at: http://stream.fs.fed.us/fishxing/aop_pdfs.html
      ii. Part XII Fish Passage Design and Implementation, Salmonid Stream Habitat Restoration Manual (California Department of Fish and Game 2009) or the most recent version, located at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=12512
      iii. Water Crossings Design Guidelines (Barnard *et al.* 2013) or the most recent version), located at: http://wdfw.wa.gov/publications/01501/
   c. General road-stream crossing criteria
      i. Span
         1. Span is determined by the bankfull channel width at crossing location.
         2. Single span structures shall maintain a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the bankfull width for alluvial channels.
         3. Multi-span structures shall maintain clear, unobstructed openings above the general scour elevation (except for piers or interior bents) that are at least as wide as 2.2 times the bank full width for alluvial channels.
         4. Entrenched streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the crossing span shall accommodate the flood prone

width. Flood prone width is the channel width measured at twice the maximum bankfull depth (Rosgen 1996).

5. Minimum structure span is 1.8 m (6 feet).

ii. Scour Prism

1. Designs shall maintain the general scour prism, as a clear, unobstructed opening (*i.e.,* native streambed material can move freely without countermeasures, or structural material to include abutments, footings, and culvert inverts).
2. When bridge abutments are set back beyond the applicable criteria span they may be located above the general scour elevation.

iii. Embedment

1. All culvert footings and inverts shall be placed below the thalweg at a depth of 0.91 m (3 feet), or the Lower Vertical Adjustment Potential (LVAP) line, whichever is deeper.
2. LVAP, as calculated in *Stream Simulation: An ecological approach to providing passage for aquatic organisms at road crossings* (USDA-Forest Service 2008)
3. In addition to embedment depth, embedment of closed bottom culverts shall be between 30% and 50% of the culvert height.

iv. Bridges

1. Primary bridge structural elements will be concrete, metal, fiberglass, or untreated timber. The use of treated wood for bridge construction or replacement is not allowed under PROJECTS. Old railroad cars, which are commonly used as bridges, may have treated wood decking. Replace treated elements with untreated wood.
2. All concrete will be poured in the dry, or within confined waters not connected to surface waters, and will be allowed to cure a minimum of 7 days before contact with surface water as recommended by Washington State Department of Transportation (2010).
3. Riprap will not be placed within the bankfull area of the stream. Riprap may only be placed below bankfull height when necessary for protection of abutments and pilings. The amount and placement of riprap will not constrict the bankfull flow.
4. Temporary work bridges will also meet NMFS fish passage criteria[9] (2011) (or the most recent version).
5. Bridge designs should allow for terrestrial wildlife movement over or under bridges whenever possible.
6. Service fish passage review and approval. The Service in consultation with NMFS engineering will review crossing structure designs if the span width is determined to be less than the criteria established above or if the design is inconsistent with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011) or the most recent version.

d. Headcut and grade stabilization. Headcuts (vertical off-sets in the streambed) often occur in meadow areas, where floodplain soils are fine textured. Headcuts may develop

[9] http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf

because of channel straightening, channel avulsion, culvert replacement or removal, or loss of riparian vegetation. Grade (streambed elevation) stabilization measures minimize the migration of headcuts upstream.

i. Methods

1. In streams with current or historical fish presence, provide fish passage over a headcut through use of morphologically appropriate grade stabilization. This includes constructed riffles for riffle-pool morphologies, rough constructed riffles/ramps for plane bed morphologies, wood jams, rock sills, and boulder weirs for step-pool morphologies, and roughened channels for cascade morphologies as described in part ii below.
2. Grade control materials can include both rock and LW. Material shall not in any part consist of gabion baskets, sheet piles, concrete, articulated concrete blocks, or cable anchors.
3. Rock for structures shall be durable and of suitable quality to assure permanence in the climate in which it is to be used. Gravel sizing depends on the size of the stream, size of bed material upstream, maximum depth of flow, plan form, entrenchment, and ice and debris loading.
4. Short-term headcut stabilization (including emergency stabilization projects) may occur without associated fish passage measures. However, fish passage will be incorporated into the final headcut stabilization action and be completed during the first subsequent in-water work period.

ii. Grade Stabilization to Promote Fish Passage

1. Service fish passage review and approval. The Service (in aquatic habitats) will review all projects containing grade control, stream bed stability, or headcut countermeasures that are proposed to promote fish passage.
2. Provide fish passage over grade control structures through use of constructed riffles for pool/riffle streams or a series of log or rock weirs for step/pool channels. If LW and boulder placement is used for headcut stabilization, refer to LW, Boulder, and Gravel Placement (PDC 34) below.
3. Construct structures in a “V” or “U” shape in plan view, oriented with the apex upstream, lower in the center to direct flows to the middle of channel.
4. Key structures into the stream bed to minimize structure undermining due to scour, preferably at least 2.5 times their exposure height. The structures should also be keyed into both banks.
5. If several structures will be used in series, space them at the appropriate distances to promote fish passage of all life stages of native fish. Incorporate NMFS (2011) fish passage criteria (jump height, pool depth, *etc.*) in the design of step structures. Recommended spacing should be no closer than the net drop divided by the channel slope (for example, a 30 cm (1 foot) high step structure in a stream with a two-

percent gradient will have a minimum spacing of 15.3 m (50 feet) [1/0.02]).

6. Include gradated (cobble to fine) material in the rock structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow and ensuring fish passage immediately following construction if natural flows are sufficient.
7. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

e. Fish Ladders
   i. Service fish passage review and approval. The Service will review fishways designs for consistency with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or the most recent version).
   ii. Design preference is based on project type, level of maintenance, and required monitoring essential for reliable fish passage. Typical fishway designs include: a) roughened channels/boulder step structures, b) channel spanning concrete sills, c) pool and chute, and d) pool and weir fishways. Roughened channel and boulder step structure fishways consist of a properly sized mix of rock and sediment in an open channel that creates enough roughness and diversity to facilitate fish passage. Our review will include any appurtenant facilities (*i.e.*, fish counting equipment, pit tag detectors, lighting, trash racks, attraction water) that may be included with the fish ladder design. See *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or the most recent version) for guidelines and PDC.
   iii. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

f. Irrigation diversion replacement/relocation and screen installation/ replacement
   i. Service fish passage review and approval. The Service in consultation with NMFS engineering will review irrigation diversion replacement/relocation and screen installation/replacement projects for consistency with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or the most recent version).
   ii. Diversion structures—associated with points of diversion and future fish screens—will pass all life stages of threatened and endangered aquatic species that historically used the affected aquatic habitat.
   iii. Water diversion intake and return points will be designed (to the greatest degree possible) to prevent all native fish life stages from swimming or being entrained into the diversion.
   iv. NMFS fish screen criteria (NMFS 2011 or the most recent version) applies to salmonid species but generally may be applied to other aquatic fish species. This includes screens in temporary and permanent pump intakes.
   v. All fish screens will be sized to match the irrigator's state water right or estimated historical water use, whichever is less.
   vi. Size of bypass structure should be big enough to pass adult fish back to the stream.

vii. Abandoned ditches and other similar structures will be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them.
viii. When making improvements to pressurized diversions, install a totalizing flow meter capable of measuring rate and duty of water use. For non-pressurized systems, install a staff gage or other measuring device capable of measuring instantaneous rate of water flow.
ix. Conversion of instream diversions to groundwater wells will only be used in circumstances where there is an agreement to ensure that any surface water made available for instream flows is protected from surface withdrawal by another water user.
x. For the removal of diversion structures constructed of local rock and dirt, the project sponsor will dispose of the removed material in the following manner:
    1. Material more than 60% silt or clay will be disposed in uplands, outside of the active floodplain.
    2. Material with more than 40% gravel will be deposited within the active floodplain, but not in wetlands.
    3. Material with more than 50% gravel and less than 30% fines (silt or clay) may be deposited below the bankfull elevation.

2. Stream Channel Enhancement (Large Wood, Boulder, and Gravel Placement)

Typical projects include LW and boulder placement, ELJs, constructed riffles, porous boulder structures and vanes, gravel placement, and tree removal for LW projects. ELJs are a type of LW placement that employs an engineered anchoring system such as ballast, pinning, or vertical piles. Such activities will occur in areas where channel structure is lacking due to past stream cleaning (LW removal), riparian timber harvest, and in areas where alluvial gravel supplies are low due to anthropogenic disruptions. These projects will occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocity areas, and floodplain function.

g. Large wood and boulder projects
    i. Place LW and boulders in areas where they would naturally occur, and in a manner that closely mimics natural accumulations for that particular stream type. For example, boulder placement may not be appropriate in low-gradient meadow streams.
    ii. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.
    iii. No limits are to be placed on the size or shape of structures as long as such structures are within the range of natural variability of a given location and do not block fish passage.
    iv. Projects can include grade control and streambank stabilization structures, as long as the size and configuration of such structures will be commensurate with scale of project site and hydraulic forces, and provided that streambank stabilization, if any, is not the principal objective of the restoration action.
    v. The partial burial of LW and boulders is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.
    vi. LW includes whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates, and the geomorphic function of the LW in that stream type. An example is, in stream reaches where LW forms immobile steps or channel-spanning jams. When available, trees with rootwads should be a minimum of 1.5x bankfull channel width, while logs without rootwads should be a minimum of 2.0x bankfull widths. In larger, wider streams, where LW is readily transported and forms complex log jams along the channel margins, bar apexes, or side channel junctions, LW should be of sufficient diameter to avoid breakage due to hydraulic forces, and of sufficient length to be fitted into a structure that can be stabilized through gravity, placement orientation, or keying the structure into the streambank.
    vii. Structures may partially or completely span stream channels or be positioned along stream banks.
    viii. Stabilizing or key pieces of LW will be intact, hard, with little decay, and if possible have root wads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.
    ix. Anchoring LW. Anchoring alternatives may be used in preferential order:

1. Use of adequate sized wood sufficient for stability due to gravity and placement orientation.
2. Orient and place wood in such a way that movement is limited.
3. Ballast the wood using gravel or rock to increase the mass of the structure to resist movement.
4. Vertical pilings to reduce lateral shifting.
5. Use large boulders as anchor points for the LW.
6. Pin LW with rebar to large rock to increase its weight.
7. Anchoring LW by cable is not allowed under PROJECTS.

h. Engineered Logjams (ELJs) are structures designed to redirect flow, change scour and deposition patterns, and retain mobile LW that might otherwise be exported by the flow.[10] While providing valuable fish and wildlife habitat, they are also designed to redirect flow and can provide stability to a streambank or downstream gravel bar. To the extent practical, ELJs are designed to simulate stable natural log jams and can be either naturally stable due to LW size and/or stream width or anchored in place using rebar, rock, or piles (driven into a dewatered area or the streambank, but not in water). They are also designed to create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out, and allows scour holes to form adjacent to the structure.
    i. Service fish passage review and approval. For ELJs that occupy greater than 25% of the bankfull cross sectional area, the Service, in consultation with NMFS engineering, will review the action for consistency with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or the most recent version).
    ii. ELJs will be patterned, to the greatest degree possible, after stable natural log jams.
    iii. Grade control ELJs are designed to arrest channel down-cutting or incision by providing a grade control that retains sediment, lowers stream energy, and increases water elevations to reconnect floodplain habitat and diffuse downstream flood peaks.
    iv. Stabilizing or key pieces of LW that will be relied on to provide streambank stability or redirect flows will be intact and solid (little decay). If possible, acquire LW with untrimmed rootwads to provide functional refugia habitat for fish.
    v. When available, key pieces with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
    vi. The partial burial of LW may constitute the dominant means of placement, and LW can be buried into the streambank or channel.
    vii. Angle and offset. The LW portions of ELJ structures should be oriented such that the force of water upon the LW increases stability. If a rootwad is left exposed to the flow, the bole placed into the streambank should be oriented downstream parallel to the flow direction so the pressure on the rootwad pushes the bole into the streambank and bed.

[10] ELJs are defined as structures composed of LW with at least three key members incorporating the use of an anchoring system.

viii. If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, vertical pilings to reduce lateral shifting, or the use of manila, sisal, or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning, chains, or bolted connections may be used. Rock may be used for ballast but is limited to that needed to anchor the LW.

i. Constructed riffles
    i. Service fish passage review and approval. The Service, in consultation with NMFS engineering, will review all constructed or engineered riffles for consistency with criteria in *Anadromous Salmonid Passage Facility Design* (NMFS 2011 or the most recent version).
    ii. Constructed riffles are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. A low flow notch shall be constructed to concentrate flows in channels where minimum flows may restrict fish passage.
    iii. Constructed riffles will be constructed out of an appropriately sized gravel mix, including the appropriate level of fines, to allow for compaction for stability and sealing to ensure minimal loss of surface flow through the newly placed material.
    iv. Gravel sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
    v. The project designer or an inspector experienced in these structures should be present during installation.
    vi. Ensure that the structure is appropriately sealed according to project objectives before equipment leaves the site.
    vii. For projects where hyporheic flow is a project objective, levels of compaction must be adjusted to allow appropriate balance of surface and sub-surface flow.

j. Porous boulder step structures and vanes
    i. Full channel spanning boulder structures are to be installed only in highly uniform, incised, bedrock-dominated channels, with the goal to enhance or provide fish habitat in stream reaches where log placements are not practicable due to channel conditions (not feasible to place logs of sufficient length, bedrock dominated channels, deeply incised channels, artificially constrained reaches, *etc.*), or where damage to infrastructure on public or private lands is of concern, or where private landowners will not allow log placements due to concerns about damage to their streambanks or property.
    ii. Install boulder structures low in relation to channel dimensions so that they are completely overtopped during bankfull channel events.
    iii. Boulder step structures are to be placed diagonally across the channel or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream.
    iv. Boulder step structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream.
    v. The use of gabions, cable, or other means to prevent the movement of individual boulders in a boulder step structure is not allowed.

vi. Rock for boulder step structures shall be durable and of suitable quality to assure long-term stability in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
vii. The project designer or an inspector experienced in these structures should be present during installation.
viii. Full spanning boulder step structure placement should be coupled with measures to improve habitat complexity and protection of riparian areas to provide long-term inputs of LW.

k. Gravel augmentation
   i. Gravel can be placed directly into the stream channel, at tributary junctions, or other areas in a manner that mimics natural debris flows and erosion.
   ii. Augmentation will only occur in areas where the natural supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate gravel accumulations in conjunction with other projects, such as simulated log jams and debris flows. Most importantly, gravel augmentation should only be used in streams that are geomorphically appropriate for gravel bed features such as bars, pool-riffle sequences, etc., to persist. That is, where the stream morphology and hydraulics are such that gravel cannot be stable or retained, augmentation will not be effective.
   iii. Gravel to be placed in streams shall be a sized for that stream, and clean alluvium with similar angularity as the natural bed material. When possible use gravel of the same lithology as found in the watershed. Reference *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) to determine gravel sizes appropriate for the stream.
   iv. Gravel can be mined from the floodplain at elevations above bankfull, but not in a manner that will cause stranding during future flood events.
   v. Crushed rock is not permitted, unless sediment in the stream reach is sub-angular to angular.
   vi. After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
   vii. Do not place gravel directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
   viii. Imported gravel will be free of invasive species and non-native seeds. If necessary, wash gravel prior to placement.

l. Tree removal for LW projects outside of Northern Spotted Owl and Marbled Murrelet Habitats
   i. Live conifers and other trees can be felled or pulled/pushed over for in-channel LW placement only when riparian zone tree stands are fully stocked[11] or over-

[11] Fully stocked stands – Stands in which all the growing space is effectively occupied but which still have ample room for development of the crop trees.[12] Overstocked stands – Stands in which the growing space is so completely utilized that growth has slowed down and many trees, including dominants, are being suppressed.

stocked.[12] Tree felling shall not create excessive streambank erosion or increase the likelihood of channel avulsion during high flows.

ii. Trees may be removed by cable, ground-based equipment, horses or helicopters.
iii. Trees may be felled or pushed/pulled directly into a stream or floodplain.
iv. Trees may be stock-piled for future instream restoration projects.
v. The project manager for an aquatic restoration action will coordinate with a Service wildlife biologist in tree-removal planning efforts to ensure no listed species or critical habitat is impacted.

m. Tree Removal within Northern Spotted Owl and Marbled Murrelet Habitats

The following Project Design Criteria applies to tree removal within the range of marbled murrelets and the spotted owl in all Douglas-fir dominated stands (even if the stands neither function as foraging habitat within a spotted owl home range nor contain murrelet nesting structure) and in hardwood-dominated stands. The purpose of these criteria is to ensure that there would be no removal or adverse modification of suitable habitat for marbled murrelet or spotted owl:

i. A wildlife biologist must be fully involved in all tree-removal planning efforts, and be involved in making decisions on whether individual trees are suitable for nesting or have other important listed bird habitat value.
ii. Outside of one site potential tree height of streams (see Table RR below for riparian restrictions), trees can be removed to a level not less than a Relative Density (RD) of approximately 35 (stand scale), which is considered as fully occupying a site. This equates to approximately 60 trees per acre in the overstory and a tree spacing averaging 26 feet. Additionally 40% canopy cover would be maintained when in spotted owl or marbled murrelet CH, when within 300 feet of occupied or unsurveyed murrelet nesting structure, and when dispersal habitat is limited in the area.

Table RR. Contiguous stream length and activity intensity criteria based on stream size.

Small perennial streams (defined as less than 27 feet ordinary-high-water elevation (OHW) width)
A maximum of **30% removal of canopy cover, which provides stream shade, may occur** over a contiguous maximum of **0.5 stream length mile***   ***OR***
A maximum of **50% removal of canopy cover, which provides stream shade, may occur over a** contiguous maximum of **0.25 stream length mile*.**
Medium-to-Large perennial streams (defined as equal to or greater than 27 feet ordinary-high-water elevation width)
A maximum of **50% removal of canopy cover, which provides stream shade, may occur over a** contiguous maximum of **0.5 stream length mile*.**

[12] Overstocked stands – Stands in which the growing space is so completely utilized that growth has slowed down and many trees, including dominants, are being suppressed.

[13] Large side channels projects are essentially channel construction projects if they contain more than 20% of flow.

***Treatment Limitations to Contiguous Stream Length:** All contiguous treated riparian segments within one Site Potential Tree will be separated by a distance of **4,600 feet**, where no eradication activities have been or will be applied. This 4,600-foot separation of non-treatment will occur between sequential contiguous treatments.

iii. Trees to be removed can be live, hazard trees, or killed through fire, insects, disease, blow down and other means. Down trees and snags should only be removed if the stand will retain NWFP standards post removal.
iv. Trees may be removed by cable, ground-based equipment, horses or helicopters, felled or pushed/pulled directly into a stream. Trees may be stock piled for future instream restoration projects.
v. Tree species removed should be relatively common in the stand (i.e., not "minor" tree species).
vi. Snags and trees with broad, deep crowns ("wolf" trees), damaged tops or other abnormalities that may provide a valuable wildlife habitat component should be reserved.
vii. No gaps (openings) greater than 0.5 acre will be created in spotted owl CH. No gaps greater than ¼ acre will be created in murrelet CH. No gaps shall be created in Riparian Reserves that contain ESA-listed fish habitat.

The following ***additional*** Project Design Criteria applies to tree removal within the range of marbled murrelet and the spotted owl in Douglas-fir dominated stands greater than 80 years old that function as foraging habitat within a spotted owl home range, and/or contain marbled murrelet nesting structure:

viii. Individual trees or small groups of trees should come from the periphery of permanent openings (roads etc.) or from the periphery of non-permanent openings (e.g., plantations, along recent clear-cuts etc.). Groups of trees greater than 4 trees shall 1) not be within marbled murrelet suitable stands or stands buffering (300 ft.) MM suitable stands, 2) not be buffering (300 ft.) individual trees with marbled murrelet nesting structure. A minimum distance of one potential tree height feet should be maintained between individual or group removals.
ix. Trees up to 36" dbh may be felled in any stands with agreement from a wildlife biologist that the trees are not providing marbled murrelet nesting structures or providing cover for nest sites. No known spotted owl nest trees or alternate nest trees are to be removed. Potential spotted owl nest trees may only be removed in limited instances when it is confirmed with the wildlife biologist that nest trees will not be limited in the stand post removal.
x. In order to minimize the creation of canopy gaps or edges, groups of adjacent trees selected should not create openings greater than ¼ acre within 0.5 miles of marbled murrelet occupied habitat or when within murrelet CH. Within spotted owl critical habitat, stands greater than 80 years old or within stands providing foraging habitat to spotted owl home ranges, gaps will be restricted to 0.5 acre openings or less. Gaps shall not be created in Riparian Reserves where ESA-listed fish occur.

3. Dam and Legacy Structure Removal

Typical projects include removal of dams, channel-spanning weirs, legacy habitat structures, earthen embankments, subsurface drainage features, spillway systems, outfalls, pipes, instream flow redirection structures (e.g., drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels. Legacy structures include past projects, such as LW, boulder, rock gabions, and other in-channel and floodplain structures. Removal projects will be implemented to reconnect stream corridors, floodplains, and estuaries, reestablish wetlands, improve aquatic organism passage, and restore more natural channel and flow conditions. Instream water control structures that impound contaminated sediment are not covered by PROJECTS.

n. Dam removal

i. Design Review

1. Service fish passage review and approval. The Service in consultation with NMFS engineering will review the action for consistency with criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011 or the most recent version).
2. RRT. The action will be reviewed by the RRT prior to submission to Service for approval.

ii. Project Documentation – At a minimum, the following information will be necessary for review:

1. A longitudinal profile of the stream channel thalweg for 20 channel widths downstream of the structure and 20 channel widths upstream of the reservoir area (outside of the influence of the structure) shall be used to determine the potential for channel degradation.
2. A minimum of three riffle cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area (outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.
3. Sediment characterization to determine the proportion of coarse sediment (greater than 2 mm) in the reservoir area.
4. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Dams with reservoirs with sediments having a d35 greater than 2 mm (i.e., 65% of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; sediments with a d35 less than 2 mm (i.e., 65% of the sediment by weight is less than 2 mm in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

iii. Design Guidance. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

iv. Monitoring and adaptive management. Dams greater than 3 m (10 feet) in height (measured at the upstream side of the structure at the approximate centerline of the stream) require a long-term monitoring and adaptive

management plan that will be developed between the Action Agencies. Develop a monitoring and adaptive management plan that has been reviewed and approved by the RRT that includes the following:

1. Introduction
2. Existing monitoring protocols
3. Project effectiveness monitoring plan
4. Project review team triggering conditions
5. Monitoring frequency, timing, and duration
6. Monitoring technique protocols
7. Data storage and analysis
8. Monitoring quality assurance plan
9. Literature cited

o. Removal of legacy structures

i. Remove material not typically found within the stream or floodplain at project sites (i.e., boulders, concrete, etc.) from the 100-year floodplain.

ii. Materials (i.e., LW and boulders.) typically found within the stream or floodplain at that site can be reused to implement habitat improvements described under the LW, Boulder, and Gravel Placement (PDC 34) activity category in PROJECTS.

iii. If the structure being removed is keyed into the bank, fill in "key" holes with native materials to restore contours of streambank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over-bank flooding. Do not mine material from the stream channel bed to fill in "key" holes.

iv. When removal of buried log structures may result in significant disruption to riparian vegetation or the floodplain, consider using a chainsaw to extract the portion of log within the channel and leaving the buried sections within the streambank.

v. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first if possible.

vi. If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal. This will require surveying a streambed longitudinal profile. If headcutting and channel incision are likely to occur due to structure removal, additional measures will be taken to reduce these impacts.

vii. If the structure is being removed because it has caused an over-widening of the channel, consider implementing other restoration categories to decrease the width to depth ratio of the stream to a level commensurate with the geomorphic setting.

