Implementation Description

Camp Valley Restoration Project

Table 1. Project information

Category: 2 – Large wood and boulder placement, and tree removal for large wood projects; 3 – Legacy structure removal; 4 – Channel reconstruction / relocation; 5 - Off- and side-channel habitat restoration; 6 – Streambank restoration; 7 – Set-back or removal of existing berms, dikes, and levees; 8 – Reduction / relocation of recreation impacts; 9 – Livestock fencing, stream crossings, and off channel livestock watering facilities; 14 –Riparian vegetative planting; 16- Beaver habitat restoration	Lead Preparer: Dan Armichardy
Applicant: Blue Mountain Aquatics	NEPA Reference: DN For Aquatic Restoration EA website*
Location: T10S, R32E, sec. 25, 35, and 36; T11S, R32E, sec. 2, 3, 9, 10, and 16 USGS Quad: Cougar Rock, Susanville	Lease/ /Case File/ Serial #: N/A (Reference #): N/A
Begin Date: 1/15/19	Due Date: 5/15/19

*Please see http://www.fs.usda.gov/detailfull/malheur/landmanagement/?cid=STELPRD3817723&width=full

Purpose and Need

The purpose of this project is to improve riparian and aquatic habitat, including high priority habitat for Endangered Species Act listed Middle Columbia River steelhead. The goal of this project is to increase Middle Columbia River steelhead carrying capacity through increasing productivity for juvenile rearing and riparian plant communities within a tributary to the Middle Fork John Day River.

Water temperatures in most years negatively influence juvenile over-summer habitats for steelhead. Riparian vegetation and its processes of streambank shading, root reinforcement, and terrestrial insect production are limited due to constraining legacy features like railroad grade levees, lowered water tables, loss of overbank flooding, and ungulate browsing. The lack of these processes in these core areas of Camp and Lick Creeks negatively impacts the ecosystem functions of available habitat to maintain cold water for cool water fisheries in and downstream of these reaches. Alder vegetation established following livestock management changes in the early 1980s. Willow and cottonwood communities are present in isolated numbers, but are lacking multiple age classes and distribution to maintain riparian resilience, to provide shade and habitat, and to provide for beaver life cycle histories that will self-maintain Camp and Lick Creeks long into the future. Flood flows that have overtopped the railroad grade have developed multiple headcuts and do not have plant communities with root masses that can withstand overbank flooding processes. As a result, upland plant species occur on the dry side of the floodplain (Figure 6, Figure 11). On the creek side, single threaded, long riffles with large substrate sizes are abundant, when beaver likely maintained multithreaded channels and willow/cottonwood communities over centuries.

John Day River Basin steelhead numbers are considerably lower than historical levels. To address this sharp decline in fish numbers, the state of Oregon, National Marine Fisheries Service, and Northwest Power and Conservation Council have developed large-scale recovery plans. The Draft Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment (Carmichael 2007) rated the Camp Creek watershed as a high priority for habitat protection and restoration in the Middle Fork John Day River subbasin. The 2005 John Day Subbasin Revised Draft Plan listed Camp Creek as the highest priority watershed. Key watershed issues in these subwatersheds are fish passage barriers; altered hydrology and sediment routing; and degraded floodplains, riparian communities, stream channels (habitat diversity/quantity), and water quality (stream temperature). The project will remove floodplain constraints (degraded floodplains) that have been created by past management, before Best Management Practices were implemented. Removing floodplain levees, while increasing connectivity to side channels and wetlands will decrease stream power and reduce peak flows in these segments and downstream. These sections have streambeds composed of cobble substrate that would transition to gravel with lowered stream energy (sediment routing). Thus, increased spawning may occur within the treatment reaches. More importantly, water will spread out across the valley and will inundate the entire valley, recreating the depositional environment. This will increase the duration of peak flows and alter the peak and receding limb of the hydrograph, increasing survivability of emerging fry (altered hydrology) and available habitat for juvenile rearing within proximity of existing adult spawning habitat. The inundation of the valley will increase organic matter exchange and improve riparian productivity of newly planted or protected cottonwoods, willows, and dogwood plants in critical shade areas (riparian communities).

Removing floodplain constraints, while increasing connectivity towards historical side channels and wetlands will put these streams on a trajectory to self-adjust over the long term. Increasing cottonwood, willow, and dogwood cover will have increased seed production benefits over time to self-maintain the rest of the reach, while increasing beaver habitats will also improve the ecohydrologic functions of this particular landscape. Juvenile rearing for steelhead will be increased to 1,300 per unit and will have a 5-year average survivability of 90 percent.