4. Fluvial Channel Reconstruction/Relocation

Typical projects include reconstruction of existing alluvial stream channels through excavation and structure placement (LW and boulders) or relocation (rerouting of flow) into historical or newly constructed channels that are typically more sinuous and complex. This proposed action applies to stream systems that have been straightened, channelized, dredged, or otherwise

modified for the purpose of flood control, increasing arable land, realignment, or other land use management goals, or for streams that are incised or otherwise disconnected from their floodplains due to watershed disturbances. For tidal wetland and estuarine projects, refer to PDC 39b and 49.

p. General project design criteria
    i. Design Review
        1. Service fish passage review and approval. The Service, in consultation with NMFS engineering, will review the action for consistency with criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011 or the most recent version).
        2. Restoration Review Team (RRT). The action will be individually reviewed by the RRT prior to submission to the Service for approval.
    ii. Design Guidance
        1. Construct geomorphically appropriate stream channels and floodplains within a watershed and reach context.
        2. Design actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that will naturally occur at that stream and valley type.
        3. To the greatest degree possible, remove non-native fill material from the channel and floodplain to an upland site.
        4. When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain where appropriate to support the project goals and objectives.
        5. Structural elements shall fit within the geomorphic context of the stream system. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder step structures shall be preferentially used in step-pool and cascade stream types.
        6. Material selection (LW, rock, gravel) shall also mimic natural stream system materials.
        7. Construction of the streambed should be based on Stream Simulation Design principles as described in section 6.2 of *Stream Simulation:An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) or other appropriate design guidance documents (see PDC 33b).

q. Project documentation. Provide the Service and the RRT with the following documentation:
    i. Background and problem statement
        1. Site history
        2. Environmental baseline
        3. Problem description
        4. Cause of problem
    ii. Project description
        1. Goals/objectives
        2. Project elements

3. Sequencing, implementation
4. Recovery trajectory: how does it develop and evolve?

iii. Design analysis
1. Technical analyses
2. Computations relating design to analysis
3. References

iv. River Restoration Analysis Tool. The River Restoration Analysis Tool (www.restorationreview.com) was created to assist the Service with design and monitoring of aquatic restoration projects. The following questions taken from the tool will be used by the RRT to evaluate the project, and should therefore be addressed in the project documentation:
1. Problem Identification
    a. Is the problem identified?
    b. Are causes identified at appropriate scales?
2. Project Context
    a. Is the project identified as part of a plan, such as a watershed action plan or recovery plan?
    b. Does the project consider ecological, geomorphic, and socioeconomic context?
3. Goals & Objectives
    a. Do goals and objectives address problem, causes, and context?
    b. Are objectives measurable?
4. Alternatives/Options Evaluation
    a. Were alternatives/options considered?
    b. Are uncertainties and risk associated with selected alternative acceptable?
5. Project Design
    a. Do project elements collectively support project objectives?
    b. Are PDC defined for all project elements?
    c. Do project elements work with stream processes to create and maintain habitat?
    d. Is the technical basis of design sound for each project element?
6. Implementation
    a. Are plans and specifications sufficient in scope and detail to execute the project?
    b. Does plan address potential implementation impacts and risks?
7. Monitoring & Management
    a. Does monitoring plan address project compliance?
    b. Does monitoring plan directly measure project effectiveness?

r. Monitoring. Develop a monitoring and adaptive plan that has been reviewed and approved by the RRT and the Service 30 days prior to the planned start of construction. The plan will include the following:
i. Introduction
ii. Existing Monitoring Protocols
iii. Project Effectiveness Monitoring Plan
1. Immediately upon completion of the new channel construction, the contractor shall survey the project and provide as-built monitoring data,

which will be supplied to the Service and the RRT for review. This survey will compare as-built metrics to proposed design metrics on channel length, substrate size, residual pool depth, pieces of LW, etc.

iv. Project Review Team Triggers
v. Monitoring Frequency, Timing, and Duration
vi. Monitoring Technique Protocols
vii. Data Storage and Analysis
viii. Monitoring Quality Assurance Plan
ix. Literature cited

5. Off- and Side-Channel Habitat Restoration

These projects will be implemented to reconnect historical side-channels with floodplains by removing off-channel fill and plugs. Furthermore, new side-channels and alcoves can be constructed in geomorphic settings that will accommodate such features. This activity category typically applies to areas where side channels, alcoves, and other backwater habitats have been filled or blocked from the main channel, disconnecting them from most if not all flow events.

a. Service fish passage review and approval. When a proposed side channel will contain greater than 20% of the bankfull flow[13], the action will be reviewed by the RRT and reviewed and approved by the Service in consultation with NMFS engineering for consistency with NMFS (2011b) Anadromous Salmonid Passage Facility Design criteria.

b. Data requirements. Data requirements and analysis for off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation.

c. Allowable excavation. Off- and side-channel improvements can include minor excavation (less than or equal to 10% of volume) of naturally accumulated sediment within historical channels, i.e., based on the ordinary high water (OHW) level as the elevation datum. The calculation of the 10% excavation volume does not include manually placed fill, such as dikes, berms, or earthen plugs (see PDC 39). There is no limit as to the amount of excavation of anthropogenic fill within historical side channels as long as such channels can be clearly identified through field or aerial photographs. Excavation depth will not exceed the maximum thalweg depth in the main channel. Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity.

[13] Large side channels projects are essentially channel construction projects if they contain more than 20% of flow.

6. Streambank Restoration

Streambank restoration as defined in PROJECTS is an action used in conjunction with other techniques such as dam removal, bridge placement, channel reconstruction, etc. It is not a stand-alone restoration action.

a. The following streambank restoration methods may be used individually or in combination:
    i. Alluvium placement
    ii. LW placement
    iii. Roughened toe
    iv. Woody plantings
    v. Herbaceous cover, in areas where the native vegetation does not include trees or shrubs
    vi. Bank reshaping and slope grading
    vii. Coir logs
    viii. Deformable soil reinforcement
    ix. Engineered log jams
    x. Floodplain flow spreaders
    xi. Floodplain roughness

b. For more information on the above methods see Federal Emergency Management Agency (2009)[14] or Cramer *et al.* (2003)[15]. Other than those methods relying solely upon woody and herbaceous plantings, streambank stabilization projects should be designed by a qualified engineer that is appropriately registered in the state where the work is performed.

c. Rock will not be used for streambank restoration, except as ballast to stabilize LW. Stream barbs and full-spanning weirs are not allowed for stream bank stabilization under PROJECTS.

d. Alluvium Placement can be used as a method for providing bank stabilization using imported gravel/cobble/boulder-sized material of the same composition and size as that in the channel bed and banks to halt or attenuate streambank erosion, stabilize riffles, and provide critical spawning substrate for native fish. This method is predominately for use in small to moderately sized channels and is not appropriate for application in mainstem systems. These structures are designed to provide roughness, redirect flow, and provide stability to adjacent streambed and banks or downstream reaches, while providing valuable fish and wildlife habitat.
    i. Service fish passage review and approval. The Service in consultation with NMFS engineering will review alluvium placement projects that occupy more than 25% of the channel bed or more than 25% of the bankfull cross sectional area.
    ii. This design method is only approved in those areas where the natural sediment supply has been eliminated, significantly reduced through anthropogenic disruptions, or used to initiate or simulate sediment accumulations in conjunction with other structures, such as LW placements and ELJs.
    iii. Material used to construct the toe should be placed in a manner that mimics attached longitudinal bars or point bars.

[14] http://www.fema.gov/pdf/about/regions/regionx/Engineering_With_Nature_Web.pdf
[15] http://wdfw.wa.gov/publications/00046/wdfw00046.pdf

iv. Size distribution of toe material will be diverse and predominately comprised of D_{84} to D_{max} size class material based on measurements for sediments in similar segments of the streambed.
v. Spawning gravels will constitute at least one-third of the total alluvial material used in the design except where the reach does not support spawning or velocities are sufficient to scour out spawning gravels.
vi. Spawning gravels are to be placed at or below an elevation consistent with the water surface elevation of a bankfull event.
vii. Spawning size gravel can be used to fill the voids within toe and bank material and placed directly onto stream banks in a manner that mimics natural debris flows and erosion.
viii. All material will be clean alluvium with similar angularity as the natural bed material. When possible use material of the same lithology as found in the watershed. Reference *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA-Forest Service 2008) to determine gravel sizes appropriate for the stream.
ix. Material can be mined from the floodplain at elevations above bankfull, but not in a manner that will cause stranding during future flood events.
x. Crushed rock is not permitted unless natural bed material is sub-angular to angular.
xi. After placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
xii. Do not place material directly on bars and riffles that are known spawning areas, which may cause fish to spawn on the unsorted and unstable gravel, thus potentially resulting in redd destruction.
xiii. Imported material will be free of invasive species and non-native seeds. If necessary, wash prior to placement.

e. LW Placements are defined as structures composed of LW that do not use mechanical methods as the means of providing structure stability (i.e., large rock, rebar, rope, cable, etc.). The use of native soil, run of alluvium, wood, or buttressing with adjacent trees as methods for providing structure stability are authorized. This method is predominately for use in small to moderately sized channels and is not appropriate for application in mainstem systems. These structures are designed to provide roughness, redirect flow, and provide stability to adjacent streambed and banks or downstream reaches, while providing valuable fish and wildlife habitat.
    i. Service Review and Approval. The Service will review LW placement projects that would occupy greater than 25% of the bankfull cross section area.
    ii. Structure shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.
    iii. Structures may partially or completely span stream channels or be positioned along stream banks.
    iv. Where structures partially or completely span the stream channel LW should be comprised of whole conifer and hardwood trees, logs, and rootwads. LW size (diameter and length) should account for bankfull width and stream discharge rates. See Section 34.a.vi

v. Structures will incorporate a diverse size (diameter and length) distribution of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, etc.
vi. For individual logs that are completely exposed, or embedded less than half their length, logs with rootwads should be a minimum of 1.5 times bankfull channel width, while logs without rootwads should be a minimum of 2.0 times bankfull widths where appropriate.
vii. Consider orienting key pieces such that the hydraulic forces upon the LW increase stability.

f. Engineered Log Jams
i. See PDC 34b.
ii. If LW mechanical anchoring is required, a variety of methods may be used. These include large angular rock, buttressing the wood between adjacent trees, vertical pilings to reduce lateral shifting, or the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, rebar pinning or bolted connections may be used. Use of cable is not covered by PROJECTS.
iii. Use a diverse assemblage of vegetation species native to the action area or region, including trees, shrubs, and herbaceous species. Vegetation, such as willow, sedge and rush mats, may be gathered from abandoned floodplains and stream channels.
iv. Do not apply surface fertilizer within 15.3 m (50 feet) of any stream channel.
v. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
vi. Conduct post-construction monitoring and treatment or removal of invasive plants until native plant species are well established.

7. Set-Back or Removal of Existing Berms, Dikes, and Levees

These projects will be conducted to reconnect historical fresh-water deltas to inundation, stream channels with floodplains, and historical estuaries to tidal influence. Such projects will take place where estuaries and floodplains have been disconnected from adjacent rivers or estuaries through drain pipes and anthropogenic fill.

a. Floodplains and freshwater deltas
    i. Design actions to restore floodplain characteristics—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type.
    ii. Remove drain pipes, fences, and other anthropogenic features to the extent possible.
    iii. To the extent possible, remove non-native fill material from the floodplain to an upland site.
    iv. Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, breaches will be created. Breaches shall be equal to or greater than the bankfull channel width to reduce the potential for scour during flood events. In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel, thus minimizing fish entrapment.
    v. When necessary, loosen compacted soils once overburden material is removed. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that floodplain function is not impeded.

b. Estuary restoration
    vi. Culverts and tide gates will be removed using the PDC and conservation measures, where appropriate, as described in Work Area Isolation (PDC 27), Surface Water Withdrawals (PDC 23), and Fish Capture and Release (PDC 28) and Fish Passage Restoration (PDC 33) above.
    vii. Temporary roads within the project area should be removed to allow free flow of water. Material either will be placed in a stable area above the ordinary high water line or highest measured tide or be used to restore topographic variation in wetlands.
    viii. To the extent possible, remove segmented drain tiles placed to drain wetlands. Fill generated by drain tile removal will be compacted back into the ditch created by removal of the drain tile.
    ix. Channel construction may be done to recreate channel morphology based on aerial photograph interpretation, literature, topographic surveys, and nearby undisturbed channels. Channel dimensions (width and depth) are based on measurements of similar types of channels and the drainage area. In some instances, channel construction is simply breaching the levee. For these sites, further channel development will occur through natural processes. Fill ditches constructed and maintained to drain wetlands. Some points in an open ditch may be over-filled, while other points may be left as low spots to enhance topography and encourage sinuosity of the developing channel.

x. In areas that may be prone to mosquito infestations, ensure that the site is not likely to provide ponded, stagnate, water that would support significant populations of mosquito larvae.

8. Reduction/Relocation of Recreation Impacts

These projects are intended to close, better control, or relocate recreation infrastructure and use along streams, shorelines, estuaries, meadows, and within riparian and upland areas. This includes removal, improvement, or relocation of infrastructure associated with designated campgrounds, dispersed camp sites, day-use sites, foot trails, and off-road vehicle roads/trails in riparian areas.

a. Design remedial actions to restore floodplain characteristics or other natural characteristics of the area—elevation, width, gradient, length, and roughness—in a manner that closely mimics, to the extent possible, those that would naturally occur at that stream and valley type, or natural surroundings.
b. To the extent possible, non-native fill material shall be removed from the floodplain to an upland site, or from natural area to an off-site location.
c. Overburden or fill comprised of native materials, which originated from the project area, can be used to reshape the floodplain, placed in small mounds on the floodplain, used to fill anthropogenic holes, buried on site, or disposed into upland areas.
d. For recreation relocation projects—such as campgrounds, horse corrals, off-road vehicle trails—move current facilities out of the riparian area or as far away from the stream/shoreline as possible.
e. Consider de-compaction of soils and vegetation planting once overburden material is removed.
f. Place barriers—boulders, fences, gates, etc.—outside of the bankfull width and across traffic routes to prevent off-road vehicle access into and across streams.
g. For work conducted on off-road vehicle roads and trails, follow relevant PDC in Road and Trail Erosion Control and Decommissioning (PDC 45) below.

9. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering

Projects will be implemented by constructing fences to exclude riparian grazing, providing controlled access for walkways that livestock use to transit across streams and through riparian areas, and reducing livestock use in riparian areas and stream channels by providing upslope water facilities.

a. Livestock fencing
    i. To the extent possible, fences will be placed outside the channel migration zone and allow for lateral stream movement.
    ii. Minimize vegetation removal, especially potential LW recruitment sources, when constructing fence lines.
    iii. Where appropriate, construct fences at water gaps in a manner that allows passage of LW and other debris.
    iv. Hollow fence post will be capped to prevent trapping small birds and mammals.

b. Livestock stream crossings
    i. The number of crossings will be minimized.
    ii. Locate crossings or water gaps where streambanks are naturally low. Livestock crossings or water gaps will not be located in areas where compaction or other damage can occur to sensitive soils and vegetation (e.g., wetlands) due to congregating livestock.
    iii. To the extent possible, crossings will not be placed in areas where listed species spawn or are suspected of spawning (e.g., pool tailouts where spawning may occur), or within 91.5 m (300 feet) upstream of such areas.
    iv. Existing access roads and stream crossings will be used whenever possible, unless new construction will result in less habitat disturbance and the old trail or crossing is retired.
    v. Access roads or trails will be provided with a vegetated buffer that is adequate to avoid or minimize runoff of sediment and other pollutants to surface waters.
    vi. Essential crossings will be designed and constructed or improved to handle reasonably foreseeable flood risks, including associated bedload and debris, and to prevent the diversion of streamflow out of the channel and down the trail if the crossing fails.
    vii. If necessary, the streambank and approach lanes can be stabilized with native vegetation or angular rock to reduce chronic sedimentation. The stream crossing or water gap should be armored with sufficient sized rock (e.g., cobble-size rock) and use angular rock if natural substrate is not of adequate size.
    viii. Livestock crossings will not create barriers to the passage of adult and juvenile fish. Whenever a culvert or bridge—including bridges constructed from flatbed railroad cars, boxcars, or truck flatbeds—is used to create the crossing, the structure width will tier to PDC listed for Stream Simulation Culvert and Bridge Projects under Fish Passage Restoration (PDC 33).
    ix. Stream crossings and water gaps will be designed and constructed to a width of 3.1 to 4.8 m (10 to 15 feet) in the upstream-downstream direction to minimize the time livestock will spend in the crossing or riparian area.
    x. When using pressure treated lumber for fence posts, complete all cutting/drilling offsite (to the extent possible) so that treated wood chips and debris do not enter water or flood prone areas.

xi. Riparian fencing is not to be used to create livestock handling facilities.

c. Off-channel livestock watering facilities
    i. Livestock watering facilities should be designed to prevent the entrapment of wildlife.
    ii. The development of a spring is not allowed if the spring is occupied by listed species.
    iii. Water withdrawals will not dewater habitats or cause low stream flow conditions that could affect listed fish. Withdrawals may not exceed 10% of the available flow.
    iv. Troughs or tanks fed from a stream or river will have an existing valid water right. Surface water intakes will be screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011 or the most recent version), be self-cleaning, or regularly maintained by removing debris buildup. A responsible party will be designated to conduct regular inspection and as-needed maintenance to ensure pumps and screens are properly functioning.
    v. Place troughs far enough from a stream or surround with a protective surface to prevent mud and sediment delivery to the stream. Avoid steep slopes and areas where compaction or damage could occur to sensitive soils, slopes, or vegetation due to congregating livestock.
    vi. Ensure that each livestock water development has a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.
    vii. Minimize removal of vegetation around springs and wet areas.
    viii. When necessary, construct a fence around the spring development to prevent livestock damage.

10. Piling, Marine Debris and Other Structure Removal

Typical projects include the removal of untreated and chemically treated wood pilings, piers, vessels, boat docks, derelict fishing gear, as well as similar structures comprised of plastic, concrete, and other material. Pilings and other structures occur in estuaries, lakes, floodplains, rivers, and nearshore or deeper water habitat, and are typically used in association with boat docks, buildings, and other facilities.

a. When removing an intact pile
    i. Install a floating surface boom to capture floating surface debris.
    ii. To the extent possible, keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions.
    iii. Dislodge the piling with a vibratory hammer, whenever feasible. Never intentionally break a pile by twisting or bending.
    iv. Slowly lift piles from the sediment and through the water column.
    v. Place chemically-treated piles in a containment basin on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment. A containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment and return flow which may otherwise be directed back to the waterway.
    vi. After piling removal, fill the holes with clean, native sediments from the project area when possible, or analogous material from other sources if excavation of native material would increase impacts to listed species.
    vii. Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

b. When removing a broken pile
    i. If a pile breaks above the surface of uncontaminated sediment, or less than 0.61 m (2 feet) below the surface, make every attempt short of excavation to remove it entirely. If the pile cannot be removed without excavation, drive the pile deeper if possible.
    ii. If dredging is likely in the area of piling removal, use a GPS (global positioning device) to note the location of all broken piles for future use in site debris characterization.

c. Removal of derelict vessels and fishing gear.
    iii. Removal operations must follow state approved guidelines.

11. Shellfish Bed/Nearshore Habitat Restoration

Typical projects may involve shellfish bed restoration, replacing shore line armoring, and providing beach nourishment. An example of a sustainable restoration action might include restoration of sediment input to the nearshore by removing bulkheads at historical feeder bluff sites, thereby allowing gradual and ongoing erosion/mass wasting of bluffs and LW recruitment, instead of one-time beach nourishment. PROJECTS does not cover projects where the sole objective is to protect upland property or to cap contaminants.

a. Shellfish bed restoration
    i. Shell or other substance used for substrate enhancement will be procured from clean sources that do not deplete the existing supply of shell bottom. Shells should be steam cleaned, left on dry land for a minimum of one month, or both, before placement in the aquatic environment. Shells from the local area should be used whenever possible.
    ii. When placing shell substrate, juveniles, adults, or spat-on-shell in areas occupied by submerged aquatic vegetation, there will be an implementation plan submitted, detailing existing condition, density, and spatial extent of native eelgrass; and proposed planting density and anticipated effects on eelgrass density and long-term viability. The implementation plan will provide reasonable assurances that submerged aquatic vegetation (eelgrass, kelp, etc.) will not be significantly affected, that there will be a net environmental benefit resulting from the action, or both.
    iii. Molluscan shellfish (live) and any co-planted submerged aquatic vegetation used for restoration will be species native to the project area.
b. Replacing hard shoreline armoring (riprap and bulkheads) with alternative or soft shore armoring to protect property. Project selection will require accurate assessment of existing conditions, erosion risks, and patterns of future degradation.
    i. Conduct a site assessment describing the conditions that created the need for the restoration project and the mechanisms that underlie it. Site assessments also describe the natural resources and the human infrastructure within the project area and their vulnerability to shoreline erosion. Effective project plans also will consider how the project fits in a broader geomorphologic context of the associated drift cell or other ecosystem component. Alternatives to "hard armor" might include, but are not limited to:
        1. Restoration of original shore geometry (bulkhead removal or setback)
        2. Beach nourishment (gravel beach design) when the goal of importing sediment is to reduce wave energy to the upper beach
        3. Grade control/slope support with LW and/or rock
        4. Wood revetment or wood/rock revetment
        5. Biotechnical slope support (vegetated geogrids, soil pillows, etc.)[16].
    ii. Restrict plantings to native vegetation.
c. Beach nourishment. Projects may use sediment harvested during already permitted dredging activities and/or gravel from upland sources. Imported material will be free of invasive species and non-native seeds. Sediment is either trucked or barged in and placed in the high tide zone of the beach, where it is likely to be reworked and

[16] See *Marine Shoreline Design Guidelines* (Johannessen *et al.*) for examples of a variety of erosion control techniques, including bioengineering, gravel beach nourishment, and the active use of logs and woody debris

redistributed by wave action. The goal is to use indigenous materials to mimic natural processes, with the expectation that the nourished beach will perform much as a natural one, for a limited period of time following material placement. Consider extant wave exposure, supply and types of natural sources of sediment, net longshore sediment transport, predicted sea level rise and the size of sediment. For example: if the goal is to restore historical surf smelt spawning habitat, sediment placement should include a sand/pea gravel mix, with the bulk in the 1 to 7 mm (< 0.28 inch) diameter range within the uppermost one-third of the tidal range (approximately + 2.1 m (7 feet) upward) (Penttila 2007).

i. Service review and approval. The Service in consultation with NMFS engineering will review beach nourishment project plans to minimize potential adverse impacts to designated critical habitat/essential fish habitat such as eelgrass or other submerged aquatic vegetation, sea lion haulouts, and other resources that may be present. The Service will also review monitoring reports.

ii. Conduct topographic and bathymetric profile surveys of the beach and offshore within the project and control areas. Pre- and post-construction surveys shall be conducted no more than 90 days before construction commences and no more than 60 days after construction ends.

iii. Develop post-project monitoring plan. The frequency and duration of monitoring should be commensurate with the scale and complexity of the project. Comparisons will be made between conditions at the project site after construction and those that were present before construction, or which exist on an adjacent reference beach similar in form to the constructed beach. (For very large projects performance monitoring of beach restoration projects often continues for 10 (biological performance) to 20 (physical performance) years.)

    6. Physical monitoring surveys shall be conducted in years 1, 2, 3, 5, and 10, and during interim years as needed to investigate the functioning of the new beach. Beach/depth profile transect surveys shall be conducted during a spring or summer month and repeated as close as practicable during that same month of the year. Detailed maps of sampling locations shall be presented as needed.
    7. Biological monitoring shall be conducted in years 2, 5, and 10 after completion of construction. Biological evaluation of the restored beach may include comparing pre-post project differences in the density of epibenthic zooplankton, numbers and length frequency of juvenile salmonids, and forage fish spawning. Detailed maps of sampling locations shall be presented as needed.

12. In-Channel Nutrient Enhancement

Typical projects include the placement of salmon carcasses, salmon carcass analogs, or inorganic fertilizers in stream channels to help return stream nutrient levels back to historical levels. This action helps restore marine-derived nutrients to aquatic systems, thereby adding an element to the food chain that is important for growth of macroinvertebrates, juvenile salmonids, and riparian vegetation. Application and distribution of nutrients throughout a stream corridor can occur from bridges, stream banks, boats, or helicopter.

a. In Oregon, follow guidelines for the placement of carcasses in the Oregon Watershed Enhancement Board's (1999) Oregon Aquatic Habitat Restoration and Enhancement Guide17. Projects are permitted through Oregon Department of Environmental Quality, which regulates the placement of carcasses instream as a discharge. Use carcasses from the treated watershed or those that are certified disease free by an ODFW pathologist.
b. In Washington, follow WDFW's *Protocols and Guidelines for Distributing Salmonid Carcasses, Salmon Carcass Analogs, and Delayed Release Fertilizers to Enhance Stream Productivity in Washington State* (Cramer 2012) or the most recent edition.
c. Ensure that the relevant streams have the capacity to capture and store placed carcasses.
d. Carcasses should be of species native to the watershed and placed during the normal migration and spawning times that would naturally occur in the watershed.
e. Do not supplement nutrients in eutrophic or naturally oligotrophic systems.

[17] http://www.habitat.noaa.gov/pdf/salmon_passage_facility_design.pdf

13. Road and Trail Erosion Control and Decommissioning

Typical projects include hydrologically closing or decommissioning roads and trails, including culvert removal in perennial and intermittent streams; removing, installing or upgrading cross-drainage culverts; upgrading culverts on non-fish-bearing steams; constructing water bars and dips; reshaping road prisms; vegetating fill and cut slopes; removing and stabilizing of side-cast materials; grading or resurfacing roads that have been improved for aquatic restoration with gravel, bark chips, or other permeable materials; contour shaping of the road or trail base; removing road fill to native soils; and soil stabilization and tilling compacted surfaces to reestablish native vegetation. Such actions will target priority roads that contribute sediment to streams and wetlands, block fish passage, or disrupt floodplain and riparian functions.

a. Road decommissioning and stormproofing
    i. For road decommissioning projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
    ii. When obliterating or removing segments immediately adjacent to a stream, use sediment control barriers between the project and stream.
    iii. Dispose of slide and waste material in stable sites out of the flood-prone area. Native material may be used to restore natural or near-natural contours.
    iv. Drainage features used for stormproofing and treatment projects should be spaced as to hydrologically disconnect road surface runoff from stream channels. If grading and resurfacing is required, use gravel, bark, or other permeable materials for resurfacing.
    v. Minimize disturbance of existing vegetation in ditches and at stream crossings.
    vi. Conduct activities during dry-field conditions (generally May 15 to October 15) when the soil is more resistant to compaction and soil moisture is low.
    vii. When removing a culvert from a first or second order, non-fishing bearing stream, project specialists shall determine if culvert removal should include stream isolation and rerouting in project design. Culvert removal on fish bearing streams shall adhere to the measures described in Fish Passage Restoration (PDC 33).
    viii. For culvert removal projects, restore natural drainage patterns and channel morphology. Evaluate channel incision risk and construct in-channel grade control structures when necessary.
b. Road relocation
    i. When a road is decommissioned in a floodplain and future vehicle access through the area is still required, relocate the road as far as practical away from the stream or in a location that minimizes impacts to the stream.
    ii. Road relocation must be constructed in a manner that will not increase the drainage network. Project must be constructed to hydrologically disconnect road from the stream network to the extent practical. New cross drains shall discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream.
    iii. This consultation does not cover new road construction (not associated with road relocation) or routine maintenance within riparian areas.

14. Juniper Removal

This restoration action will be conducted in riparian areas and adjoining uplands to help restore plant species composition and structure that would occur under natural fire regimes. Juniper removal will occur in those areas where juniper have encroached into riparian areas as a result of fire exclusion, thereby replacing more desired riparian plant species such as willow, cottonwood (*Populus* spp.), aspen (*Populus tremuloides*), alder (*Alnus* spp.), sedge, and rush. Guidelines on management of western juniper can be found at: http://www.oregon.gov/OWEB/MONITOR/docs/westernjunipermanagementfieldguide.pdf. The following measures will apply:

a. Remove juniper to natural stocking levels where juniper trees are expanding into neighboring plant communities to the detriment of other native riparian vegetation, soils, or streamflow.
b. Do not cut old-growth juniper, which typically has several of the following features: sparse limbs, dead limbed or spiked-tops, deeply furrowed and fibrous bark, branches covered with bright-green arboreal lichens, noticeable decay of cambium layer at base of tree, and limited terminal leader growth in upper branches.
c. Felled trees may be left in place, lower limbs may be cut and scattered, or all or part of the trees may be used for streambank or wetland restoration (e.g., manipulated as necessary to protect riparian or wetland shrubs from grazing by livestock or wildlife or otherwise restore ecological function in floodplain, riparian, and wetland habitats).
d. Where appropriate, cut juniper may be placed into stream channels and floodplains to provide aquatic benefits. Juniper can be felled or placed into the stream to promote channel aggradation as long as such actions do not obstruct fish movement and use of spawning gravels or increase width to depth ratios.
e. On steep or south-facing slopes, where ground vegetation is sparse, leave felled juniper in sufficient quantities to promote reestablishment of vegetation and prevent erosion.
f. If seeding is a part of the action, consider whether seeding will be most appropriate before or after juniper treatment.
g. Juniper tree removal in riparian or upland areas must not result in significant soil disturbances that may cause increased sedimentation and erosion.
h. Slash materials should be gathered by hand or with light machinery to reduce soil disturbance and compaction. Avoid accumulating or spreading slash in upland draws, streams, and springs. Slash control and disposal activities must be conducted in a manner that reduces the occurrence of debris in aquatic habitats.
i. When using feller-buncher and slash-buster equipment, operate equipment in a manner that minimizes soil compaction and disturbance to soils and native vegetation to the extent possible. Equipment exclusion areas (buffer area along stream channels) should be as wide as the feller-buncher or slash-buster arm.

15. Native Fish Protection

Typical projects include the removal of brook trout or other non-native fish species via electrofishing or other manual means to reduce competition or hybridization with bull trout.

a. The measures specified in this PDC are designed to protect listed species under Service's jurisdiction.
b. For brook trout or other non-native fish species removal, staff experienced in the specific removal method shall be involved in project design and implementation.
c. When using electrofishing for removal of brook trout or other non-native fish species, use the following guidelines:
    i. Electrofishing shall be conducted using the methods outlined in the NMFS's guidelines (NMFS 2000).
    ii. Electrofishing equipment shall be operated at the lowest possible effective settings to minimize injury or mortality to bull trout.
    iii. To reduce adverse effects to bull trout, electrofishing shall only occur from May 1 (or after emergence occurs) to July 31 in known bull trout spawning areas. No electrofishing will occur in any bull trout habitat after August 15.
    iv. Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in 30 cm (1 foot) of water.
    v. Electrofishing will not be conducted within core areas that contain 100 or fewer adult bull trout.
d. Other removal methods, such as dip netting, spearing, and other means can be used.

16. Beaver Habitat Restoration

This restoration action includes installation of in-channel structures to encourage beavers to build dams in incised channels and across potential floodplain surfaces.

a. In-channel structures
    i. Consist of porous channel-spanning structures comprised of biodegradable vertical posts (beaver dam support structures) approximately 0.5 to 1 meter (19.7 to 39.4 inches) apart and at a height intended to act as the crest elevation of an active beaver dam. Variation of this restoration treatment may include post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams as described by Lewallen *et al.* (2015 (*In prep*.), 2012).
    ii. Place beaver dam support structures in areas conducive to dam construction as determined by stream gradient or historical beaver use.
    iii. Place in areas with sufficient deciduous shrub and trees to promote sustained beaver occupancy.

b. Habitat Restoration
    i. Beaver restoration activities may include planting riparian hardwoods (species such as willow, red osier dogwood (*Cornus sericea*), and alder) and building exclosures (such as temporary fences) to protect and enhance existing or planted riparian hardwoods until they are established as described by the Malheur National Forest (NF) and the Keystone Project (2007)[18].
    ii. Maintain or develop grazing plans that will ensure the success of beaver habitat restoration objectives.

[18] http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033699.pdf

17. Wetland Restoration

Typical projects restore degraded wetlands by a) excavation and removal of fill materials; b) contouring to reestablish more natural topography; c) setting back existing dikes, berms and levees; d) reconnecting or re-creating historical tidal and fluvial channels; e) planting native wetland species; or f) a combination of the above methods. This action does not include installation of water control structures or fish passage structures.

a. Include applicable General Construction Measures (PDC 13-32) and PDC for specific types of actions as applicable (e.g., Off- and Side-Channel Habitat Restoration (PDC 37); Set-Back or Removal of Existing Berms, Dikes, and Levees for Wetland and Estuary Restoration (PDC 39); and Dam and Legacy Structure Removal (PDC 35)) to ensure that all adverse effects to fish and their designated critical habitats are within the range of effects considered in PROJECTS.

18. Tide/Flood Gate Removal, Replacement, or Retrofit

Typical projects may include the removal, replacement, or the upgrade of existing tide and flood gates by modifying gate components and mechanisms in tidal stream systems where full tidal exchange is incompatible with current land use or where backwater effects are of concern. Projects will be implemented to reconnect stream/slough corridors, floodplains, estuaries and nearshore habitats, reestablish wetlands, improve aquatic organism passage, and restore more natural channel and flow conditions. Tide/flood gate replacement or retrofit may include, but is not limited to, excavation of existing channels, adjacent floodplains, flood channels, and wetlands, and may include structural elements such as streambank restoration and hydraulic roughness elements. Placement of new gates where they did not previously exist is not covered in PROJECTS, except where an existing tidegate is being replaced with one upstream in the same drainage as part of a levee setback project.

a. Service review and approval. The Service in consultation with NMFS engineering will review tide/flood gate removal, replacement, and retrofit projects for consistency with Anadromous Salmonid Passage Facility Design (NMFS 2011 or the most recent version).
b. For removal projects, if a culvert or bridge will be constructed at the location of a removed tide gate, the structure will be large enough to allow for a full tidal exchange.
c. Follow PDC for Staging, Storage, and Stockpile Areas (PDC 16), Hazardous Material Spill Prevention and Control (PDC18), Equipment, Vehicles, and Power Tools (PDC19), Surface Water Withdrawal and Construction Discharge Water (PDC 23), Work Area Isolation (PDC 27), Timing of In-Water Work (PDC 25), Fish Capture and Release (PDC 28); Site Restoration (PDC 31), and Revegetation (PDC 32). Excavation below the OHW line shall be conducted to the maximum extent possible during low tide cycles or low flow cycles in the downstream watercourse.
d. Overall design goals. Tide/flood gate replacement or retrofit design data will demonstrate:
    i. A clear linkage to limiting factors identified within an appropriate sub-basin plan or recovery plan, or based on recommendations by a technical oversight and steering committee within a localized region.
    ii. The identification and, to the extent possible, the correction of the degraded baseline condition.
    iii. The use of analytical approaches for determination of the tidal prism and exchange.
    iv. Appropriate self-sustaining hydrologic design that includes climate change to reduce maintenance.
e. General project design criteria
    i. Site specific project design criteria will be set based on tidal restoration, fish passage, climate change and flood protection needs as determined and set forth by the RRT. At a minimum, the RRT will assess the following design options after determining necessity of the project.
    ii. Tide/Flood Gate Replacement or Retrofit Options in order of preference
        1. Dike removal
        2. Dike breach
        3. Dike setback (With the existing tide gate, or a replacement with an upgraded tidegate as described below)
        4. Bridge
        5. Non-gated pipe or “bare” culvert

a. Existing pipe minus the tide gate (removed)
b. Installation of new pipe minus a tide gate

iii. Tide Gate
6. Fiberglass or aluminum gate
7. Side hinged gate
8. Self-regulating tide gate
a. Tension (cable) operated
b. Float (cam) operated

iv. Hybrid (such as self-regulating tide gate coupled with non-gated pipe)
v. Other design options as recommended by the RRT
vi. Design actions to restore tidal exchange characteristics—elevation, cross-sectional area, timing—in a manner that closely mimics, to the greatest degree possible, those that would naturally occur at that stream type.

f. Design report & associated documentation. Tide/flood gate replacement and retrofit design and adaptive management documentation shall include:
i. Background and Problem Statement
1. Site history
2. Environmental baseline
3. Problem description
4. Cause of problem

ii. Project Description
1. Goals/objectives
2. Project elements
3. Sequencing, implementation
a. Place cofferdam upstream of the culvert to prevent drainage water from entering the work area. A downstream cofferdam will also be installed to isolate the work area from the watercourse.
b. The existing culvert requiring replacement is then excavated with equipment staged on the dike or shoreline above OHW.
c. Excavated material is stockpiled upland for replacement in the dike once the new culvert is in-place.
d. Waste water removed from within the cofferdam work area shall be discharged to a location landward of OHW line in a manner that allows removal of fine sediments prior to the discharged water returning to the watercourses.
e. Upon completion of the tide gate/flood gate repairs and/or replacement, all material used to construct the cofferdams shall be removed from the watercourses and the project site returned to pre-project or improved conditions.
f. Restore LW features to redeveloping tidal channels.
g. Drainage ditches will be filled to become part of the surrounding contiguous tidal marsh or will be modified to become part of the tidal channel network.
9. Proposed work window
10. Recovery trajectory: Describe how the new stream/tidal channel will develop and evolve.

iii. Design Analysis, including technical analyses, computations relating design to analysis, and references. Analyses shall be appropriate to the level of project complexity. At a minimum, analyses will include the following:
    11. Hydraulic Analysis
        a. Model conditions, duration, boundary conditions, inputs, and outputs will be collaboratively developed by RRT and modeler.
    12. Sediment Assessment
    13. Risk Analysis
iv. Detailed construction drawings
v. Other regulatory jurisdictions for tide and floodgate repair and replacement will also be addressed: *i.e.*, United States Army Corps of Engineers (USACE), River and Harbors Act §10, Clean Water Act §404, Coastal Zone Management Act, ODFW Fish Passage Oregon Administrative Rule (OAR); ODEQ & WDOE §401, WDFW Hydraulic Project Approval, Washington Environmental Policy Act evaluation, Washington Shoreline Management Act
vi. River Restoration Tool. Review by the RRT will also include an evaluation using the River Restoration Analysis Tool (www.restorationreview.com), and therefore the following questions will be addressed in the project documentation:
    1. Problem Identification
        a. Is the problem identified?
        b. Are causes identified at appropriate scales?
    2. Project Context
        c. Is the project identified as part of a plan, such as a watershed action plan or recovery plan?
        d. Does the project consider ecological, geomorphic, and socioeconomic context?
    3. Goals & Objectives
        e. Do goals and objectives address problem, causes, and context?
        f. Are objectives measurable?
    4. Alternatives Evaluation
        g. Were alternative considered?
        h. Are uncertainties and risk associated with selected alternative acceptable?
    5. Project Design
        i. Do project elements collectively support project objectives?
        j. Are design criteria defined for all project elements?
        k. Do project elements work with stream processes to create and maintain habitat?
        l. Is the technical basis of design sound for each project element?
    6. Implementation
        m. Are plans and specifications sufficient in scope and detail to execute the project?
        n. Does plan address potential implementation impacts and risks?
    7. Monitoring and Management
        o. Does monitoring plan address project compliance?
        p. Does monitoring plan directly measure project effectiveness?

q. Does the maintenance plan include replacement for components that corrode over time?

g. Monitoring and adaptive management. Develop a monitoring and adaptive management plan that has been reviewed and approved by the RRT, that includes the following:
   i. Introduction
   ii. Existing monitoring protocols
   iii. Project effectiveness monitoring plan
   iv. Project review team triggering conditions
   v. Monitoring frequency, timing, and duration
   vi. Monitoring technique protocols
   vii. Data storage and analysis
   viii. Monitoring quality assurance plan
   ix. Literature cited

19. Native Vegetation Restoration and Management

These restoration actions will be conducted in upland areas, including coastal and nearshore habitats, oak savannah and prairie habitats, and forest habitats. Categories of restoration and management activities and PDC included:

1) Manual and mechanical vegetation management techniques,
2) Grazing,
3) Prescribed burning,
4) Herbicide treatments (see also PDC 29),
5) Plant population enhancement,
6) Surveys and Monitoring (see PDC 26).

Restoration and management actions will help restore plant species composition and structure that would occur under natural disturbances regimes, such as flooding, fire, or tidal and wave action. Actions include the conversion of human-altered habitats to historic oak savannahs, short and tall grass prairies, conifer and hardwood forests, and coastal dune restoration. Restoration of these upland communities encompasses the direct manipulation of plants and soils/sand to alter existing or competing plant communities to recover or maintain select native plant communities. This is achieved by the use of mechanical, physical, burn, grazing, or chemical techniques to eradicate or control undesirable vegetation and alter vegetation and soil properties.

Native vegetation restoration will also include plant population enhancement (propagule collection, propagation, population augmentation and reintroduction) of listed plants. Activities can occur in prairie, oak woodland and savanna, and coastal habitats. A summary of treatments used for each activity and the benefits to listed species is presented in the following table. These treatments are an integration of the several restorations actions described in the Programmatic Consultation for Western Oregon Prairie Restoration Activities (2008), Programmatic Consultation for Oregon's Restoration and Recovery Programs (2010), and Programmatic Biological Assessment for Habitat Restoration Activities, Western Washington Version (2006).

In addition to improving conditions for listed plant species, these actions will also benefit other listed species that depend on native plant communities for their continued existence. A complete description of the proposed action, PDC for native vegetation restoration and species-specific conservations measures will be maintained in PROJECTS Handbook, which may be amended through annual updates, provided all additions/amendments do not result in any additional effects beyond those considered in the Biological Opinion issued for PROJECTS.

Table 2. Activities and Treatment Techniques for Native Vegetation Restoration in Idaho, Oregon and Washington. (Table removed from Handbook)

i. Manual and mechanical (non-herbicide) treatment methods. The following methods may be used:Limit native vegetation removal and soil disturbance within the riparian zone by limiting the number of workers to the minimum necessary to complete manual, mechanical, or hydro-mechanical plant control (e.g., hand pulling, bending[19], clipping, stabbing, digging, brush-cutting,

[19] Knotweed treatment pre-treatment; See Nickelson (2013).

mulching, radiant heat, portable flame burner, super-heated steam, pressurized hot water, or hot foam (Arsenault *et al.* 2008; Donohoe *et al.* 2010))[20].

ii. Do not allow cut, mowed, or pulled vegetation to enter waterways.

Mowing. Sites may be mowed using tractor mowers, flail mowers, or hand-held mowers (e.g. rotary line trimmers). In sites supporting populations of listed plants and/or butterflies:

i. Mowing will generally be implemented in the fall and winter, after listed plants have senesced for the season and /or butterflies are in diapause (Table 3).
ii. Tractor mowers should be rubber-tracked to minimize soil compaction and/or rutting.
iii. Tractor mowing decks should be set sufficiently high to avoid soil gouging; see Table 3 for species specific information.
iv. Mowing activities will follow the timing restrictions and mower height settings provided in Table 3 for all affected listed species.
v. Spring mowing is allowed at restoration sites with listed plant species, as indicated in Table 3, but only if necessary to control serious infestations of weeds that reproduce mainly by seed (*e.g.*, meadow knapweed) and threaten persistence of the listed species in that area. In these instances, up to one half of area occupied by the listed plant population(s) at a site may be mowed in an effort to reduce seed set by non-native weeds. Spring mowing must be approved by the local Service office and species lead.
vi. Manual removal. Invasive plants may be removed year-round using manual methods and hand tools, including hoeing, grubbing, pulling, clipping or digging. Tools that may be used include shovel, hoe, weed wrench, lopping shears, trowel, etc.
vii. Cutting/thinning/removing tree stumps. Handheld power tools may be used to cut down woody vegetation, control and remove invasive woody plants, and reduce tree density. The extent of these actions could be guided by reviews of site records (including aerial photographs) and percent cover thresholds for the habitat types.
    - In highly degraded sites, low impact vehicle-mounted tree shears may be used to thin woody vegetation.
    - Tree stumps and their root systems may be removed manually or mechanically using vehicle-supported machinery to avoid re-sprouting. This should be restricted to the dry season if listed species are present.
    - Cutting or thinning may be implemented either at times of the year when listed species are dormant, or in the case of selective manual methods where workers enter the site on foot, in such a way as to avoid trampling of any listed species.
    - If herbicides will be used to treat freshly-cut stumps, trees must be felled at times that coincide with timing restrictions for chemical use.
    - All cut material will be piled or chipped and spread away from populations of listed plants or butterflies or hauled off-site for disposal, unless material

[20] See http://ahmct.ucdavis.edu/limtask/equipmentdetails.html

is needed to use for a prescribed burn treatment. In cases where work is done during the wet season, cut debris may be temporarily piled on-site, but away from listed plants and butterflies, until the dry season when equipment can access the work area to remove debris.

viii. Girdling trees. Girdling trees involves removal of a ring of bark near the base of a tree with an axe or chainsaw. It eventually kills the tree and is done to control and remove invasive woody plants. Girdling may be applied at any time of year. Workers will enter sites on foot and take care to avoid trampling listed plants and animals, and native species that support listed animals. Depending on management objectives, girdled trees may remain on site or be removed during the dry season when listed plants and butterfly host lupines are dormant.

ix. Raking. Raking is used to reduce thatch build up. Rakes may be tractor-mounted or hand-held.

- Raking will occur when listed plants are dormant (generally August 15 to February 28).
- Efforts will be made to avoid disturbing underlying soil.
- In sites with listed plant species that do not senesce in the winter (*e.g.*, Nelson's checkermallow), efforts will be made to avoid individuals of the listed plant.
- When rakes are tractor-mounted, tractors shall be equipped with rubber tracks to minimize soil compaction.

x. Shade cloth. Used to control monotypic weed infestations. Dark cloth placed over weeds and fastened to ground with stakes for two years. Shade cloth is installed during the growing season, but will not be used directly over any individuals of listed plant or animal species but can be used 20 m (65 feet) from listed species, unless species-specific measures state otherwise.

xi. Sod Rolling. Used to control invasive plants, especially those which spread by rhizomes. A bulldozer is used to roll away the top layer of soil and plant material, leaving a relatively intact soil layer beneath. The removed vegetative mats are deposited into windrows at the edge of the site, where they compost in place. This technique will not be used where listed species are present, but can be used 10 m (33 feet) from listed plant and animal species unless species-specific measures state otherwise.