The desired condition of the Camp Valley project area is to improve:

- Riparian vegetation (increase algae mats, brook-grasses, spike-rushes, sedges, bulrushes, young and middle age class groups of cottonwood, species composition of wetland obligate plant communities, and willow cover).
- Side channels and wetlands (increase the length of side channels and the area connected to peak flows that will store water later into the receding limb of the hydrograph).
- Floodplain condition (increase the area of the floodplain that can be inundated frequently).
- Stream temperature (reduce the width-to-depth ratio of the stream and increase effective shade).
- Bed and channel form (decrease the average riffle length).
- Altered flow timing (increase the residence time of water on Camp Creek's floodplain through connecting side channels and slowing water down in convex wetlands and through beaver dams).
- Juvenile rearing habitat in proximity of threatened Middle Columbia River steelhead spawning habitat overall.
- Juvenile rearing capacity for chinook salmon which currently enter Camp Creek and its main tributary (Lick Creek) from the Middle Fork John Day.

The actions proposed by this project are the remaining essential actions for the Camp Creek Watershed Restoration Action Plan with the exception of the lowermost 1 mile of Camp Creek.

Land Use Plan Conformance

The project falls under Management Area 3B "Anadromous Riparian Areas" of the Malheur National Forest Land and Resource Management Plan (Malheur Forest Plan). The goal of Management Area 3B is to "Manage riparian areas to protect and enhance their value for wildlife, anadromous fish habitat and water quality… Design and conduct management in all riparian areas to maintain or improve water quality and beneficial uses" (USDA Forest Service 1990). The project is consistent with Management Area 3B standards to provide the necessary habitat to maintain or increase populations of management indicator species; manage the composition and productivity of key riparian vegetation to protect or enhance riparian-dependent resources; plan, design, and implement riparian habitat improvement activities to upgrade riparian areas that are not in a condition to meet management objectives or the desired future condition; improve the rate of recovery in riparian areas that are not in a condition to meet management objectives by eliminating or reducing the impacts of management activities that may slow riparian recovery; maintain or enhance water quality and/or fish habitat through instream or riparian improvements; and provide for input of large woody debris into all classes of streams (USDA Forest Service 1990, Management Area 3B standards 5, 8, 9, 10, 11, and 12, page IV-63).

Camp Creek Reaches 3, 4, 5, Lick Creek Reach 1, and Cottonwood Creek Reach 1 are within a category 1 riparian habitat conservation area (fish-bearing stream) as designated by PACFISH/INFISH, and contain designated critical habitat for Middle Columbia River steelhead by the National Marine Fisheries Service.

All proposed activity categories comply with the Forest Plans as amended by the Record of Decision and Standards and Guidelines of the INFISH (USDA and USDI 1995a), PACFISH (USDA and USDI 1995b).

Proposed Action and Implementation Plan

The following project activities will occur in Camp Creek Reaches 3, 4, and 5, Lick Creek Reach 1, and Cottonwood Creek Reach 1:

- Remove railroad grade berms that effectively split the valley in half.
- Redistribute the soil in the railroad grade (which is soil scraped from Camp Creek) as a growth medium for riparian grasses and shrubs.
- Activate secondary side channels.
- Place wood at strategic locations within railroad grade removal areas that effectively activate valley and secondary side channels during 2-year event.
- Release overland/floodplain energy within floodplain depressions to facilitate floodplain deposition and provide a growth medium for riparian plants.
- Fence existing hardwoods and shrubs (panels, fence, electric, and buck and pole).
- Plant cottonwood and willow.
- Rebuild existing wildlife exclosure.
- Rest or temporary exclusion from livestock grazing within Camp Creek Riparian pastures where work takes place using multiple strategies (electric fencing, small wildlife hog panel exclosures).
- Restore cool water tributary confluences of Trail Creek, Cougar Creek, and Cottonwood Creek.

General Actions and Timeline:

March-June 15th

- Flag invasive weed treatments/area identification-avoidance areas.
- Flag heritage avoidance areas.
- Flag trees within tipping units and follow guidelines from silviculture.
- Meet with permittees and discuss project prior to turn out.
- Arrange multiple field work trips with Oregon Natural Desert Association (revegetation).
- Place informational signs along each primary reach of the project area (work with public affairs).
- Work with public affairs to submit an article to the Blue Mountain Eagle describing the project and notifying the public of implementation in 2019.

Detailed Action Description by Reach:

Camp Creek Reach 3:

Phase 1 (June 15-July 15)

Work within Camp Creek reach 3 would entail tipping of trees with an excavator from the identified tipping unit starting June 15th. These trees would be utilized entirely within reach 3 to meet wood requirements or, if adequate in number, would be moved to other locations within the project area. Aspen are located within the tipping unit adjacent to National Forest System Road 3600000. As part of this work, all conifers would be removed around aspen to desired prescription by silviculture and wildlife. A grapple skidder would be utilized to move trees to desired locations adjacent to National Forest System Road 3600000 and a flatbed log truck would be required to move these trees in proximity of wood structures.