Table 3. Species-specific timing for mowing and prescribed burn methods for the control or removal of invasive and non-native vegetation at project sites occupied by listed plant species. See species-specific conservation measures for additional restrictions on these activities for listed animals that may be present.

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	Mechanical Mowing – Timing [Mower Deck Height]	Spring Mowing Allowed?
Bradshaw's lomatium	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Cook's desert-parsley	Fall burns after September 1	Summer/Fall mowing after July 15 [5 cm (2 inches)]	No

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	Mechanical Mowing – Timing [Mower Deck Height]	Spring Mowing Allowed?
Gentner's fritillary	Fall burns after September 1	Summer/Fall mowing after July 15 [15 cm (6 inches)]	No
Golden Paintbrush	Fall burns after August 15	Late winter (February to March 15) mowing OK , then mow again after September 15, if site not burned	Yes- with restrictions.. Complete by mid-March
Howell's spectacular thelypody	Not Allowed	Not Allowed	No
Kincaid's lupine	Fall burns after August 15	Fall mowing after August 15 15 cm [6 inches)]	Yes- with restrictions.
Large-flowered woolly meadowfoam	Fall burns after September 1	Summer/Fall mowing after July 15 [5 cm (2 inches)]	No
Nelson's checkermallow	Fall burns after August 15; up to 50% of the occupied area at a site.	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Rough popcorn flower	Fall burns after August 15	Fall mowing after August 15 [10 cm (4 inches)]	No
Spalding's catchfly	Not Allowed	Not Allowed	No
Ute ladies'- tresses	Not Allowed	Not Allowed	No
Water Howellia	Not Allowed	Not Allowed	No
Wenatchee Mountains checkermallow	Fall burns after August 15	Unlikely mowing could be accomplished. Selective weed removal would be helpful.	No
Western lily	Fall burns[7] between November 1 and March 1	Fall mowing[7] between November 1 and March 1 [10 cm (4 inches)]	No
Willamette daisy	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes- with restrictions.
LISTED ANIMAL SPECIES			
Fender's blue butterfly	Burning OK on 25 to 33% of an occupied area after August 15 to Nov 15.	August 15 to March 1 [15 cm (6 inches)]	No
Oregon silverspot butterfly	Burning OK on 25 to 33% of an occupied area from October 1 to mid July	October 1 to Mid-May. No more than 75% of an occupied area	Yes Complete by May 15
Taylor's checekerspot butterfly	Burning OK only on 33% of an occupied area during diapause only (Sept 10 to Feb 15)	Mowing OK during diapause September 10 to February 15	No.

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	Mechanical Mowing – Timing [Mower Deck Height]	Spring Mowing Allowed?
Vernal pool fairy shrimp	Any time	Treat invasive plants any time if listed plants not present	Yes
Streaked horned lark	Outside of nesting season in suitable habitat. Anytime in unsuitable habitat.	Sept 1 to March 30: 100% April 1 to August 31 no more than 50% of an occupied area. Mower set to highest level to meet objectives.	Yes, up to 50% of an occupied area.
Mazama pocket gopher	Yes but must get approval from local office	Yes, but must get approval from local office	Yes, but must get approval

xii. Solarization. Also used to kill monotypic weed patches. A site is covered with plastic sheeting, which remains for at least three months during the growing season. Follow-up weeding may be necessary once plastic is removed. This technique will not be used where listed plants or animals are present, but can be used in adjacent habitat no closer than 10 m (30 feet) to listed plant and animal species unless species specific measures state otherwise.

xiii. Tilling/disking. A tractor with a tiller/disk attachment will be used to turn up the soil to a depth of no more than 30 cm (12 inches). This technique will be implemented along existing ground contours when possible, and will not occur during the wet season. Tilling/disking must be followed immediately with introduction of native plant species unless further weed eradication is scheduled to take place. Tilling and disking will not be used within 10 m (30 feet) of known populations of listed plant and animal species, unless species specific measures state otherwise.

c. Livestock grazing. Used to control shrubby invasive vegetation, new invasive vegetation sprouts, and leaf litter buildup.
   i. Livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Cook's desert parsley, Gentner's fritillary, Howell's spectacular thelypody, Nelson's checkermallow, large-flowered meadowfoam, rough popcornflower, and Spalding's catchfly, unless approved by the local Service office or species lead.
   ii. Grazing at low-moderate levels during the dry season will be allowed in prairies after August 1 and before listed plant species emerge the following year.
   iii. Grazing will not occur during the wet season when soils are soft or saturated, unless approved by the local Service office and species lead.
   iv. Grazing intensity and duration must not result in excessive trampling of vegetation or the creation of bare soil.
   v. Grazing activities will be monitored on a daily or weekly basis, as appropriate to avoid negative impacts.
   vi. Grazing activities will be terminated once management objectives are achieved at the project site. Animals will be removed from the site within three days of this termination.

vii. Animals used in grazing activities will be isolated from invasive and non-native vegetation prior to being released into a project site to avoid contaminating the area with seeds and/or other reproductive parts from invasive and non-native vegetation.

d. Prescribed burning.
   i. Prescribed burning is the measured application of fire to control invasive woody plants, remove thatch and invigorate native plant populations in upland and wet prairie systems. The technique involves the hand application of fire via drip torches or similar equipment.
   ii. A 15 m (50 feet) vegetative buffer will be maintained adjacent to any fish-bearing stream.
   iii. A burn plan is required, although it may vary by management objectives and site conditions.
   iv. Prescribed fire for sites with listed plants, butterflies, pocket gophers, and remnant prairie vegetation should be of low intensity, and take place on cool, cloudy days later in the dry season. Woody vegetation may be removed from treatment area prior to burning.
   v. Timing of burns when listed species are present will be consistent with Table 3.
   vi. All burns will comply with State regulations and protocols.
   vii. Firebreaks will be used to prevent fire from spreading outside of planned burn area. Fire retardant chemicals will be used sparingly near listed plant and animal populations, and will not be used within 37 m (120 feet) of a watercourse.
   viii. An area 3 to 6 m (10 to 20 feet) wide may also be mowed around the outside boundary of the burn area to help assure fire control.
   ix. Fire management vehicles will be restricted to adjacent non-native or resilient vegetation except during an emergency, and then for only the duration of the emergency.
   x. Human movement in the prescribed burn area will be managed to minimize impacts on listed plants and the native prairie community (except as needed for human safety).
   xi. At sites supporting listed plant species that do not completely senesce by late summer (*e.g.*, Nelson's checker-mallow), no more than one half of the occupied habitat may be burned in any year, if burning is allowed (See Table 3).

e. Herbicide Methods for Prairie, Nearshore, and Oak Savannah Sites more than 100 feet from water. Other herbicides identified as "aquatic use" in PDC 29 may also be used in prairies.
   i. Allowed Herbicides (a subset of those allowed under PDC 29)
      - Aminopyralid
      - Triclopyr (*e.g.* Garlon 3A)
      - Glyphosate (non-aquatic formulation e.g. Roundup)
      - 2,4-D amine (Amine 400)
      - Clethodim (*e.g.* Envoy)
      - Sethoxydim (*e.g.* Poast)
      - Fluazifop-P-butyl (Fusilade)
      - Oryzalin

- Diquat dibromide (Reward)
- Triclopyr + 2,4-D ester (Crossbow)

ii. All herbicide treatments will be conducted using a limited number of techniques to reduce potential for chemical drift and runoff. See Table 4 below for specific application techniques and timeframes for each allowed chemical in these habitats.

iii. Use of all herbicides for prairie, nearshore and oak savannah restoration sites will also follow PDC 29, and all species-specific conservation measures for each listed species potentially affected.

Table 4. Upland Herbicide Table. Underlined herbicide indicates aquatic formulation. Non-underlined herbicides are upland only and cannot be used closer than 30.5 m (100 feet) from any waterbody. Manufacturers' label requirements for application techniques should supercede any of the recommendations provided below, and any techniques that are inconsistent with the label requirements should not be used.

2, 4-D amine *(e.g. Weedar 64) will be used for treating broadleaf species. It will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.* • *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasive while protecting native plants.* • *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.* • *Cannot be used if it may impact threatened or endangered plants that do not completely senesce or in vernal pools.*
Aminopyralid *(e.g. Milestone) will be used for selective control of invasive and noxious broadleaf weeds.* • *Cannot be used closer than 30.5 m (100 feet) from any waterbody* • *Use spot spray or wipe-on.* • *Boom spray may be used with caution as aminopyralid is persistent and can cause damage to native habitats.* • *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*
Chlorsulfuron *(e.g. Telar, Glean, Corsair) is used for the control of broadleaf weeds and some annual grasses.* • *Use spot spray or wipe-on.* • *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*
Clethodim *(e.g Envoy) will be used to treat non-native grass species.* • *Application timing is limited to June 1 to December 15 (upland prairie sites) and August 1 to October 25 (wet prairie sites). Applications during this period will allow for residual chemical to break down prior to fall rains.* • *It will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle. If using a weed wiper to apply clethodim near listed plants during the growing season, the herbicide will be applied at a height to target upper grass stems, and avoid lower-stature listed plants.* • *Boom spraying may occur in some areas with large infestations. Boom sprayers may be mounted on all-terrain vehicles or tractors.*

- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Clopyralid *(e.g. Transline) Will be used to treat grasses and broadleaf woody and herbaceous species.*

- *Will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.*
- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Diquat dibromide *(e.g., Reward) will be used to top-kill or burn-down annual and perennial vegetation. Non-native plants recovery quicker than native plants allowing a window to use other herbicides on the invasive plants while the native plants are senesced.*

- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Fluazifop-P-butyl *(e.g. Fusilade II) will be used for treating competing grass species.*

- *It will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.*
- *Boom spraying may occur in some areas with large infestations. Boom sprayers may be mounted on all-terrain vehicles or tractors.*
- *Cannot be used closer than 30.5 m (100 feet) from any waterbody.*
- *Early season application should be between February 15 to May 15.*
- *Tall oat grass may be treated from February 15-December 15 if listed plants are not present.*
- *All other applications should be limited to later in the year June 1 to December 15 at upland prairie sites and August 1 to October 25 at wet prairie sites. Applications during this period will allow residual chemical to break down prior to fall rains.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Glyphosate – Aquatic *(e.g. Rodeo, AquaMaster, AquaPro) will be used to treat grasses and broadleaf woody and herbaceous species. It will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle (tractors may be used on dry upland sites).*

- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Glyphosate – Upland *(e.g. Roundup)*

Same conditions as aquatic glyphosate except cannot be used closer than 30.5 m (100 feet) from any waterbody.
***Imazapic** (e.g. Plateau)is used for pre-and post-emergent control of some annual and perennial grasses and some broadleaf weeds.* • *Early season application will be allowed (February 15 to May 15).* • *All other applications will be limited to later in the year (June 1 to December 15 at upland prairie sites and August 1 to October 25 at wet prairie sites). Applications during this period will allow residual chemical to break down prior to fall rains.* • *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*
***Imazapyr – Aquatic** (e.g. Habitat) is a non-selective herbicide used for the control of a broad range of weeds including grasses, herbs, woody species, and riparian and emergent species.* • *Early season application will be allowed (February 15 to May 15).* • *All other applications will be limited to later in the year (June 1 to December 15 at upland prairie sites and August 1 to October 25 at wet prairie sites). Applications during this period will allow residual chemical to break down prior to fall rains.* • *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*
***Imazapyr – Upland** (e.g. Arsenal, Chopper)* • *Same as aquatic Imazapyr except cannot be applied within 30.5 m (100 feet) from any waterbody*
***Metsulfuro- methyl** (e.g. Escort) will be used to treat grasses and broadleaf woody and herbaceous species.* • *Will be applied primarily via spot foliar application using a backpack sprayer or mounted on an all-terrain vehicle.* • *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.* • *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.* • *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*
***Oryzalin** (e.g. Surflan) with an adjuvant (Activator 90) will be used for treating woody plants and grass species.* • *Will be applied via spot foliar application using a hand-held wand.* • *Will not be allowed at wetland prairie sites.* • *Early season application will be allowed (February 15 to May 15).* • *All other applications will be limited to later in the year (August 1 to December 15 at upland prairie sites). Applications during this period will allow for residual chemical to break down prior to fall rains.* • *Cannot be used on listed plants that do not completely senesce, butterflies, on in veral pools.*
***Picloram** (e.g. Tordon) will be used for treating woody plants and grass species.* • *Will be applied via spot foliar application using a hand-held wand.* • *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.* • *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*

- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Sethoxydim *(e.g. Poast, Vantage) will be used for treating grass species.*

- *Will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.*
- *Early season application will be allowed (February 15 to May 15).*
- *All other applications will be limited to later in the year (June 1 to December 15 at upland prairie sites and August 1 to October 25 at wet prairie sites). Applications during this period will allow for residual chemical to break down prior to fall rains.*
- *If using a weed wiper to apply sethoxydim near listed plants during the growing season, the herbicide will be applied at a height to target upper grass stems, and avoid lower-stature listed plants.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Sulfometuron- methyl *(e.g. Oust, Oust XP) will be used to control annual and perennial grasses and broad-leaved weeds. Application may be either postemergent or preemergent.*

- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Triclopyr-TEA *(e.g. Garlon 3A, Renovate 3) will be used to control woody species and broadleaf weeds.*

- *For woody species control, it will be hand painted or directly wicked onto fresh cut stumps within 24 hours of cutting; no spraying is allowed.*
- *For broadleaf weed control, it will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.*
- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

Triclopyr+2,4-D ester (e.g. Crossbow) *will be used to control woody species and broadleaf weeds.*

- *For broadleaf weed control, it will be applied primarily via spot foliar application using a hand-held wand or mounted on an all-terrain vehicle.*
- *Cannot be used closer than 30.5 m (100 feet) from any waterbody.*
- *Wipe-on type application will be allowed February 1 to August 15 to allow for control of tall invasives while protecting native plants.*
- *Spray and wipe-on application will be permitted August 15 to December 15 when native plants and listed species are dormant.*
- *Check for additional restrictions at sites with listed plants that do not completely senesce and/or listed animals.*

f. Plant Population Enhancement

i. Plant populations may be augmented or introduced to increase the number and viability of listed plant populations.
ii. Restoration may also include the restoration of native prairie structure and function; thus, seeds and plant parts of non-listed native species may be collected, and a variety of native forbs, including nectar species for listed butterfly species or forage species for Mazama pocket gophers, and grasses will be augmented or introduced as part of the prairie restoration efforts.
iii. Enhancement includes propagule collection of seeds and/or rhizomes, propagule storage for later cultivation or outplanting, propagule transport, cultivation and/or outplanting of listed prairie plants in nursery or greenhouse for later cultivation or outplanting, generally described in the subsequent sections, but may be altered if needed to meet species-specific requirements. The most recent, species-specific guidance should be followed for these techniques, as directed by the Service state species lead(s) for the targeted species.

g. Propagule Collection
i. Seeds and rhizomes of listed plants will be collected from existing populations. Collection on Federal lands will require a 10(a)(1)(a) permit.
ii. Before propagule collection begins, collectors will determine the number of propagules needed for plant cultivation or reintroduction objectives.
iii. Restrictive collection methods and limits to propagule removal per local plant population are designed to protect the viability of the source population (Menges *et al.* 2004). Generally, collection limits are defined separately for populations of different sizes and levels of vulnerability: very small populations (<50 individuals) and those that occur on roadsides and other at-risk sites; populations between 50 and 500 individuals; and populations with >500 individuals. Propagule collections should target local populations of >500 individuals, when available. If species-specific information indicates lower limits are needed, those lower limits should be followed.

Annual seed and rhizome collection limits for listed plant populations of various sizes.

Roadside and populations < 50 individuals	**Populations of 50-500 individuals**	**Populations > 500 individuals (60 m^2 for lupine)**
50% seeds, 2% rhizome biomass	15% seeds, 2% rhizome biomass	25% seeds, 2% rhizome biomass

iv. Collections will occur only after seed is fully mature, or in the fall for rhizomes.
v. Collectors will harvest mature seed from throughout the population and within all habitat types found at the population location, in order to collect a genetically diverse sampling of the population.
vi. Collections will occur in dry weather or when seeds can be dried immediately after collection.

vii. Collectors will gather seed receptacles (pods, capsules or heads), gather loose seed, or excavate and remove a small amount of rhizome material.
viii. Collectors will either remove pods, capsules, or heads by hand or by use of cutting devices. Mesh bags may be tied over stems with developing fruits to capture seeds as they are released from the plant. Loose seed from the plant or from the ground may be gathered by hand or with hand-held harvesting tools such as flails and hoppers (seed containers).
ix. Rhizomes from mature plants will be exposed by carefully hand-digging to avoid harming plants or exposing plant roots. Once a portion of the rhizome is exposed, a portion of it will be removed using a sharp knife or pruner. The exposed rhizome will then be reburied. Small amounts of plant material (less than 2% of individual plant biomass) may be gathered for tissue culture techniques for propagating these species, but tissue samples should be taken from throughout the population to maximize genetic diversity.

h. Propagule Transport
    i. Before seeds are transferred to storage bags, they will be cleaned by hand or by sieve and blower. Rhizomes should be stored in cool moist conditions until transferred to potting medium. Collectors will use "breathable" containers to store and transport collected plant propagules; these containers include paper envelopes and bags, tin or glass vessels, or glassine envelopes. Plastic bags will not be used. If collecting small seeds, collectors will avoid seed leakage by taping the seams and corners of paper containers prior to transport. Collectors will label all propagule containers, either before placing seeds in them, or immediately after collection with the following information: 1) Name of plant; 2) Place of collection, and 3) Date of collection.
    ii. If possible, collectors will place propagules from each individual plant in a separate container. During transport, propagules will be stored in a cool, dry environment, avoiding placing propagules in heat (*i.e.*, trunk of car) or direct sunlight.

i. Propagule Storage
    i. Plant propagules must be properly stored until cultivation or outplanting. Remove and discard all diseased propagules. Thoroughly dry seeds at room temperature before long-term storage. Only well dried seed should be stored. Moist seeds become damp, moldy and vulnerable to insect attacks. Seeds will be mixed and turned 4 to 5 times per day over 4 to 5 days. After drying the seeds, seeds will be cleaned to remove all malformed, broken, undersized, diseased seeds, weed seeds, other crop seeds, chaff and other vegetative matter.
    ii. Seeds will be stored in containers that are airtight and moisture proof to prolong their viability. Seeds have a tendency to absorb moisture; to maintain dryness and deter insect predation, the storage containers may be filled to a quarter capacity (25%) with such agents as dry wood ash, diatomaceous earth, dry charcoal, lime, silica gel or paper.

iii. Rhizomes will be stored in cool, moist conditions within a suitable medium to keep the material alive and viable until cultivation. Seed material will be stored for no more than two years before cultivating or outplanting unless placed in a cold-storage facility.

j. Propagule Cultivation
   i. Propagules will be grown in a greenhouse or nursery facility. Plants will be supplied with suitable growing medium, soils, fertilizers or other chemical additives to prevent algal, fungal or insect infestations that inhibit growth or cause mortality.
   ii. Plants will be cultivated in greenhouses so that individual populations are isolated in a manner that cross-pollination contamination does not occur.
   iii. Mixing of genetic lines from source populations that are historically genetically isolated in the field will be conducted with caution and according to a Service-approved genetic management program to avoid deleterious effects due to out-crossing depression and potential loss of entire seed collection efforts.
   iv. Seed and rhizome material from field collections and their carefully maintained F1 progeny from the same population or populations from the same recovery zone may be cultivated for plant introduction activities. Under greenhouse cultivation, propagules and progeny from F1 and F2 generations may used for introduction into prairie habitat. Only the F1 generation should be used for subsequent propagation. The F2 generation propagules and plant plugs may be outplanted in the field, but further greenhouse propagation is not permitted. The F3 propagules or plant plugs will not be propagated or introduced into prairie habitat unless genetic information suggests that negative effects of genetic drift or domestication have not occurred.

k. Propagule Collection from Propagated Plants
   i. Propagules may be collected from plants cultivated at a greenhouse or nursery facility for further cultivation or outplanting. Seed and rhizome material will be collected from greenhouse grown propagules and successive F1 progeny and outplanted to augmentation and reintroduction sites. To avoid in-breeding depression or genetic drift that could arise from successive population in-crossing of a limited greenhouse-grown population, seed collected from F3 progeny will not be outplanted to augmentation or reintroduction sites.

l. Population augmentation and reintroduction.
   i. Augmentation of existing populations may be accomplished by sowing seeds or planting bulbs or propagules of listed plants to increase the population size.
   ii. Reintroduction (via seeds, bulbs or propagules) into an unoccupied site may be used to create new populations or to recreate a lost one at suitable sites.
   iii. To minimize the potential for outbreeding depression, the source of seeds or propagules used in augmentation and reintroduction projects should be populations that are nearby or which occupy similar habitat as the restoration site. Management tasks to implement augmentation and reintroduction are provided below.

m. Seeding Augmentation or Restoration Sites
    i. If necessary to prepare the seed bed, soil may be prepared for sowing or planting by shallow-depth hand or (where listed plants are not present) equipment tilling the site. Seed will be sown in the ground either by no-till drill if soil is dry enough to support vehicle weight without soil compaction, or by hand-sowing into the soil. Harrowing may be used if all other methods are unfeasible, and harrow equipment is operated at least 2 m (6 feet) from listed plants. Seed or bulb planting will occur in a manner that conforms to the density and spacing of the source populations, taking into consideration that significant pre-establishment mortality may occur and planting in higher densities may compensate for loss.
    ii. Seeding or planting will be planted in a manner to facilitate subsequent monitoring efforts. Mapped grids, metal tags or flags will be used to indicate the planted areas. This will assist with post-planting monitoring of introduction efforts.

n. Outplanting Augmentation or Restoration Sites
    i. When outplanting into prairie sites with existing populations of listed species (plants, butterflies, Mazama pocket gophers), field personnel will take care to avoid trampling listed species.
    ii. Propagules (rhizomes, plugs or bulbs) should be outplanted when soil is saturated by rain (generally November through April). Propagules should be planted when growing cycles of individual plants in the greenhouse or nursery match that of plants growing in the field (*e.g.*, do not outplant an actively growing plug when wild plants are dormant).
    iii. Propagules from native sources or grown from seed, bulbs, or rhizome cuttings will be prepared for outplanting at the project site by first clearing away existing dead and living vegetation to expose soil. Avoid disturbing existing rhizomes. The soil will be excavated to the approximate depth and width of the plug or rhizome. The plug will be inserted directly into the soil or with amended soils containing mulch or fertilizer so that the rim of the plug is level with the surrounding soil. A small amount of native soil should be added over the plug to reduce desiccation.
    iv. Propagules will be planted in a manner that conforms to the density and spacing of the source populations, taking into consideration that some pre-establishment mortality will occur and planting in higher densities may compensate for loss. Propagules will be planted in habitat conditions (soil, topography, etc.) similar to the propagule's source habitat.
    v. Propagules will be planted in a manner to facilitate subsequent monitoring efforts. Mapped grids, metal tags or flags will be used to indicate the planted areas. This will assist with post-planting monitoring of introduction efforts.

o. Collection and Out-planting of Non-listed Native Plants
    i. Seed and plant parts from many native prairie plants may be collected to create nursery stock for restoration projects, and a variety of native forbs, including nectar species for butterfly species and grasses will be augmented or re-introduced as part of the prairie restoration efforts.

ii. If listed species occur at a site where collection of seeds or plant parts of non-listed plants or outplanting of nonlisted plants is to take place, care will be taken to avoid trampling or otherwise harming listed species.

20. Upland Silvicultural Treatments

This restoration action will be used to alter the structure and plant species composition of forest. Forest road decommissioning and stormproofing or elimination of roads and trails is addressed in PDC 45. Activities can include restorative thinning, understory management, downed wood & snag creation, oak release, prairie and oak savanna restoration, and planting of native species. Work may entail use of power tools and/or hand crews.

a. Silvicultural treatments will not occur if they remove or permanently degrade occupied, suitable, or critical habitats for listed terrestrial species.
b. Forest thinning will occur in overstocked areas or conifer release areas, as prescribed in a management plan for the site.
c. Thinning, or single tree removal will be restricted to areas above the slope break on steep slopes and highly erodible soils to prevent accelerated soil erosion and increased sedimentation rates.
d. Trees will be thinned manually, by cutting or girdling.
e. Felled trees will be left onsite if appropriate for nutrient cycling, cover, and to reduce elk/deer browse on seedlings.
f. Where trees are removed to restore prairie, savanna, or coastal bog habitats, felled trees will be removed from the site and/or limbed, chipped or burned to allow for restoration of desired habitat.
g. Manual pruning of limbs is allowed to attain attributes of growth, structure, or form.
h. Timber yarding techniques used during silvicultural treatments must not cause excessive soil disturbances and compaction.
i. Slash materials should be gathered by hand or with light machinery to reduce soil disturbance and compaction. Avoid accumulating or spreading slash in upland draws and springs. Slash control and disposal activities must be conducted in a manner that reduces the occurrence of debris in aquatic habitats.
j. Planting of native species can occur on the project site using PDC 32.
k. Control of invasive species may occur on the project site using PDC 29.

21. Installation of Wildlife Structures

The installation or construction of wildlife habitat structures will increase cover, shelter, and nesting habitats for a variety of wildlife species. Habitat structures may include, but are not limited to, bat roosting and breeding boxes, avian nest boxes and platforms, turtle basking logs, conifer and hardwood snags, and brush piles.

a. Wildlife nesting structures should be:
    i. Built for specific native avian and mammalian species.
    ii. Designed for easy cleaning and maintenance.
    iii. Properly suspended or supported.
    iv. Protected from wind driven rain.
    v. Properly ventilated.
    vi. Designed to eliminate predation or placed in protected areas.
    vii. Built without perches to prevent house sparrow and starling occupancy.
    viii. Constructed with pine, plywood, cedar, redwood, or cypress (cedar preferred).
b. Do not use pressure treated or creosote-based wood products for any part of a nesting or feeding structure unless it is in direct contact with the ground, such as a mounting post.

SPECIES-SPECIFIC CONSERVATION MEASURES

Bull Trout

In addition to the proposed PDC for specific restoration actions, as applicable, the following specific conservation measures are proposed for bull trout:

a. Projects that would expose populations of bull trout to non-native fish such as brook trout or brown trout where such exposure does not currently exist, must be approved by the Service Manager or designee for the affected state.
b. The driving of steel or concrete piles within the wetted width of a stream, lake, or shoreline is not covered under PROJECTS. If steel or concrete piles are to be driven adjacent to bull trout spawning and rearing habitat, the action agencies will work with the Service to determine what (if any) site-specific PDC or conservation measures are needed to reduce potential impacts to bull trout.
c. For nearshore projects in Puget Sound, no in-water work is allowed in bull trout marine foraging, migration and overwintering habitat from February 16 – July 15, and near the Duwamish River from February 16 - September 30.
d. For all projects, the project manager will work with internal and external bull trout experts to determine the best timing for each project in occupied habitat to minimize impacts to all listed fish. Any exceptions to in-water work windows recommended by ODFW, WDFW, or IDFG will be approved by the Service and NMFS.
e. To reduce adverse effects to bull trout, electrofishing will only occur from May 1 (or after emergence occurs) to July 31 in known bull trout spawning areas. No electrofishing will occur in any bull trout habitat after August 15.
f. Project specific conservation measures are contained in the applicable PDC above.

Lahontan Cutthroat Trout

In addition to the proposed PDC for specific restoration actions, as applicable, the following specific conservation measures are proposed forLahontan cutthroat trout:

a. For all projects, the project manager will work with internal and external Lahontan cutthroat trout experts to determine the best timing for each project in occupied habitat to minimize impacts to all listed fish. Any exceptions to in-water work windows recommended by ODFW, WDFW, or IDFG will be approved by the Service and NMFS.
b. Project specific conservation measures are contained in the applicable PDC above.

Warner Sucker

In addition to the proposed PDC for specific restoration actions, as applicable, the following specific conservation measures are proposed for for Warner sucker:

a. Consider all options for alternatives to fish ladder construction including 1) dam removal; 2) relocation of the point of diversion to allow for water withdrawal without the use of a dam; 3) consult with NMFS and the Service while designing project and before implementation.
b. Fishways for Warner sucker should be reviewed for use of the most current state of knowledge for design. Criteria for sucker passage are in development and likely to be refined. For example, a 15.2 x 15.2 cm (6 x 6 inch) orifice and no more than 1.16 m/s (3.8 feet per second) velocity are the best current design standards. Baffled chutes and roughened channels are preferred and should be considered where feasible to install.
c. Whenever practical projects in sucker habitat should be carried out during October or November to this reduce stress on the fish and avoid impacts to larval suckers. For all projects that occur outside

of the October-November timeframe, the project manager will work closely with internal and external Warner sucker experts to determine the best timing for each project on a site-specific basis. Any exceptions to in-water work windows recommended by ODFW will be approved by the Service.

Northern Spotted Owl

The proposed conservation measures for spotted owl are:

a. To reduce adverse effects to spotted owl, projects will not generally occur during the critical breeding period between March 1 to July 15. Exact timing for a given location may vary and deviations from the above breeding period can be modified with approval of the local Service office. Projects should (a) be delayed until after the critical breeding season (unless the action involves Type I helicopters, which extends the critical nesting window to September 30); (b) delayed until it is determined that young are not present.
b. The Service wildlife biologist may extend the restricted season based on site-specific information (such as a late nesting attempt).
c. Table 12 shows disruption distances applicable to the equipment types proposed in the BA. These distances can be locally altered based on current information.
d. No activity within this proposed action will cause adverse effects to spotted owl critical habitat when analyzed at the appropriate local scale as determined by the Service wildlife biologist.
e. For (LW) projects, follow conservation measures as outlined in the Tree Removal for LW Projects under PDC 34f. When the proposed action agency is involved in the selection of trees for removal, a wildlife biologist will determine if individual trees are suitable for nesting or have other important listed bird habitat value. No trees determined as suitable for nesting or having other critical habitat value for listed birds will be removed under PROJECTS.
f. No hovering or lifting within 152 m (500 feet) of the ground within occupied northern spotted owl habitat during the critical breeding season by Incident Command System (ICS) Type I or II helicopters would occur as part of any proposed action addressed by this assessment.

Table 12. Disturbance, disruption (harass) and/or physical injury (harm) distance thresholds for spotted owls. Distances are to a known occupied spotted owl nest tree or suitable nest trees in unsurveyed nesting habitat.

Project Activity	**No Effect** **(Mar 1 – Sept. 30)**	**NLAA** "may affect" disturbance distance **(Mar 1 – Sept. 30)**	**LAA – Harass** early nesting season disruption distance (**Mar 1–Jul 15**[11])	**LAA – Harass** late nesting season disruption distance (**Jul 16**[11]**–Sep 30**)	**LAA** – **Harm** direct injury and/or mortality (**Mar 1 – Sept. 30)**
Light maintenance (e.g., road brushing and grading) at campgrounds, administrative facilities, and heavily-used roads	>0.25 mile	≤ 0.25 mile	NA[1]	NA	NA
Log hauling on heavily-used roads	>0.25 mile	≤ 0.25 mile	NA[1]	NA	NA

Project Activity	**No Effect** **(Mar 1 – Sept. 30)**	**NLAA** "may affect" disturbance distance **(Mar 1 – Sept. 30)**	**LAA – Harass** early nesting season disruption distance (**Mar 1–Jul 15**[11])	**LAA – Harass** late nesting season disruption distance (**Jul 16**[11]**–Sep 30**)	**LAA** – **Harm** direct injury and/or mortality (**Mar 1 – Sept. 30)**
(USFS maintenance levels 3, 4, and 5)					
Chainsaws (includes felling hazard/danger trees)	>0.25 mile	66 yards to 0.25 mile	≤ 65 yards[2]	NA	NA
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	>0.25 mile	66 yards to 0.25 mile	**≤** 65 yards[2]	NA	NA
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	>0.25 mile	120 yards to 0.25 mile	**≤** 120 yards[3]	NA	**≤** 5 yards(injury)[3]
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	**≤** 265 yards[5]	**≤** 100 yards[6] (hovering only)	NA
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	**≤** 150 yards[7]	**≤** 50 yards[6] (hovering only)	NA
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	**≤** 110 yards[8]	**≤** 50 yards[6] (hovering only)	NA
Small fixed-wing aircraft (Cessna 185, etc.)	>0.25 mile	111 yards to 0.25 mile	**≤** 110 yards	NA	NA
Tree Climbing	>66 yards	26 yards to 65 yards	**≤** 25 yards[9]	NA	NA

NLAA = "not likely to adversely affect." **LAA** = "likely to adversely affect" **≥ is greater than or equal to, ≤ is less than or equal to.**

Table 12 (Spotted Owl) Footnotes:

1. NA = not applicable. Based on information presented in Tempel and Gutiérrez (2003, p. 700), Delaney *et al.* (1999, p. 69), and Kerns and Allwardt (1992, p. 9), we anticipate that spotted owls that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads.

Project Activity	**No Effect** **(Mar 1 – Sept. 30)**	**NLAA** "may affect" disturbance distance **(Mar 1 – Sept. 30)**	**LAA – Harass** early nesting season disruption distance (**Mar 1–Jul 15**[11])	**LAA – Harass** late nesting season disruption distance (**Jul 16**[11]**–Sep 30**)	**LAA** – **Harm** direct injury and/or mortality (**Mar 1 – Sept. 30)**

2. Based on Delaney *et al.* (1999a, p. 67) which indicates that spotted owl flush responses to above-ambient equipment sound levels and associated activities are most likely to occur at a distance of 65 yards (60 m) or less.
3. Impulsive sound associated with pile-driving is highly variable and potentially injurious at close distances. A review compiled by Dooling and Popper (2007, p. 25) indicates that birds exposed to multiple impulses (e.g., pile driving) of sound at 125 dBA or greater are likely to suffer hearing damage. We have conservatively chosen a distance threshold of 120 yards for impact pile-driving to avoid potential effects to hearing and to account for significant behavioral responses (e.g. flushing) from exposure to loud, impulsive sounds. Based on an average maximum sound level of 110 dBA at 15.2 m (50 feet) for pile-driving, exposure to injurious sound levels would only occur at extremely close distances (e.g., ≤ 5 yards).
4. Impulsive sound associated with blasts is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 to 0.6 miles from blast sites (Holthuijzen *et al.* 1990, p. 273). Exposure to peak sound levels that are >140 dBA are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pp. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen *et al.* (1990, p. 272), which documented peak sound levels from small blasts at 138 to 146 dBA at a distance of 100 m (110 yards).
5. Based on an estimated 92 dBA sound-contour (approximately 265 yards) from sound data for the Chinook 47d presented in Newman *et al.* (1984, Table D.1).
6. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. The hovering rotor-wash distance for the Chinook 47d is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USDA-Forest Service 2008b, chapters 5, 6).
8. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USDA-Forest Service 2008b, chapters 5, 6), and Bell 206 (85-89 dBA at 100 m)(Grubb *et al.* 2010, p. 1277).
9. Based on Swarthout and Steidl (2001, p. 312) who found that 95% of flush responses by spotted owls due to the presence of hikers on trails occurred within a distance of 24 m.
10. Based on recommendations presented in *Smoke Effects to Northern Spotted Owls* (USFWS 2008b, p. 4).

Project Activity	**No Effect** **(Mar 1 – Sept. 30)**	**NLAA** "may affect" disturbance distance **(Mar 1 – Sept. 30)**	**LAA – Harass** early nesting season disruption distance (**Mar 1–Jul 15[11]**)	**LAA – Harass** late nesting season disruption distance (**Jul 16[11]–Sep 30**)	**LAA – Harm** direct injury and/or mortality (**Mar 1 – Sept. 30)**
11. The exact dates are variable by physiographic province, and differences by locality. Work with the Service to select the proper dates when planning or implementing projects.					

Marbled Murrelet

The proposed conservation measures for the murrelet are:

a. To avoid or minimize adverse effects to marbled murrelets, a wildlife biologist must 1) determine if murrelets may occur in the vicinity of the project, and 2) if it is determined that murrelets may occur in the vicinity of the project, conduct a site survey to determine if an active nest may be within the disruption distance of the project. If a survey approved by the Service is not completed, it will be assumed that suitable habitat is occupied, and appropriate conservation measures will be implemented.
b. Projects will seek to avoid disturbance by every reasonable means, including; adjusting project timing, location, and equipment used.
c. If impacts cannot be avoided, projects within the applicable disruption distance of occupied or suitable but unsurveyed habitat will be LAA, until it can be determined that young are not present.
d. Projects within occupied or suitable but unsurveyed murrelet habitat will only occur 2 hours after official sunrise, and will cease 2 hours prior to official sunset during the murrelet nesting season, which in Oregon is April 1 to September 15, and in Washington from April 1 to September 23.
e. No suitable, potential, or critical marbled murrelet habitat is to be removed as part of this action.
f. Within suitable, potential, or critical habitat, garbage containing food and food trash generated by workers in project areas will be secured or removed to minimize attraction of corvids, which have been identified as predators of murrelet eggs and young.
g. Table 18 shows marbled murrelets disruption distances that are applicable to the proposed actions under PROJECTS. Distances and times can be locally revised based on current information available from the appropriate Service field office.
h. For large wood (LW) projects, follow conservation measures as outlined in PDC 34. When the proposed action agency is involved in the selection of trees for removal, a wildlife biologist will determine if individual trees are suitable for nesting or have other important listed bird habitat value. No trees determined as suitable for nesting or having other critical habitat value for listed birds will be removed under PROJECTS.

Table 18. Disturbance and disruption distance thresholds for Marbled Murrelet during the nesting season (April 1 to September 15 for Oregon; April 1 to September 23 for Washington). Distances are to a known occupied marbled murrelet nest tree or suitable nest trees in unsurveyed nesting habitat.

Action	Action Not Likely Detected Above Ambient Levels	Disturbance Distances	Disruption Distances	Increased Risk of Physical Injury and/or Mortality
Light maintenance (e.g., road brushing and grading), at campgrounds, administrative facilities, and heavily-used roads	> 0.25 mile	≤ 0.25 mile	NA[1]	NA
Log hauling on heavily-used roads (USFS maintenance levels 3, 4, 5)	>0.25 mile	≤ 0.25 mile	NA[1]	NA
Chainsaws (includes felling hazard/danger trees)	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	Potential for mortality if trees felled contain platforms
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, piling removal, road decommissioning, beach nourishment, infrastructure removal, etc.	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[2]	NA
Pile-driving (steel H piles, pipe piles)	>0.25 mile	121 yards to 0.25 mile	≤ 120 yards[3]	≤ 5 yards(injury)[3]
Helicopter: Chinook 47d	>0.5 mile	266 yards to 0.5 mile	≤ 265 yards[4]	100 yards[5] (injury/mortality)
Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	>0.25 mile	151 yards to 0.25 mile	≤ 150 yards[6]	50 yards[5] (injury/mortality)
Helicopters: K-MAX, Bell 206 L4, Hughes 500	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[7]	50 yards[5] (injury/mortality)
Tree Climbing	>0.25 mile	111 yards to 0.25 mile	≤ 110 yards[8]	NA

1. NA = not applicable. We anticipate that marbled murrelets that select nest sites in close proximity to heavily used roads are either undisturbed by or habituate to the sounds and activities associated with these roads (Hamer and Nelson 1998, p. 21).
2. Based on recommendations from murrelet researchers that advised buffers of greater than 100 m (328 feet) to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012, pp. 6-9).
3. Impulsive sound associated with pile-driving is highly variable and potentially injurious at close distances. A review compiled by Dooling and Popper (2007, p. 25) indicates that birds exposed to multiple impulses (e.g., pile driving) of sound at 125 dBA or greater are likely to suffer hearing damage. We have conservatively chosen a distance threshold of 120 yards for impact pile-driving to avoid potential effects to hearing and to account for significant behavioral responses (e.g. flushing)

from exposure to loud, impulsive sounds. Based on an average maximum sound level of 110 dBA at 15.2 m (50 feet) for pile-driving, exposure to injurious sound levels would only occur at extremely close distances (e.g., ≤ 5 yards).

4. Based on an estimated 92 dBA sound-contour (approximately 265 yards) for the Chinook 47d (Newman *et al.* 1984, Table D.1).
5. Because murrelet chicks are present at the nest until they fledge, they are vulnerable to direct injury or mortality from flying debris caused by intense rotor wash directly under a hovering helicopter. Hovering distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.
6. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).
7. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m)(Grubb *et al.* 2010, p. 1277).
8. Based on recommendations from murrelet researchers that advised buffers of greater than 100 m (328 feet) to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012d, pp. 6-9).

Streaked Horned Lark

LARK UPDATE on PDC 6.c. specified that additional review is required for any project that may affect streaked horned larks, which had only been recently listed under the ESA at the time of completion of the Opinion. If a project is proposed that may affect the streaked horned lark or its designated critical habitat, PDC 6.c. required the project to be reviewed and approved by the Service Manager or designee for the affected state.

Since the PROJECTS Biological Opinion was completed in 2015, there have been several orojects that had possible effects to streaked horned larks (2015-2019). As anticipated in the analysis section of the Opinion, most of the prairie restoration projects were implemented in habitat that was not suitable for streaked horned larks, or was highly degraded (i.e., dense vegetation, deep thatch, etc.). Therefore, most projects that had the potential to affect larks or their designated critical habitat were at sites that had few, if any, larks, and the effects were largely beneficial through creation or restoration of suitable habitat for the species. Over the past five years, we found that neither the annual area limit nor the anticipated take of individual streaked horned larks was exceeded in any year. We therefore conclude that the requirement of PDC 6.c. (individual review of any project that may affect the streaked horned lark) is not necessary, and we remove this requirement for all future projects.

The proposed action includes several specific conservation measures for projects that may affect streaked horned larks. These measures will be incorporated into the project design as appropriate:

a. For projects that will occur during the nesting season (April 1 to August 31) within the range of the streaked horned lark, pre-project surveys will be conducted using survey methods approved by the Service to determine presence/absence of larks in suitable habitat. Information acquired through these surveys will be used to direct restoration activities away from likely nesting areas and/or stagger treatments to allow for nests to be incubated, hatched, and fledged on known occupied sites.

b. Implement surveys and monitoring activities using the most efficient and least disruptive methods to ensure that streaked horned larks at the restoration sites are identified and appropriately protected during project implementation.
    - Surveys for streaked horned larks must be conducted according to the current survey protocols recommended by the Service.
    - Surveys and monitoring must be conducted by highly qualified staff with a background in avian transect and point count survey techniques. The ability to hear and identify lark songs is necessary.
    - Conduct surveys and monitoring in a way that minimizes disturbance of larks on the site; this is particularly important during the breeding season.

c. Mowing: When possible mowing will be accomplished outside of the April 1- August 31 nesting season. When that is not possible, individual mowing treatments during the nesting season may occur on up to 50% of a project site at any given treatment period. Cumulative mowing during the April 1 to August 31 nesting season may equal 100% of a project site.

d. Mower decks will be raised to highest level possible to achieve the desired biological outcomes and to minimize ground level impacts. Mowing will target tall/dense vegetation to prevent seed set of undesirable species and/or foster native prairie seedlings (i.e. targeted mosaic/patch mowing).

e. Grazing will occur outside of the nesting season April 1 to August 31.

f. Prescribed fire may be used on 100% of an area to reduce thatch and improve the characteristics of the site for nesting.

g. Herbicide application: Limit herbicide use to those listed under PDC 51. Use the largest spray booms practical to minimize wheel track passes in treatment unit. Where possible use narrow tires and/or 4 wheeled machines rather than floatation tires/3 three wheeled machines. Individual herbicide applications may cover up to 100% of suitable lark habitat on a given site.

h. During the breeding season on occupied habitat (foraging or nesting), herbicides are limited to the following chemicals and application methods (Table LARKS-1)[21]. NOTE: Sulfometuron-methyl, Picloram, and Diquat dibromide are not allowed in occupied lark habitat during the breeding season.

i. All of the above tools may be used singly or in combination as treatments specifically to enhance breeding conditions for streaked horned larks in the short term at a project site.

[21] Updated herbicide usage for Larks, June 2020, based on USFWS analyses conducted for herbicides proposed in BPA's Habitat Improvement Program 4.

Table LARKS-1. Allowable herbicides for use in occupied streaked horned lark habitats during the breeding season (April 1- August 31). Herbicide buffer distances by herbicide formula, stream type, and application method for aquatic habitat restoration projects. Check species-specific conservation measures for additional restrictions for other listed species at each project site.

Allowed Herbicides in Occupied Lark Habitats	**No Application Buffer Width (feet)**					
	Streams and Roadside Ditches with flowing or standing water present and Wetlands			***Dry Streams, Roadside Ditches, and Wetlands (no standing water present)***		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
2, 4-D amine	100	100	100	100	100	100
Aminopyralid	100	100	100	100	100	100
Aquatic Glyphosate	100	waterline	Waterline	50	None	None
Aquatic Imazapyr	100	15	Waterline	50	None	None
Aquatic Triclopyr-TEA	**Not Allowed**	15	Waterline	**Not Allowed**	None	None
Chlorsulfuron	**Not Allowed**	50	bankfull elevation	**Not Allowed**	15	bankfull elevation
Clethodim	100	100	100	100	100	100
Clopyralid	100	15	bankfull elevation	50	None	None
Fluazifop-P-butyl	100	100	100	100	100	100
Glyphosate	100	100	100	100	100	100
Imazapic	100	15	bankfull elevation	50	None	None
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
Metsulfuron-methyl	100	15	bankfull elevation	50	None	None
Oryzalin	**Not Allowed**	975	975	**Not Allowed**	975	975
Sethoxydim[1]	100	50	50	100	50	50
Triclopyr - BEE	**Not Allowed**	100	100	**Not Allowed**	100	100
Triclopyr +2,4-D ester (e.g., Crossbow)	**Not Allowed**	100	100	**Not Allowed**	100	100

[1] NOTE: acutely toxic to bees and should not be applied in areas when plants are blooming and attractive to bees.

Fender's Blue Butterfly

The proposed action included following conservation measures for Fender's blue butterfly:

a. Pre-project surveys will be conducted using direct observation methods by a qualified biologist for adult Fender's blue butterfly during the midApril to June 30 flight period on any project site that supports or may support Kincaid's lupine (*Lupinus sulphureus ssp. kincaidii*), longspur lupine (*L. arbustus*), or sickle-keeled lupine (*L. albicaulis*). Information acquired through population and vegetation surveys will be used to direct restoration/recovery activities away from key breeding areas. Unsurveyed areas within 2 km of a known Fender's blue butterfly population will be assumed occupied if no surveys are conducted.
b. Restoration activities will minimize impacts to Kincaid's lupine, spur lupine (*Lupinus laxiflorus = L. arbustus*) or sickle-keeled lupine (*L. albicaulis*) or remove habitat including the following nectar sources: tapertip onion (*Allium acuminatum*), narrowleaf onion (*Allium amplectens*), Tolmie's mariposa lilly (*Calochortus tolmiei*), small camas (Camassia quamash), clearwater cryptantha (*Cryptantha intermedia*), Oregon sunshine (*Eriophyllum lanatum*), Oregon geranium (*Geranium oreganum*), toughleaf iris (*Iris tenax*), pale flax (*Linum angustifolium*), blue flax (*Linum perenne*), Meadow checkermallow (*Sidalcea campestris*), rose checker-mallow (*Sidalcea virgata*), American vetch (*Vicia Americana*), bird vetch (*V. cracca*), common vetch (*V. sativa*), and tiny vetch (*V. hirsute*)) within occupied habitats.
c. Care shall be taken to avoid trampling or damaging Fender's blue butterflies (adult, eggs and larvae) and their host and nectar plants during all activities. Foot traffic shall be minimized in occupied habitat. High occupancy areas will be identified and flagged. On-site personnel will meet and discuss a 'walking plan' each day before work begins.
d. All vehicles, equipment, and supplies (e.g., boots, clothing, hand tools, heavy equipment, utility all-terrain vehicles, etc.), before being used in and around Fender's blue butterfly habitat, will be disinfected and/or cleaned of mud, dirt, debris, and vegetative matter, as appropriate, to prevent the potential introduction of nonnative/invasive plant, plant/animal pathogens, and wildlife species into the habitat.

Manual, Mowing and Ground Disturbing Activities

e. The following manual and mechanical treatments for invasive and non-native plant control may occur year-round in occupied habitat or critical habitat for Fender's blue butterfly, as long as precautions are taken to prevent negative effects to lupine host plants: 1) hoeing, grubbing, pulling, clipping, or digging using shovels, hoes, weed wrenches, lopping shears, and trowels, and 2) handheld power tools may be used to cut down woody vegetation, control and remove invasive woody plants.
h. Tractor mower decks will be a set a minimum of 15 cm (6 inches) above ground to reduce impacts to butterfly larvae.
i. Spring mowing will not be allowed at sites with Fender's blue butterflies.
j. Mowing may be conducted throughout sites with Fender's blue butterflies after lupine senescence and before lupine re-emergence (generally August 15 to March 1). Fall mowing may occur over 100% of an occupied site.
k. After the butterfly flight season but before Kincaid's lupine senescence (generally June 30 through August 15), tractor mowing may occur no closer than 2 m (6 feet) from the nearest Kincaid's lupine plants.

l. Mowing with hand-held mowers may be implemented during Fender's blue butterfly flight season (generally April 15 to June 30) as long as a buffer of at least 8 m (25 feet) is maintained between the mower and any individual of a Kincaid's lupine plant.
m. Tilling, disking, plowing, excavation, or other extensive ground disturbing activities will not occur within 20 m (65 feet) of critical habitat or known Fender's blue butterfly or Kincaid's, spur, or sickle-keeled lupine occupied habitats.
n. Removed vegetation shall not be piled in areas where Fender's blue butterfly larval food plants and adult nectar plants are present. In cases where work is done during the wet season, cut debris may be temporarily piled on-site, but away from listed plants and butterflies, until the dry season when equipment can access the work area to remove debris.
o. Raking: At sites supporting Fender's blue butterfly populations of 100 or more adult butterflies, a maximum of one third of the occupied habitat may be raked annually. At sites supporting Fender's blue butterfly populations of fewer than 100 adult butterflies, a maximum of one quarter of the occupied habitat may be raked annually.
p. Tree Removal: If large vegetation is removed in close proximity to known occupied butterfly habitat, trees shall be felled away from the occupied habitat. Any fallen trees shall be carefully removed from the habitat to minimize disturbance to vegetation, particularly to the larval food plants. Trees and shrubs near roads or trails that may serve as effective visual and/or access barriers near occupied or suitable butterfly habitat would not be removed.

Livestock Grazing

q. Livestock grazing will not occur in critical habitat or any habitat occupied by the Fender's blue butterfly.

Prescribed fires

r. Prescribed fires will occur after August 15 to allow for the most native plants to have set and released their seeds, and begun to senesce, and, if Fender's blue butterfly is present, to avoid the flight season of adults (April 15- June 30).
s. Fender's blue butterfly refugia within project sites will be protected with a firebreak and/or watered down prior to a burn.
t. The year following a burn, management of project sites will be limited to manual methods and herbicide applications, as appropriate. Additionally, during a burn year, management activities will also be limited for areas adjacent to these project sites.
u. At sites supporting 100 or more adult Fender's blue butterflies, the size of the burn unit will be no more than one third of the occupied habitat actively used by butterflies. At sites supporting fewer than 100 adult Fender's blue butterflies, the size of the burn unit will be no more than one quarter of the occupied habitat.
v. The center of the burn unit must be within 100 m (328 feet) of unburned occupied habitat, which can serve as a recolonization source.
w. In any one year, no more than 1,000 acres of occupied butterfly habitat will be burned; this number represents about one third of designated critical habitat across the range of the species, and imposes a conservative limit on the potential losses to fire.

Herbicides

a. Application of herbicides for control of nonnative grasses, shrubs, and forbs, as well as removal of conifers may include broadcast or spot or wiper application. Broadcast application will only occur outside of occupied habitat with a 5 m (16 feet) buffer. Wiping using a hand held herbicide

applicator wick or an ATV mounted boom and spot-spray applications of herbicide may occur in butterfly occupied habitat, as further described in items "b" through "f".

b. At sites supporting 100 or more adult Fender's blue butterflies, the size of the area treated with herbicides will be no more than one half of the occupied habitat actively used by butterflies. At sites supporting fewer than 100 adult Fender's blue butterflies, the size of the area treated with herbicides will be no more than one third of the occupied habitat.
c. In Fender's blue butterfly-occupied habitats, spring (defined as February 15 to April 15) herbicide treatments are limited to:
    a. Fluazifop-p-butyl (Fusilade) with Nufilm surfactant applied using a backpack sprayer and wand, and/or a low ground pressure broadcast boom sprayer (such as spray buggy or ATV mounted sprayer) (item "d" below),
    b. hand-wiping of glyphosate to control tall invasive grasses with specified provisions (item "e" below),
    c. hand painting/wicking Triclopyr on fresh stumps cut within 24 hours (allowed anytime outside of the FBB flight season which is generally May/June).
d. For upland prairie habitats within occupied habitats: application of the grass specific herbicide Fusilade may only occur in the spring (February 15 to April 15) and June 1 to October 31. For wet prairie habitat that is occupied, application of Fusilade may only occur from August 1 to approximately October 31 to allow herbicides to decay prior to the rainy season.
e. Hand-wiping of glyphosate to treat tall invasive grasses may occur from May 1 - June 30 on up to 1/2 of the occupied lupine habitat with specified provisions If hand-wiping of glyphosate in Fender's blue butterfly-occupied lupine habitat to control tall invasive grasses during the growing season, the herbicide will be applied as follows: 1) wiping will occur at the end of the primary Fender's blue butterfly flight season and under optimal growth stage for selectively treating tall grasses following the "bolt stage", 2) a 25% solution will be hand wiped using a sponge not exceeding 61 cm (2 ft) in length, and 3) wiping will occur no less than 15 cm (6 inches) higher than the tallest flowering lupine raceme in a patch.
f. All other herbicide applications (not previously described above in "c" through "e") will only be applied from August 15 to October 31 when listed plant species are dormant and Fender's blue butterflies are in diapause.
g. For herbicide applications following fire, but before April 15 (the start of the flight season), burned areas may be treated with no restrictions for butterflies, because fire will have killed any larvae and the area will be unoccupied.

Oregon Silverspot Butterfly

The proposed action included following conservation measures for Oregon silverspot butterfly:

a. Population surveys for Oregon silverspot butterfly will be required prior to restoration activities proposed in areas with suitable habitat for the butterfly. Surveys using direct observation will be conducted for Oregon silverspot butterfly from mid-July-September 30 during the flight period using a modified Pollard walk method in occupied habitat (Pickering *et al.* 1992). Occupancy of listed species will be assumed in all suitable habitat located within 2 km (1.2 miles) of known occupied habitats.
b. Habitat surveys for early blue violets (*Viola adunca*) will be done during the peak violet blooming period from April-May to determine habitat suitability for Oregon silverspot butterfly. Information acquired through population and vegetation surveys will be used to direct restoration/recovery activities away from key breeding areas with violet concentrations of 10 to 15 violets per square meter, depending on leaf density.

c. Care shall be taken to avoid trampling or damaging Oregon silverspot butterfly (adult, eggs and larvae) and early blue violets during all activities. Foot traffic shall be minimized in occupied habitat. High occupancy areas will be identified and flagged. On-site personnel will meet and discuss a 'walking plan' each day before work begins.
d. All vehicles, equipment, and supplies (e.g., boots, clothing, hand tools, heavy equipment, utility all-terrain vehicles, etc.), before being used in and around Oregon silverspot butterfly habitat, will be disinfected and/or cleaned of mud, dirt, debris, and vegetative matter, as appropriate, to prevent the potential introduction of nonnative/invasive plant, plant/animal pathogens, and wildlife species into the habitat.

Grazing

e. Livestock grazing will not occur in critical habitat or any habitat occupied by the Oregon silverspot butterfly or early blue violet.

Manual, Mechanical and Ground-Disturbing Treatments

f. Manual removal within occupied habitat should be reserved for situations in which such habitat is imminently threatened by invasive plant species and manual removal is determined to be absolutely necessary to protect the long term viability of violet populations and nectar resources for the benefit of the Oregon silverspot butterfly. Invasive plants may be manually removed year-round using hand tools, including hoeing, grubbing, pulling, clipping or digging. Tools that may be used include shovel, hoe, weed wrench, lopping shears, trowels, etc.
g. Mowing, tilling, disking, plowing, excavation, or other extensive ground disturbing activities will not occur during the butterfly flight period (mid-July –September).
h. Mowing and handwork with line-trimmers will not occur May 15-September 30 within habitat areas containing early blue violets to minimize the potential to harm the larger butterfly larvae or pupae.
i. No more than 75% of the total meadow area will be mowed at any given site each year, including the 25 – 33% occupied portions.
j. Untreated strips of occupied habitat, approximately 3 m (10 feet) wide, will be distributed on the meadow edges throughout the mowed portions of a site, or 25% of each meadow.
k. Mowers (wheeled and/or rubber-tracked tractors) will typically be set at a 100 mm (4 inches) height or higher to minimize impacts to larvae located on or near the violets. However, where low mowing is needed as a substitute for burning, mowing (including flail mowers), may be set to minimum height, including to just above ground level. Haying, silaging, and similar equipment may be used in conjunction to remove cut material from the field. This low mow alternative may be used when burning is infeasible or incomplete and is limited to 25-33% of occupied habitat in any one year, October to mid-May.
l. Removed vegetation shall not be piled in areas where Oregon silverspot butterfly larval food plants and adult nectar plants are present. In cases where work is done during the wet season, cut debris may be temporarily piled on-site, but away from larval food plants and butterflies, until the dry season when equipment can access the work area to remove debris.
m. Raking: At sites supporting Oregon silverspot butterfly populations of 200 or more adult butterflies, a maximum of one third of the occupied habitat may be raked annually. At sites supporting Oregon silverspot butterfly populations of fewer than 200 adult butterflies, a maximum of one quarter of the occupied habitat may be raked annually.
n. Shade Cloth: Prior to planting native seed or vegetation, black plastic or tarps may be used to smother and solarize the existing vegetation. When the tarps are removed six months to two

years later, the bare soil must be replanted with native vegetation to minimize the establishment of unwanted vegetation. Tarps will not be placed over areas containing early blue violet plants.

o. Tilling/Disking /Sod Rolling: Tilling, disking, plowing, excavation, sod rolling, or other extensive ground disturbing activities will not occur within 1 m (3 feet) of known Oregon silverspot butterfly or early blue violet occupied habitats.

p. Tree Removal: If large vegetation is removed in close proximity to known occupied butterfly habitat, trees shall be felled away from the occupied habitat. Any fallen trees shall be carefully removed from the habitat to minimize disturbance to vegetation, particularly to the larval food plants. Trees and shrubs near roads or trails that may serve as effective visual and/or access barriers near occupied or suitable butterfly habitat would not be removed.

Prescribed Fires

q. Burns may be conducted at any time of year under suitable weather conditions as part of a 3-4 year disturbance rotation, but not more than 25-33% of the occupied area in any one year.

r. For project sites supporting less than 200 butterflies, no more than one quarter of the meadow habitat will be burned.

s. For project sites supporting greater than 200 butterflies no more than one-third of meadow habitat will be burned.

t. Once burned, a project site will not be re-burned for at least three years, to allow butterfly and native plant populations to rebuild. The year following a burn, management of project sites will be limited to seeding, manual techniques and herbicide applications.

Herbicide Application

u. Use of herbicides is limited to those listed in PDC 29 for use with listed butterflies.

v. Within Oregon silverspot butterfly occupied habitat, herbicide applications will be permitted if habitat is imminently threatened by invasive plant species.For application of herbicides clopyralid, (e.g., Stinger) and glyphosate (e.g., Rodeo), wipe-on and spray application will be limited to avoid the Oregon silverspot butterfly flight period mid-July through September.

w. All other herbicide applications will occur during Oregon silverspot butterfly diapause, October 1-April 1, prior to peak early blue violets leaf production and outside of the butterfly flight period.

x. Herbicide treatments must be followed with native seed or plant introductions as necessary to minimize or eliminate the establishment of invasive and non-native vegetation.

Taylor's Checkerspot Butterfly

Restoration activities in TCB habitat (both occupied and unoccupied) will be completed in an effort to conserve, create, and sustain high quality prairie habitat. These activities will be designed to increase the abundance and diversity of host and nectar plant species and the extent of early seral habitat conditions. All activities will be coordinated with the Service and land owners/managers, as appropriate. Proposed conservation measures for TCB include:

- Surveys for TCB within 0.81 km (0.5 miles) of known populations will be required prior to restoration activities proposed in areas with suitable habitat for the butterfly. Suitable habitat would include prairie/grassland areas containing the larval host plants *Plantago lanceolata* (narrow-leaf plantain) or *Castilleja levisecta* (golden paintbrush) in Oregon, and narrow-leaf plantain and *Castilleja hispida* (harsh paintbrush) in Washington. Surveys using direct

observation will be conducted for TCB during the mid-April to June 15 flight period, except in the North Olympic Penisula where surveys may occur until July 15. Information acquired through surveys will be used to direct restoration/recovery activities away from key breeding areas.

- Unless further restricted below, restoration activities in occupied habitat would not be performed during the TCB flight season (April 15 to June 15) to reduce the potential for adverse effects to TCB individuals.
- Use of prescribed fire shall be limited to no more than one-third of each occupied site each year depending on site specific conditions.
- Mowing (large mow deck motorized or pulled by tractor, all-terrain vehicle, etc.) in occupied habitat will only be permitted for restoration purposes and when prescribed fire is not a feasible substitute or would not achieve the desired treatment without first being mowed. Mowing in occupied habitat shall occur while larvae are in extended diapause (September 10 to February 15).
- Cutting and removal of vegetation in occupied habitat shall be implemented while TCB larvae are in extended diapause *(*September 10 to February 15).
- If large trees are removed in close proximity to known occupied butterfly habitat, they shall be felled away from the occupied habitat. Any fallen trees shall be carefully removed from the habitat to minimize disturbance to vegetation, particularly to the larval food plants. Trees and shrubs near roads or trails that may serve as effective visual and/or access barriers near occupied or suitable butterfly habitat will not be removed.
- Removed vegetation shall not be piled in areas where TCB larval food plants and adult nectar plants are present. Removed vegetation, including trees and shrubs, may be piled on-site to serve as fuel for on-site prescribed burns, but well away (>10 m or ~33 feet) from larval and adult food sources.
- The application of herbicides for control of nonnative grasses, shrubs, and forbs, as well as removal of conifers may include broadcast or spot-spray application. Broadcast application shall only occur outside of occupied habitat with a ~3 m (15 feet) buffer. Spot-spray application of herbicide may occur in occupied habitat.
- Herbicide selection, storage, use, and disposal shall be implemented according to the product label instructions and any special provisions written into the restoration proposal included with the permit application. Any modifications associated with the restoration proposal must be approved by the Service before being implemented.
- If appropriate to improve habitat conditions for TCB, herbicide treatments will be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation where there is significant bare ground exposed.
- Livestock grazing may occur in critical habitat or any habitat occupied by the TCB. Livestock grazing may only occur while TCB are in diapause (September 10 to February 15). A grazing plan must be approved by the local office before implementation.
- Livestock exclusion fences and fencing/gating to exclude off-road vehicles and restrict recreational use would be designed not to impede the movement of TCB between areas of suitable habitat.
- All vehicles, equipment, and supplies (*e.g.,* boots, clothing, hand tools, heavy equipment, utility all-terrain vehicles, *etc.*), before being used in and around TCB habitat, will be disinfected and/or cleaned of mud, dirt, debris, and vegetative matter, as appropriate, to prevent the potential introduction of nonnative/invasive plant, plant/animal pathogens, and wildlife species into the habitat.
- Foot traffic shall be minimized in occupied TCB habitat. High occupancy areas will be identified

and flagged. On-site personnel will meet and discuss a 'walking plan' each day before work begins.

- Care shall be taken to avoid trampling or damaging the following: TCB larval food plants which include narrow-leaved plantain (*Plantago lanceolata*), harsh and the threatened golden paintbrush (*Castilleja hispida and, Castilleja levisecta*), annual Blue-eyed Mary (*Collinsia parviflora*), and annual Sea blush (*Plectritus congesta*); and TCB adult nectar plants which include Puget balsamroot (*Balsamorhiza deltoidea)*, Sea thrift (*Armeria maritima)*, biscuit root (*Lomatium triternatum, L. utriculatum),* wild strawberry (*Fragaria virginiana),* common camas (*Camassia quamash*)*,* and grassland Saxifrage *(Saxifrage integrifolia)*. Special care should also be taken to avoid disturbance to the threatened golden paintbrush.
- If more than 5% of the TCB larval host plants (*P. lanceolata, C. hispida and C. levisecta*) and/or adult nectar plants are trampled or damaged in any individual location during permitted activities (*i.e.,* during the growing season on a calendar year basis), the project manager shall cease all activity at the location and contact the appropriate Service office as soon as possible to re-evaluate these activities.

Vernal Pool Fairy Shrimp

The following conservation measures are proposed for fairy shrimp:

a. For all activities, care shall be taken to avoid trampling or damaging fairy shrimp during its active life stages (outside of the egg stage), which occurs when pools are inundated for 2 to 3 weeks typically sometime between October 15 to March 15. Care shall also be taken to avoid damaging vernal pool habitats during all activities year-round.

Table 27. Acres of Critical Habitat, by CHU, by ownership, providing Habitat Protection for vernal pool fairy shrimp, as of December 2014.

Land Parcel	CHU#	Ownership	Acres Of Critical Habitat
Wildlands Bank	CHU1	Wildlands, Inc.	120
Parson's Easement	CHU1	Private	40
Rogue Plains Reserve	CHU1	The Nature Conservancy (TNC))	100
Agate Reservoir	CHU2	U.S. Bureau of Reclamation	154
Jackson County School District #9	CHU2	Jackson County School District #9	34
Hornecker	CHU2	Private	5
ODOT Dutton road mitigation area	CHU2	Oregon Department of Transportation	4
Jackson Sports Park	CHU2	Jackson County	73
Agate Desert Preserve	CHU3	TNC	53
Denman Wildlife Area[22]	CHU3	Oregon Department of Fish & Wildlife	720

[22] This Area is composed of the Military Slough Tract (1,178 acres) and the Hall Tract (620 acres). A 12-acre wetland mitigation

Land Parcel	CHU#	Ownership	Acres Of Critical Habitat
Whetstone Preserve	CHU3	TNC	144
ODOT Conservation Bank	CHU3	Oregon Department of Transportation	200
City of Medford	CHU3	City of Medford	3
Bear Creek Valley Sanitary Authority	CHU3	City of Medford	5
Upper and Lower Table Rock	CHU4	BLM	892
Total			**2,547**

b. Population surveys to determine presence/absence will be conducted as needed. All surveyors must have current Service permits and follow terms and conditions of the permit and Service survey guidelines.
c. Mowing/Mechanical: Manual and mechanical treatments for invasive and non-native plant control may occur anytime of the year adjacent to occupied habitat or fairy shrimp critical habitat if listed plants are not present. If listed plants are present, manual and mechanical treatments are allowed during the listed plant dormancy periods (typically from mid-June to January).
d. Raking: Raking may be permitted any time of year if location does not have listed plant presence or during summer/fall dormancy from mid-June to January.
e. Shade Cloth: Use of shade cloth in uplands around the vernal pool flanks (when pools are wet) to control non-native invasive plants is allowed if location has been determined to have no listed plant species present. Shade cloth may be also be used in the flanks or basins when pools are no longer inundated.
f. Sod Rolling: Sod rolling is not permitted in vernal pool complexes unless area has been cleared for presence of listed plants and vernal pool fairy shrimp.
g. Tilling/Disking: Tilling and disking is not permitted in vernal pool habitat.
h. Tree Removal: If large vegetation is removed in close proximity to vernal pool habitat, trees shall be felled away from the pools. Any fallen trees shall be carefully removed from the habitat to minimize disturbance to vegetation.
i. Livestock Grazing: Livestock grazing may be used in critical habitat or any habitat occupied by fairy shrimp, but will be managed with seasonal restrictions or with rotational grazing to allow the vernal pool habitats to rest every 2 to 3 years.
j. Burning: Burning is permissible any time of year. No buffers are required around pools.
k. Herbicides: Herbicides may be used in habitat surrounding vernal pools to control of noxious and invasive weed infestations when other approved methods are not expected to effective. Only herbicides listed as appropriate for riparian/aquatic use in PDC 29 will be used, and application of herbicides will occur when vernal pools are dry. Herbicide applications will maintain a 3 m (10 feet) buffer from the high water mark of each pool.

site is also located within the Military Slough Tract for impacts associated with the filling of 3 acres of wetlands at the Medford Airport.

Mazama Pocket Gopher

The average number of acres per year (averaged over 5 years) of Mazama pocket gopher subspecies habitat expected to be treated is: Roy Prairie pocket gopher: 40 ac; Olympia pocket gopher: 135 ac; Tenino pocket gopher: 79 ac; and Yelm pocket gopher: 107 acres. Many sites will be treated in succession using multiple types of restoration, e.g., first mow, then burn, then apply herbicides, within 1 or 2 seasons or between years.

The following conservation measures should be incorporated into the project design prior to review and approval by the appropriate Service manager as required in PDC 6.c of the proposed action:

a. Determine habitat suitability and the potential for gopher occupancy. A person qualified in identifying gopher habitat suitability will assess habitat suitability throughout all areas that would be affected by the action, either directly or indirectly. If the action will require on-site staging of equipment, sourcing, stockpiling, or wasting/disposal of materials, and/or new or improved haul roads or points of access, the probable locations for these activities will be included in the survey.
b. Conduct mound surveys within suitable and potentially occupied habitat. A person qualified in identifying gopher habitat suitability will perform and gopher mound survey (Service-approved occupancy/absence survey when developed and approved, or best professional judgment of species expert) well in advance of the restoration. If such a survey protocol is not yet in place, suitable habitat will be the surrogate used for analysis of species impacts. Occupancy/absence surveys will only be conducted by or under the supervision of a qualified, trained and experienced (Service-approved) biologist. Occupancy/absence surveys should only be conducted during the months of June through October, when the likelihood of detecting and positively identifying signs of occupancy is highest, or at the time an approved protocol deems necessary.
c. Projects in pocket gopher Habitat/Potential Habitat. Projects in documented pocket gopher habitat will require approval from the local Service office prior to implementation (see PDC 6.c in Section 1.3.2.1). If there is no Service-approved occupancy/absence protocol in place, and potential habitat is being used as the surrogate, then projects in potential habitat will require approval from the local Service office prior to implementation. The following design criteria should be incorporated into project design before seeking Service approval:
    i. Identify all Mazama pocket gopher mounds in the project area. Although mounds are an imprecise measure or indicator of pocket gopher activity and occupancy, they are useful at determining occupancy when combined with other information, such as soils and historic range. Occupied gopher habitat should be assumed to extend well beyond all positively identified gopher mounds and other signs of occupancy. This enlarged area, which will generally extend to surround a grouping or cluster of observed mounds and corresponding tunnel systems, represents a Habitat Protection Area or Zone (HPA or HPZ) intended to help minimize project impacts to gophers.
    ii. Projects should make significant efforts to avoid impacting HPAs or HPZs.
    iii. Heavy Equipment. Heavy equipment operations pose a risk of collapsing Mazama pocket gopher tunnel systems and burrows. To minimize impacts to gophers, the following activities should be conducted on areas that will not be occupied by gophers, such as existing roads, areas lacking appropriate soil, and other developed areas.
        i. on-site staging of equipment
        ii. sourcing
        iii. stockpiling, and/or wasting/disposal of materials
        iv. new or improved haul roads or points of access.

iv. Soil Disturbance. For projects and actions that involve grading, excavation within the HPA or HPZ, placement of fill, and/or other soil disturbance extending more than 20 cm (8 inches) below the ground surface (e.g., deep tillage to remove or break clayey subsoils and hardpan): a) these activities will fully avoid occupied gopher habitat (HPA or HPZ) during the months of April, May, and June, the period of gopher birthing and early natal development, so as to avoid collapsing, excavating, or otherwise physically disturbing burrows or nests that may contain immobile pups; and, b) an Adaptive Management Plan, subject to approval by the appropriate Service office, will be prepared in advance and implemented to avoid and reduce impacts to occupied gopher habitat (or potential habitat, if that is being used as a surrogate) and avoid impacts to gopher individuals.

Mowing/Mechanical treatments to reduce non-native vegetation:
Use lightest machine possible, broadest sweep (to reduce number of passes required), and not less than 20.3 cm (8 inches) above ground. Mowing will generally be implemented in the fall and winter; tractor mowers should be rubber-tracked to minimize soil compaction and/or rutting; tractor decks should be set sufficiently high to avoid soil gouging.

Tilling/Disking/Sod Rolling treatments to reduce non-native vegetation:
These project types will not be used in occupied gopher habitat, and will not be used in the wet season. Tilling/disking must be followed immediately with introduction of native plant species unless further weed eradication is scheduled to take place.

Seeding with a Harrow:
A harrow may be used in conjunction with seeding, but it is usually the wire mesh type of harrow, not tines. There will be very little ground disturbance from the harrow itself.

Raking:
Raking will only disturb the shallow duff on top of the soil, not standing or live plants.

Tree Removal
Minimize soil disturbance if this occurs in occupied Mazama pocket gopher habitat (or in potential habitat, if used as a surrogate). Fell tree in sections if possible to minimize soil impacts. Fell away from suitable habitat if possible, and minimize soil disturbance when removing downed trees.

Livestock Grazing
Used sparingly and carefully to avoid soil impacts, tunnel compaction, and foraging vegetation loss.

Prescribed Burns:
Objectives for prescribed ecological burns will focus on creating a mosaic of burned habitat patches that will incorporate exclusions plots within each burn unit with the long-term management goal of a 1 to 3 year rotational burn of each managed area, if at all possible. The goal is to conduct increased ecological burns, with appropriate oversight, to support Mazama pocket gopher habitat. Prescribed ecological fire goals will be measured based on a three-year average of acres burned. Potential and currently suitable Mazama pocket gopher habitat will be managed with prescribed ecological burning as necessary and appropriate. Ecological fire is required to create quality gopher foraging vegetation in prairie habitat and keep woody vegetation out of Mazama pocket gopher habitat. Fire is one tool to support development

of gopher foraging habitat and it may be necessary to use selective or broadcast herbicide application, or manual removal of encroaching plant species when the use of fire is either not possible or inadequate to ensure the maintenance of suitable Mazama pocket gopher habitat. Restrictions on size and placement of prescribed fire units must be established in coordination with other species' needs, particularly Taylor's checkerspot butterfly and streaked horned lark, which may not tolerate large-scale or poorly timed burns. Fire extent may vary from 5 to 20% of any individual site. From the description of PDC 51: Prescribed fire for sites with pocket gophers should be of low intensity, and take place on cool, cloudy days later in the dry season. Timing of burns will require Service approval.

Herbicide Application:

Lower toxicity herbicides shall be used whenever possible. Herbicide may be applied throughout the year; not every area is treated, but some areas may be treated twice in one year. Selective herbicide application is encouraged, i.e., spot/targeted treatment vs broadcast application treatments (see PDC 29). In occupied (or presumed occupied) gopher habitat, spot spraying will be the preferred method, but broadcast spraying may occur at some occupied sites for three different purposes. Broadcast spraying involves the use of wheeled or tracked vehicles such as ATVs or tractors.

(1) Broadcast spraying in occupied habitat is used immediately following a fall burn, within the footprint of a burned area, to kill the non-native vegetation that emerges before the native plants. This usually occurs within 2 weeks to 1 month of the burn, dependent on weather; newly-emerging plants need some amount of moisture to grow so, often this will not happen until after the first rain, post-burn. The herbicide used is glyphosate, and it targets non-native grasses, herbs, and forbs. Glyphosate disrupts photosynthesis, so only actively growing (photosynthesizing) plants are killed, and they are killed down through the root. Seeds are not affected, and neither are plants without growing parts above ground. Prior to glyphosate application, the burned area is surveyed to determine the density of the non-native plants vs native plants that have emerged. If too many native plants would be affected, spot spray would be utilized. If native plants would not be substantially harmed, then herbicides may be applied using a broadcast spray. If there are just a few places with native plants, these areas would be covered for protection from broadcast spraying.

No herbicide kills everything it targets. There are multiple "flushes" of growth after a burn. Some non-natives will come in with the natives, in that second flush of growth, or even later. Some are covered by duff or other cover during herbicide application and are thus protected from the herbicide’s effects. Therefore it is anticipated that some non-natives will remain on-site requiring a future treatment.

In very degraded prairie sites, such as areas with abundant tall oat grass or Scot's broom, there are not many native plants left on the site or within the seed bank. Therefore, the area would be seeded after herbicide treatment. Areas may need repeated seeding in successive years to fully establish a native plant community at a site. It is unknown how many acres of degraded prairie will be treated for the duration of this project. As per the description of the proposed action, burned areas will not exceed 20% of a given site, and thus neither will post-burn herbicide treatments.

In very degraded prairie sites that are occupied by gophers, the only food available to the gophers is non-native plants. Broadcast application of glyphosate will kill the photosynthesizing non-native plants that the gophers would otherwise be eating. Food remaining for gophers afterwards will be

the individual non-native plants that did not have green parts above ground, and any available food caches. The newly seeded natives will not have a developed root system (i.e., food for gophers) for perhaps a year, a period longer than their cache will feed them, estimated at about 2 weeks. Gophers will be reliant on those remaining non-native plants -- and whatever native plants still occur on these sites -- for food.

(2) In spring, in low-quality prairie habitats, the herbicide Fusilade will be used to target grasses such as tall oat grass (*Agrostis* spp). Fusilade is a grass-specific herbicide, and does not kill forbs and herbs. Fusilade is applied when the target grasses reach about 20.3 to 30.5 cm (8 to 12 inches), usually in late March to early May. If too many native grasses would be negatively affected by the use of broadcast spraying, spot spraying will be used. Sometimes a second application is warranted, but the second time is usually a spot-spray to catch the few patches of grass that were missed the first time.

(3) Garlon is usually used for controlling infestations of Scot's broom. Garlon is a broad-spectrum herbicide that will also kill forbs and grasses. Garlon is used when burning is either not possible or feasible (e.g., in an area that cannot be burned due to its location adjacent to housing, or because there are only so many burns that can be performed in a single year due to limited burn windows and/or limited staffing). It is usually applied in the late summer or fall, after native plants have senesced. The area is often mowed first to limit seed-set.

<u>Shade Cloth and Solarization:</u>
Use of shade cloth will not occur within 19.8 m (65 feet) of occupied habitat, and solarization will not occur within 10 m (33 feet) of occupied habitat. A maximum of 3 acres of Mazama pocket gopher habitat will be treated using shade cloth or solarization (each) per year within each subspecies' range. Likely it would be far less than this amount (per subspecies) in any given year.

GENERAL CONSERVATION MEASURES FOR PLANTS

PROJECTS covers restoration project effects to several listed plant species (Table 29) in Idaho, Oregon and Washington. This section first presents the General Plant Conservation Measures and then describes the different potential impacts to plants from the various proposed measures. In the subsequent sections, each species and its status is described, as well as any additional effects or species-specific conservation measures.

Table 29. Listed plant species addressed in PROJECTS.

	Listed Plant Species					
Species	**Federal Status**	**Federal Listing Date and Reference**	**Recovery Priority Number[23]**	**State Status**		
				ID	**OR**	**WA**
Bradshaw's lomatium, *Lomatium bradshawii*	Endangered	September 30, 1988; 53 FR 38448	5	--	Endangered	Endangered
Cook's Desert-Parsley (*Lomatium cookii)*	Endangered	December 7, 2002; 67 FR 68004	2C	--	Endangered	--
Gentner's fritillary (*Fritillaria gentneri*)	Endangered	December 10, 1999; 64 FR 69195	2	--	Endangered	--
Golden paintbrush, *Castilleja levisecta*	Threatened	June 11, 1997; 62 FR 31740	2	--	Endangered	Endangered
Howell's spectacular thelypody (*Thelypodium howellii ssp. spectabilis*)	Threatened	May 26, 1999; 64 FR 28393	8	--	Endangered	--
Kincaid's lupine, *Lupinus sulphureus* ssp. *Kincaidii*	Threatened	January 25, 2000; 65 FR 3875	6C	--	Threatened	Endangered
Large-flowered Woolly Meadowfoam (*Limnanthes floccosa ssp. grandiflora*)	Endangered	December 7, 2002; 67 FR 68004	3C	--	Endangered	--
Nelson's checker-mallow, *Sidalcea nelsoniana*	Threatened	February 12, 1993; 58 FR 8235	2	--	Threatened	Endangered
Rough Popcornflower (*Plagiobothrys hirtus*)	Endangered	January 25, 2000; 65 FR 3866	2C	--	Endangered	--

[23] Listed species are given a recovery priority number, which may range from a high of 1C to a low of 18, whereby priorities to recovery tasks are assigned. The criteria on which the recovery priority number is based are degree of threat, recovery potential, taxonomic distinctiveness, and presence of an actual or imminent conflict between the species and development activities. The "C" indicates the potential for conflict between the species and construction, development, or other economic activities.

Spalding's Catchfly *(Silene spaldingii)*	Threatened	October 10, 2001; 66 FR 51597	8C	Threatened	Endangered	Threatened
Ute Ladies'- Tresses (*Spiranthes diluvialis*)	Threatened	January 17, 1992; 57 FR 2048		Threatened	--	Endangered
Water Howellia (*Howellia aquatilis*)	Threatened	July 14, 1994; 59 FR 35860	13	Threatened	Threatened	Threatened
Wenatchee Mountains Checker-Mallow (*Sidalcea oregana* var. *calva*)	Endangered	December 22, 1999; 64 FR 71680	3	--	--	Endangered
Western lily (*Lilium occidentale*)	Endangered	August 17, 1994; 59 FR 42171	2	--	Endangered	--
Willamette daisy, *Erigeron decumbens* var. *decumbens*	Endangered	January 25, 2000; 65 FR 3875	3C	--	Endangered	--

The required conservation measures to minimize impacts to listed plants are listed below. In addition to these measures, species specific measures are found in the following species sections.

For all of the above mentioned listed plant species that may occur in a project area within the scope of this proposed action, the following conservation measures will be applied:

1) A qualified biologist with experience in pertinent species will determine whether there are listed plants, critical habitat, or suitable habitat for listed plants in the project area. If the site conditions warrant, surveys and site visits will be conducted at the appropriate time of year to identify all listed plant species and determine whether individual listed plants or potential habitat are present and may be adversely affected by project activities. (See Table 30 for survey timing).
2) If one or more listed plants are present and likely to be adversely affected by the project, the project will establish clearly marked buffers to avoid or minimize effects to listed plants. Buffers from listed plants are as follows:
    i) Vehicle and equipment staging areas will be located at least 15 m (50 feet) from listed plants.
    ii) Manual and mechanical methods to remove invasive/non-native plants at project sites occupied by a listed plant species will maintain a buffer of 2 m (6 feet.) around green growing plants. If listed plants have senesced, this buffer is no longer required.
    iii) Tilling, disking, plowing, excavation, raking or sod rolling (*i.e.,* larger scale sub-surface ground disturbances) or other use of heavy equipment will not occur within 10 m (33 feet) of listed plants.
    iv) Spot and hand applications of herbicide will maintain a minimum distance of 1 m (3.3 feet) from listed plants, unless they are dormant, in which case no buffer is required.
    v) Broadcast applications will maintain a minimum distance of 3 m (16 feet) from listed plants, unless they are dormant, in which case no buffer is required.
    vi) For all herbicide applications, listed plants will be physically shielded (e.g., covered with buckets or some other barrier that will not harm the plants) as needed to protect them

from spray or drift, unless they are dormant, in which case shielding is not necessary. Plants will be uncovered immediately after spraying has been completed.

vii) Dust-abatement additives and stabilization chemicals will not be applied within 10 m (33 feet) of listed plants or critical habitat for listed plants.

3) Prior to restoration activities at areas with listed plants, all project staff will be familiarized with identification of any listed plants in the area and will be aware of listed plant locations within the project area.
4) Access points and tracks within occupied, suitable or critical habitats for listed plant species must be limited and clearly marked to avoid soil compaction and damage to listed plant species from vehicles and/or foot traffic.
5) Herbicide applications may be used to control or remove invasive native and non-native vegetation in accordance PDC 29 of the proposed action of the biological assessment. Appropriate protective measures must be used to protect listed plants to herbicide exposure, as listed in PDC 29 and as determined necessary during project design by the appropriate species' leads.
6) Herbicides will not be applied at locations where nearby listed plants may be in the path of surface runoff from the project.
7) Ground-disturbance activities (*e.g.,* tilling, disking, and plowing) and herbicide use should be followed with native seed or plant introductions to minimize or eliminate the establishment of invasive and non-native vegetation, unless it is determined the local seed source/bank is sufficient.

For aquatic restoration projects (Restoration Actions 33-53)

8) Where listed plant(s) are present at the site and habitat conditions may or may not be improved for listed plants:
    a) Establish clearly marked buffers (as listed above) to avoid effects to listed plants and identify treatment areas with flagging or fencing prior to restoration activities to minimize effects to listed plants.
    b) If the site and location of listed plants is such that goals of the aquatic restoration project cannot be achieved without harming or killing a portion or all listed plant(s) at the site, the project manager will work with the appropriate local Service office to develop a site plan that minimizes the number of plants that are harmed or killed while still achieving project goals and objectives. The plan will include which plants will be affected, including salvage and relocation of these plants if deemed appropriate.

For upland restoration projects (Restoration Actions included under PDC 51)

9) Where listed plants and their critical and/or occupied habitats are affected by habitat improvements that promote better habitat conditions for those species in the long term (such as prairie restoration actions):
    a) Project will follow all appropriate restrictions under PDC 51.
    b) Project design will address both the critical elements of the life cycle of the listed plant species as well as the biotic and abiotic environmental factors that sustain rare plant taxa (e.g., pollinators).
    c) Recovery Plans and Action Plans should be used to prioritize, guide and plan restoration activities.

Table 30. Generalized Optimal Survey Times for Flowering Periods of Listed Plants in Oregon and Washington. (*) timing may need to be adjusted in some localities, based on site specific conditions.

Species	Optimal Survey Time Period*
Bradshaw's Lomatium (*Lomatium bradshawii*)	April to mid-May
Cook's Desert Parsley (*Lomatium cookii*)	Mid-March through May (varies with spring moisture)
Gentner's Fritillary (*Fritillaria gentneri*)	April to June
Golden Paintbrush (*Castilleja levisecta*)	April to September
Howell's Spectacular Thelypody (*Thelypodium howellii* ssp. *spectabilis*)	June through July
Kincaid's Lupine (*Lupinus sulphureus* ssp. *kincaidii*)	May through July
Large-flowered Wooly Meadowfoam (*Limnanthes floccose*)	Mid-March to May (varies with spring moisture)
Nelson's Checkermallow (*Sidalcea nelsoniana*)	Late May to Mid-July
Rough Popcornflower (*Plagiobothrys hirtus*)	Mid-June to early July
Spalding's Catchfly (*Silene spaldingii*)	June to September
Ute Ladies'-Tresses (*Spiranthes diluvialis*)	July to late August
Water Howellia (*Howellia aquatilis*)	May through August
Wenatchee Mountains Checker-Mallow (*Sidalcea oregano* var. *calva*)	June to Mid-August
Western Lily (*Lilium occidentale*)	May to July
Willamette Daisy (*Erigeron decumbens* var. *decumbens*)	Mid-June to early July

d) Treatment areas will be clearly marked with flagging or fencing prior to restoration activities to avoid inadvertently affecting listed plants.
e) Livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Cook's desert parsley, Gentner's fritillary, Howell's spectacular thelypody, large-flowered meadowfoam, Nelson's checkermallow, rough popcornflower, and Spalding's catchfly, unless approved by the local Service office.
f) Mowing activities will follow the timing restrictions and mower height settings provided in Table 31 for all affected listed species.

g) Spring mowing is allowed at restoration sites with listed plant species, as indicated in Table 31, but only if necessary to control serious infestations of weeds that reproduce mainly by seed (e.g., meadow knapweed) and threaten persistence of the listed species in that area. In these instances, up to one half of area occupied by the listed plant population(s) at a site may be mowed in an effort to reduce seed set by non-native weeds. Spring mowing must be approved by the local Service office.

h) Herbicides applications may be used to control or remove invasive native and non-native vegetation in accordance PDC 29 of the proposed action of the biological assessment. If listed animals are present (*e.g.*, streaked horned larks, butterflies, Mazama pocket gophers, or vernal pool fairy shrimp), additional restrictions may be required.

i) All broadcast applications will only occur after listed when plants are senesced and/or no longer growing (which varies by species and site conditions from year to year) , unless otherwise approved by the local Service office or species lead. Shield listed plants that do not fully senensce. Use appropriate buffers, as described in the General Plant Conservation Measure #2.

j) Spot and hand applications may occur any time of the year. Use appropriate buffers, and shield plants, as described in the General Plant Conservation Measure #2.

k) Herbicides will not be applied at locations where nearby listed plants may be in the path of surface runoff from the project.

l) Herbicide treatments must be followed with native seed or plant introductions if necessary to minimize or eliminate the establishment of invasive and non-native vegetation.

Table 31. Species-specific timing for mowing and prescribed burn methods for the control or removal of invasive and non-native vegetation at project sites occupied by listed plant species. See species-specific conservation measures for additional restrictions on these activities for listed animals that may be present.

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	Mechanical Mowing – Timing [Mower Deck Height]	Spring Mowing Allowed?
Bradshaw's lomatium	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Cook's desert parsley	Fall burns after September 1	Summer/Fall mowing after July 15 [5 cm (2 inches)]	No
Gentner's fritillary	Fall burns after September 1	Summer/Fall mowing after July 15 [15 cm (6 inches)]	No
Golden Paintbrush	Fall burns after August 15	Late winter (February to March 15) mowing OK , then mow again after September 15, if site not burned	Yes- with restrictions. Complete by mid-March
Howell's spectacular thelypody	Not Allowed	Not Allowed	No
Kincaid's lupine	Fall burns after August 15	Fall mowing after August 15 15 cm [6 inches)]	Yes- with restrictions.

Listed Plant Species	Treatment Method and Timing		
	Prescribed Burns (Calendar Timing)	Mechanical Mowing – Timing [Mower Deck Height]	Spring Mowing Allowed?
Large-flowered woolly meadowfoam	Fall burns after September 1	Summer/Fall mowing after July 15 [5 cm (2 inches)]	No
Nelson's checkermallow	Fall burns after August 15; up to 50% of the occupied area at a site.	Fall mowing after August 15 [15 cm (6 inches)]	Yes With restrictions.
Rough popcorn flower	Fall burns after August 15	Fall mowing after August 15 [10 cm (4 inches)]	No
Spalding's catchfly	Not Allowed	Not Allowed	No
Ute ladies'- tresses	Not Allowed	Not Allowed	No
Water Howellia	Not Allowed	Not Allowed	No
Wenatchee Mountains checkermallow	Fall burns after August 15	Unlikely mowing could be accomplished. Selective weed removal would be helpful.	No
Western lily	Fall burns[7] between November 1 and March 1	Fall mowing[7] between November 1 and March 1 [10 cm (4 inches)]	No
Willamette daisy	Fall burns after August 15	Fall mowing after August 15 [15 cm (6 inches)]	Yes- with restrictions.
LISTED ANIMAL SPECIES			
Fender's blue butterfly	Burning OK on 25 to 33% of an occupied area after August 15 to Nov 15.	August 15 to March 1 [15 cm (6 inches)]	No
Oregon silverspot butterfly	Burning OK on 25 to 33% of an occupied area from October 1 to mid July	October 1 to Mid-May. No more than 75% of an occupied area	Yes Complete by May 15
Taylor's checekerspot butterfly	Burning OK only on 33% of an occupied area during diapause only (Sept 10 to Feb 15)	Mowing OK during diapause only; September 10 to February 15	No.
Vernal pool fairy shrimp	Any time	Treat invasive plants any time if listed plants not present	Yes
Streaked horned lark	Outside of nesting season in suitable habitat. Anytime in unsuitable habitat.	Sept 1 to March 30: 100% April 1 to August 31 no more than 50% of an occupied area. Mower set to highest level to meet objectives.	Yes, up to 50% of an occupied area.
Mazama pocket gopher	Yes but must get approval from local office	Yes, but must get approval from local office	Yes, but must get approval

Bradshaw's Lomatium

All of the General Plant Conservation Measures (Section 3.13.1) apply for Bradshaw's lomatium. Additional species-specific measures include:

- Broadcast application of grass-specific herbicides may be used in on up to half of an area occupied by Bradshaw's lomatium between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
- All other broadcast applications will only occur after August 15 when Bradshaw's lomatium is dormant.

Cook's Desert-Parsley

All of the General Plant Conservation Measures (Section 3.13.1) apply for Cook's desert parsley. In addition, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Cook's desert-parsley, unless approved by the local Service office. This plant can be associated with vernal pool habitats, which can support vernal pool fairy shrimp (another listed species), and additional PDC, restrictions, and conservation measures may apply for vernal pool fairy shrimp.

Gentner's Fritillary

All of the General Plant Conservation Measures (Section 3.13.1) apply for fritillary. In additional, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Gentner's fritillary, unless approved by the local Service office.

Golden Paintbrush

All of the General Plant Conservation Measures (Section 3.13.1) apply for golden paintbrush. Additional species-specific measures include:

- Broadcast application of grass-specific herbicides may be used in on up to half of an area occupied by golden paintbrush between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
- All other broadcast applications will only occur after the plant has senensced (typically August 15 in Oregon and August 30 in Washington).

Howell's Spectacular Thelypody

All of the General Plant Conservation Measures (Section 3.13.1) apply for thelypody. In additional, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by Howell's spectacular thelypody, unless approved by the local Service office.

Kincaid's Lupine

All of the General Plant Conservation Measures (Section 3.13.1) apply for Kincaid's lupine. Additional species-specific measures include:

- Broadcast application of grass-specific herbicides may be used in on up to half of an area occupied by Kincaid's lupine between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
- All other broadcast applications will only occur after August 15 when Kincaid's lupine is dormant. This plant is the primary host plant for Fender's blue butterflies (another listed species); see additional PDC, restrictions, and conservation measures that apply for Fender's blue butterfly.

Meadowfoam

All of the General Plant Conservation Measures (Section 3.13.1) apply for meadowfoam. In additional, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by large-flowered meadowfoam, unless approved by the local Service office. Also, this plant can be associated with vernal pool habitats, which can support Cook's desert parsley and vernal pool fairy shrimp (other listed species), and additional PDC, restrictions, and conservation measures may apply for vernal pool fairy shrimp.

Nelson's Checkermallow

All of the General Plant Conservation Measures (Section 3.13.1) apply for Nelson's checkermallow. Nelson's checkermallow does not senesce completely in the fall like many other prairies plant species, and additional protections include:

- Burning: at any site with a population of this species, no more than one half of the occupied habitat may be burned in any year.
- Herbicide use: protect Nelson's checkermallow plants from herbicide drift or overspray:
    - When treating target plants with triclopyr, glyphosate or 2,4-D amine, apply by hand (*e.g.*, with a backpack sprayer wand) when working near Nelson's checker-mallow to ensure protection of the listed plant.
    - For all herbicide applications not excluded below, cover or otherwise protect (*e.g.*, by clipping leaves to remove exposed green tissue) individual Nelson's checker-mallow plants to ensure that no herbicide comes in contact with the plant. Means of coverage may include 5-gallon buckets, tree protection tubes or other suitable shielding or covering material. Immediately after herbicide treatment, remove coverings.
    - When applying glyphosate with a weed wiper in areas with Nelson's checkermallow, no covering of individual Nelson's checker-mallow is necessary apply glyphosate at a height to target upper grass stems, and avoid shorter Nelson's checkermallow plants.
    - No covering of Nelson's checkermallow is required if treating target plants with clopyralid, sethoxydim or clethodim.
    - Broadcast application of grass-specific herbicides or clopyralid may be used in on up to half of an area occupied by Nelson's checkermallow between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
    - All other broadcast applications will only occur after August 15.
    - All other herbicides will only be applied from August 15 to October 31 when the species is not actively growing and mostly dormant.

Rough Popcornflower

All of the General Plant Conservation Measures (Section 3.13.1) apply for popcornflower. In addition, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by popcornflower, unless approved by the local Service office.

Spalding's Catchfly

All of the General Plant Conservation Measures (Section 3.13.1) apply for catchfly. In addition, livestock grazing will not be used to control or remove invasive and non-native vegetation at project sites occupied by catchfly, unless approved by the local Service office.

Utes Ladies'-Tresses

All of the General Plant Conservation Measures (Section 3.13.1) apply for Ute ladies' tresses. There are no additional species-specific measures.

Water Howellia

All of the General Plant Conservation Measures (Section 3.13.1) apply for water howellia. There are no additional species-specific measures.

Wenatchee Mountains Checker-Mallow

All of the General Plant Conservation Measures (Section 3.13.1) apply for Wenatchee mountain checkermallow. There are no additional species-specific measures.

Western Lily

All of the General Plant Conservation Measures (Section 3.13.1) apply for Western Lily. There are no additional species-specific measures.

Willamette Daisy

All of the General Plant Conservation Measures (Section 3.13.1) apply for Willamette daisy. Additional species-specific measures include:

- Broadcast application of grass-specific herbicides may be used in on up to half of an area occupied by Willamette daisy between February 15 and April 15. If using a weed wiper to apply a grass-specific herbicide for a particular listed plant during the growing season, the herbicide will be applied to the upper grass stems of targeted non-native plants, thus avoiding the shorter listed plant species.
- All other broadcast applications will only occur after August 15 when Willamette daisy is dormant; spot and hand applications may occur any time of the year.

Lamprey & Freshwater Mussel Conservation Recommendations (updated June 2020)

The Service recommends that the Action Agencies consider biological needs of lamprey and freshwater mussel species whenever they plan or conduct any instream or near-stream projects.
This information is provided for its use to proactively develop and implement restoration actions that reduces impacts on these unlisted, but ecologically important, aquatic species.

Lamprey

The following recommendations are for Pacific lamprey, but may also benefit other species of lamprey (e.g. river lamprey, western brook lamprey). Consideration of Pacific lamprey is important for many reasons:

- They are a Tribal Trust species, because they have a high cultural significance to Native American tribes from California to Alaska and;
- They may have served as a primary food source for aquatic, mammal, and avian predators that also prey on ESA-listed salmonids and other recreational and commercially important fish species.
- Their abundance and distribution has significantly declined throughout its range over the past three decades, and efforts to reverse this decline are needed (USFWS 2019[24]).

While Pacific lamprey are anadromous like salmon, their life history has some unique aspects that are typically not considered during implementation of instream activities, even when using design considerations and best management practices for salmonids. Adjustments to minimize adverse effects to Pacific lamprey should be made at the project design phase to accommodate lamprey passage, lamprey spawning periods, existence of nests, upstream and downstream movement, and avoid direct mortality to larval lamprey burrowed in the substrate.

Threats to Lampreys

Larval lamprey spend most of their time burrowed in stream substrates, moving during flow events and mostly at night. Many age classes can concentrate together in the same areas because of habitat preference, making larval lamprey populations particularly susceptible to activities that involve dredging/excavating, stranding and use of toxic chemicals. Adults also prefer to move at night, hiding in large rock and boulder substrate during the day. Threats to lampreys include:

- Poor passage conditions and entrainment.
- De-watering and streamflow management from water diversions, instream projects and hydropower peaking
- Dredging from construction, channel maintenance and mining activities
- Chemical poisoning from accidental spills or chemical treatments
- Poor water quality
- Stream and floodplain degradation (channelization, loss of side channels, scouring)

Lamprey Recommendations:

The biological considerations of lamprey should be incorporated into project design, objectives, salvage and best management practices for the protection and conservation of this species. Currently there are several guidance documents available to assist in such actions:

1. *Best Management Guidelines for Native Lampreys during In-Water Work* (Lamprey Technical Workgroup 2020) https://www.fws.gov/pacificlamprey/Documents/2020%20Lamprey%20BMG%20Final.pdf covers a broad spectrum of actions including biology, salvage during dewatering actions, habitat restoration, screening, and passage and includes case studies.
2. *Practical Guidelines for Incorporating Adult Pacific Lamprey Passage at Fishways* (Lamprey Technical Workgroup 2017)

[24] U.S. Fish and Wildlife Service. 2019. Pacific lamprey (*Entosphenus tridentatus*) Assessment. 283 pp. https://www.fws.gov/pacificlamprey/Documents/PacificLamprey_2018Assessment_final_02282019.pdf

(https://www.fws.gov/pacificlamprey/Documents/2017.06.20%20LampreyPsgFINAL.pdf) includes specific guidance on providing upstream passage within existing fishways and in new fishway designs, and includes case studies.

3. *Barriers to Adult Pacific Lamprey at Road Crossings: Guidelines for Evaluation and Providing Passage (*Lamprey Technical Workgroup 2020) includes culvert passage assessments and recommendations for lamprey passage, and includes case studies. Available: https://www.fws.gov/pacificlamprey/LTWGMainpage.cfm
4. Additional documents, information, and materials may be found on the website for the Pacific Lamprey Conservation Initiative's Lamprey Technical Workgroup: https://www.fws.gov/pacificlamprey/LTWGMainpage.cfm

Freshwater Mussels

While no species of freshwater mussels are federally listed in the Pacific Northwest, they are of high value (culturally, ecologically, and environmentally) to many entities. The Service recommends that the Action Agencies require considerations for the biological needs of all native freshwater mussel species for all permits requiring instream or near-stream projects. There are six species of western freshwater mussels: the western pearlshell, the western ridged mussel, the winged floater, the Oregon floater, the Yukon floater, and woebegone floater. The Xerces Society for Invertebrate Conservation (Xerces Society) maintains a great resource for western freshwater mussels at https://xerces.org/endangered-species/freshwater-mussels. To paraphrase from the Xerces Society's website:

> "Freshwater mussels are experiencing a dramatic decline; 72% percent of North American freshwater mussels are considered extinct or imperiled, representing one of the most at-risk groups of animals in the United States. The decline of freshwater mussels has been well studied in eastern North America but has received very little attention in states west of the Rocky Mountains….
>
> "Native freshwater mussels have immense ecological and cultural significance. As filter-feeders, they can substantially improve water quality by filtering out harmful pollutants, which benefits both humans and aquatic ecosystems…. These animals can be highly sensitive to environmental changes and thus have great potential to be used as indicators of water quality. Freshwater mussels have been historically important sources of food, tools, and other implements for many Native American tribes. Native Americans in the interior Columbia Basin have harvested these animals for at least 10,000 years, and they remain an important cultural heritage for tribes today."

Mussel Recommendations:

The biological considerations of freshwater mussel species should be incorporated into project design, objectives, salvage and relocation, and best management practices for the protection and conservation of this species. The Xerces Society has developed a publication "Conservation the Gems of Our Waters: Best Management Practices for Protecting Native Western Freshwater Mussels during Aquatic and Riparian Restoration, Construction, and Land Management Projects and Activities (Blevins et al. 2017), and a companion handbook, Mussel Friendly Restoration (Blevins et al. 2019)- both available online at https://xerces.org/publications/guidelines/mussel-friendly-restoration. These documents include information on determining if mussels are present at your site, project development and review, salvage and relocation, monitoring and practices for minimizing project impacts for several different activities

(i.e. construction, vegetation management, flow management, restoration). The Xerces Society website also has a field identification guide developed by the Xerces Society and Confederation Tribes of the Umatilla Indian Reservation at https://pnwmussels.org/wp-content/uploads/2016/07/QuickMusselGuide_CTUIR.pdf

Mussel References:

Blevins, E., L. McMullen, S. Jepson, M. Backblurn, A. Code, and S.H. Black. 2017. Conserving the Gems of Our Waters. The Xerces Society for Invertebrate Conservation. Portland, Oregon. 108 pp. Available: https://xerces.org/western-freshwater-mussels/.

Blevins, E., L. McMullen, S. Jepson, M. Blackburn, A. Code, and S.H. Black. 2019. Mussel Friendly Restoration. The Xerces Society for Invertebrate Conservation. Portland, Oregon. 32 pp. Available: https://xerces.org/western-freshwater-mussels/.

SPECIES AND CRITICAL HABITATS NOT LIKELY ADVERSELY AFFECTED

This appendix is referenced in the U.S. Fish and Wildlife Service's (Service) Concurrence letter in Section 1.2 of the PROJECTS Biological Opinion (Opinion), and provides additional supporting information for our concurrence with the Action Agencies on several ESA-listed species and designated critical habitats. The Service concurs with the Action Agencies that their proposed PROJECTS restoration program may affect, but are unlikely to adversely affect the following species and critical habitats:

- Canada lynx and its critical habitat,
- Columbian white-tailed deer,
- Gray wolf,
- Grizzly bear,
- Northern Idaho ground squirrel,
- Pygmy rabbit,
- Woodland caribou and its critical habitat,
- Oregon spotted frog and its proposed critical habitat,
- Western snowy plover and its critical habitat, and
- Critical habitats for the following species: Mazama pocket gopher, marbled murrelet, Northern spotted owl, streaked horned lark, Fender's blue butterfly, Taylor's checkerspot butterfly, Kincaid's lupine, and Willamette daisy.

The following sections provide the proposed conservation measures for each species.

Canada Lynx

Implement the following conservation measures:

a. Prior to initiating restoration activities in lodgepole pine, cedar/hemlock and sub-alpine forest habitats at or above 3,000 ft. elevation in Idaho, Oregon and Washington, contact the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* Canada lynx.
b. Activities within or near potential denning sites will be reviewed by the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* the lynx.
c. The project will meet the standards and guidelines identified in the Northern Rockies Lynx Management Direction (NRLMD) and/or in the current and upcoming revised (2013) LCAS (Lynx Conservation Assessment and Strategy) or most recent revisions of these documents. The current LCAS is available at: http://library.fws.gov/Pubs5/Lynx_consassess_2000.pdf
d. The project will not result in increased off-road vehicle/snowmobile access to lynx habitat during or following implementation.

Columbian White-tailed Deer

Implement the following conservation measures:

a) Restoration projects in Columbian white-tailed deer habitat will follow guidelines in the the Service's 2010 *Lewis and Clark National Wildlife Refuge and Julia Butler Hansen Refuge for the Columbian White-tailed Deer Comprehensive Conservation Plan*[25]; and the Natural Resouces Conservation Service's 2011 *Conservation Implementation Strategy Columbia County White-*

[25] http://www.fws.gov/pacific/planning/main/docs/WA/jbh-lc/Draft%20CCP%20EIS/0%202%20Table%20of%20Contents.pdf

Tailed Deer Habitat Improvement or the most recent revisions of these documents. To avoid and minimize impacts to Columbian white-tailed deer during the fawning period, restoration activities will not occur from June 1 to July 15 within the following region: The Columbia River, including all islands and extending 3.2 km (2 miles) inland from both sides of the river, from Svensen Island, Clatsop County, to the confluence with the Willamette River. The Columbia River includes the outlet of Vancouver Lake from the Lake, north to its confluence with the Columbia River just south of the confluence of the Lewis River and Columbia Rivers. If survey and review of literature indicate the project will not impact Columbian white-tailed deer and this is confirmed by Service biologists with expertise in Columbian white-tailed deer biology, this timing restriction may be waived.

b) To avoid and minimize impacts to Columbian white-tailed deer and their movements, fencing projects on Puget Island, the Hunting Islands, Price Island, and 3.2 km (2 miles) inland from the Columbia River between 3.2 km (2 miles) east of Cathlamet and 3.2 km (2 miles) west of the community of Ridgefield, will use only three-strand wire (barbed or smooth) and have a maximum fence height of ~106 cm (42 inches) with lower strands at least 46 cm (18 inches) above the ground. Taller fences to temporarily exclude deer and other animals from plant establishment areas are allowed, but must be removed within 3 years.
c) Project personnel will be instructed to not approach Columbian white-tailed deer adults or fawns at any time and to reduce vehicle speeds around project sites where deer occur, to avoid vehicle-deer collisions.
d) Herbicides will not be used in known or suitable Columbian white-tailed deer fawning areas from June 1 to July 15. Use only herbicides listed under PDC 29.
e) Restoration projects proposed within the areas identified in conservation measures a & b above, which include activities under: Dams, Water Control or Legacy Structure Removal, River, Stream, Floodplain, Wetland Restoration, Set-back or Removal of Existing Berms, Dikes, and Levees, will be reviewed by the appropriate Service field office to confirm the project will have *no effect* or *is not likely to adversely affect* Columbian white-tailed deer or its critical habitat.

Gray Wolf

Implement the following conservation measures:

a) Prior to implementing restoration actions in suitable habitat for wolves, the project manager will contact the appropriate Service field office to confirm the project is not likely to adversely affect gray wolves. Furthermore, the following conservation measures will be implemented:
b) Restoration activities generating noise above ambient levels within 1.6 km (1 mile) of any known gray wolf den or rendezvous site (based on current information from state wildlife agencies and the Service), will not occur from December 1 to June 30, unless the project is reviewed by the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* the gray wolf.
c) Restoration activities will not increase trail or road densities within gray wolf habitat.

Grizzly Bear

Implement the following conservation measures:

a) Prior to implementing restoration actions in suitable habitat for grizzly bears, the project manager will contact the appropriate Service field office to confirm the project is not likely to adversely affect grizzly bears.

b) Restoration activities generating noise above ambient levels will not occur within 0.4 km (0.25 mile) (and 1.6 km (1.0 mile) for pile driving) of known grizzly bear den sites (based on current information from state wildlife agencies and the Service) from October 15 through May 15. Activities within 0.4 km (0.25 mile) of a known den site at any time of year will be reviewed by the appropriate Service field office to confirm the project will have *no effect* or *is not likely to adversely affect* grizzly bear.

a. Restoration activities generating noise above ambient levels, motorized vehicle use (including helicopters), or increasing human use within 0.4 km (0.25 mile) (1.6 km (1.0 mile) for pile driving) of grizzly bear core areas is not covered by this programmatic Opinion and will require a separate Section 7 consultation.
b. Restoration activities will not degrade or destroy key grizzly bear foraging habitat (e.g., avalanche chutes, berry/shrub fields, fruit/nut sources).
c. Restoration activities will not increase trail or road densities within core areas or areas actively used by grizzly bears.
d. Within recovery areas, or areas actively used by grizzly bears, all attractants, including food and garbage, will be stored in a manner unavailable to wildlife at all times.
e. Within recovery areas, or areas actively used by grizzly bears, no-cut buffers (minimum of 25 feet) will be maintained in riparian zones to provide vegetative screening along streams and wetlands. Visual cover will also be maintained adjacent to roads and major habitat components such as snow chutes and shrub fields.

Northern Idaho Ground Squirrel

Implement the following conservation measures:

a) Prior to implementing restoration actions in suitable or occupied habitat for Northern Idaho ground squirrel, the project manager will contact the appropriate Service field office to confirm the project has no effect or is not likely to adversely affect Northern Idaho ground squirrel.

b) If a project occurs within northern Idaho ground squirrel suitable habitat, a qualified wildlife biologist must conduct onsite surveys during the appropriate time of year at least three times during a 7-day period in potential northern Idaho ground squirrel habitat to determine their presence. If surveys are not completed, suitable habitat will be assumed occupied.

a. If upland projects will occur within 0.4 km (0.25 mile) of a known occurrence or potential habitat of northern Idaho ground squirrel, contact the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* the northern Idaho ground squirrel.
b. Avoid pile driving within 1.6 km (1 mile) of occupied northern Idaho ground squirrel habitat, unless it is confirmed the activity is not likely to adversely affect northern Idaho ground squirrel.
c. Avoid all restoration activities within occupied northern Idaho ground squirrel between April 1 and August 15 to avoid the northern Idaho ground squirrel above ground activity period, unless confirmed by the appropriate Service field office that the project will have *no effect* or is *not likely to adversely affect* the northern Idaho ground squirrel.
d. Do not locate parking, vehicle turnout, staging or fueling areas, or any type of temporary sites associated with a project, within occupied or potential habitat.
e. No off-road travel will occur in occupied habitat.

Pygmy Rabbit

Implement the following conservation measure:

a. Prior to initiating restoration activities in the central Columbia Plateau (Douglas, Lincoln, Adams and Grant counties in Washington State) in dense, tall stands of sagebrush, or if any evidence of

pygmy rabbit presence is detected in a project area outside of these counties, but within the historical range of the pygmy rabbit, contact the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* the pygmy rabbit.

Southern Selkirk Mountains Woodland Caribou and Critical Habitat

Implement the following conservation measures:

a. Prior to initiating restoration activities at elevations at 4,000 feet or above in Bonner or Boundary counties in Idaho or east of the Pend Oreille River, Pend Oreille County, Washington, within recovery zones (as defined in the Woodland Caribou Recovery Plan[26]), contact the appropriate Service field office to confirm the project will have *no effect* or is *not likely to adversely affect* woodland caribou.
b. Projects that are scheduled during early winter in the woodland caribou recovery area or within 0.8 km (0.5 miles) of these habitats and generate noise above ambient levels will be evaluated by the local Service office to determine if there will be disturbance effects to woodland caribou.
c. Any vegetation management in woodland caribou habitat will not affect more than 1.0 acre of native forest per year.
d. Projects will not result in increased access for snowmobiles or other off-road vehicles and will not result in new roads in woodland caribou habitat.

Oregon Spotted Frog and Critical Habitat

Implement the following proposed conservation measures:

a. Aquatic restoration projects within proposed critical, suitable or occupied habitats or within 5 km (3.1 miles) of proposed critical habitat will be reviewed by the local Service office to ensure the project is not likely to adversely affect Oregon spotted frog and will not adversely affect PCEs of the proposed Oregon spotted frog critical habitat, per PDC 6.c of the proposed action.
b. Electrofishing will not occur in proposed Oregon spotted frog critical habitats or within 5 km (3.1 miles) of these critical habitats at any time, unless the local Service office has determined there is no likelihood of adverse effects to Oregon spotted frog individuals (frogs, tadpoles, or eggs). If Oregon spotted frog individuals are found during any electrofishing activities, all such activities shall be terminated, and the local Service office will be notified immediately to determine next steps.

Western Snowy Plover

Implement the following conservation measures:

a. Prior to initiating restoration activities on coastal beaches, project managers will coordinate with the appropriate Service field office to identify western snowy plover nesting and wintering areas.
b. Restoration activities occurring on coastal beaches will not occur within western snowy plover nesting or foraging habitat from March 15 to September 15.
c. Ground disturbing activities on coastal dunes that are occupied by snowy plovers will occur during the fall and winter months outside of the plover's critical nesting period (*i.e.,* March 15 to September 15). These activities will include the control or removal of invasive and non-native vegetation on coastal dunes through manual, mechanical, and chemical methods. Other

[26] http://ecos.fws.gov/docs/recovery_plan/940304.pdf

restoration actions may include grading of beach/dune habitat and removal of wood from the beach, and placement of shell hash.

d. Proposed restoration activities generating noise above ambient levels will not occur within 0.4 km (0.25 mi) of a western snowy plover occupied beach during the critical nesting period.
e. In-channel nutrient enhancement activities will not occur in coastal streams from March 15 to September 15 nor within 15 km (9.3 mi) of a western snowy plover occupied beach, in order to not attract potential avian or mammalian predators to nesting areas.
f. Project personnel must take appropriate measures to not attract potential avian or mammalian predators to project sites in plover habitat. These include: eliminating human-introduced food sources, properly disposing of organic waste, and not planting vegetation that could be potential cover or perches for predators near designed critical or suitable habitats.