One D10 bulldozer would be utilized to grade floodplain, road berm, and railroad grade (legacy berms) to desired elevations within specified locations. This work would occur prior to the instream work window. Activation of floodplain and side channels would not occur during this period. Legacy berm removal metrics for reach 3 are summarized in Table 2**Error! Reference source not found.**.

Phase II (July 15-August 15)

Instream work would involve two to three excavators building primary and secondary wood structures, floodplain wood placement, and post/anchor structures, completing finishing touches on off-channel work. Pools would also be excavated associated with these structures. Within over-widened sections of Camp Creek in the project area, fill from legacy berms would be utilized to reduce the width of the existing channel by half using streambank restoration techniques. Railroad grade and other legacy berms within the floodplain are composed almost entirely of floodplain soil which had been scraped up from the valley floor to construct the grade and berms. Because of this, many of the floodplains adjacent to the railroad grade lack a suitable soil for hardwoods.

Legacy berms associated with log weirs were not modified within the project area. However, log weirs that were removed and wood placed in proximity to those weirs as part of the 2011 work would be modified to effectively interact with the stream channel, facilitate deposition, and activate side channels that were disconnected due to the railroad grade and log weir legacy berms.

Phase III (October 15-November 12)

Riparian hardwood planting would entail planting of approximately 5,000 willows, 5,000 dogwood and 5,000 cottonwoods initially. Planting would occur in clusters. The focus in the fall would be on planting cut stakes, however rooted stock may be available and utilized. Planting focus areas include newly activated floodplains and side channels as well as any streambank restoration areas. Planting strategy is two-fold with one planting focusing on maximizing stream shade and the other planting located on outside meanders to facilitate stream channel meandering on both mainstem Camp Creek and within newly activated side channels following legacy berm removal.

Planting would occur in the fall once hardwoods enter dormancy. Between October 15 and October 31st on normal years, rainfall returns and a two week window ideal for planting occurs. Seeding of native seed on bare soil areas would also occur during this time. A mini or small-tracked excavator would be utilized for planting with the capability to auger or dig holes and trenches for planting.

Fencing: A combination of electric fencing, hog panel configurations with a narrow internal width, and potential rest of gather pasture would be utilized for hardwood protection. Electric fencing and hog panel costs were submitted as part of the grant application for this project through the Oregon Watershed Enhancement Board.

Electric fencing, hog panel maintenance, and set up would be the responsibility of aquatic staff and not the permittee. Because of the projects proximity to National Forest System Road 3600000, it is anticipated that maintenance, set up, and monitoring should be generally straightforward. It is also anticipated that with strong coordination with pasture riders, any downed electric fence could be reported to Forest Service staff and addressed in an appropriate manner. Designated monitoring areas would not be fenced, however it should be noted that because livestock may concentrate in these areas, this use should be addressed accordingly as part of the end of year monitoring and standard checks.

Portions of the lowermost livestock fence are located on top of the railroad grade down the middle of the valley. As part of the work, these fences would be relocated to the toeslope of the valley.

Metrics Associated with Actions:

- Total reach length: 1.5 miles
- Reconnected floodplain: 12.67 acres
- Miles of side channel activated: 2.1 miles
- Primary wood structures (20 trees per structure): 14 structures
- Secondary wood structures (10 trees per structure): 10 structures

Table 2. Reach 3 grade and berm removal in acres, miles, and feet.

Reach 3 Grade/Berm Removal	Acres	Miles	Feet
	0.235	0.101	533.28
	0.274	0.095	501.6
	0.913	0.258	1362.24
	0.592	0.197	1040.16
Total	**2.014**	**0.651**	**3437.28**

- Electric fencing: 1.04 miles, 5,284 feet
- Panels: 75, 10x5 narrow wildlife exclosure design
- Tree tipping unit area: 6.505 acres

Camp Creek Reach 4:

Phase 1 (June 15-July 15)

Work within Camp Creek reach 4 would entail tipping of trees with an excavator from the identified tipping units starting June 15th. These trees would be utilized entirely within reach 4 of Camp Creek to meet wood requirements. A grapple skidder would be utilized to move trees to desired locations in addition to a flatbed truck which may be required to move these trees in proximity of wood structures. Potential staging areas are identified in the map.

One D10 bulldozer would be utilized to grade floodplain, road berm, and railroad grade (legacy berms) to desired elevations within specified locations. This work would occur prior to the instream work window. Activation of floodplain and side channels would not occur during this period. This work would also occur at the tributary confluence of Pepper Creek, Trail Creek and Cottonwood Creek which have had their alluvial fans altered by legacy berms. Legacy berm removal metrics for reach 4 are summarized in Table 3**Error! Reference source not found.**.

Phase II (July 15-August 15)

Instream work would involve two to three excavators building primary and secondary wood structures, floodplain wood placement, and post/anchor structures, completing finishing touches on off-channel work. Pools would also be excavated associated with these structures. Within over-widened sections of Camp Creek in the project area, fill from legacy berms would be utilized to reduce the width of the existing channel by half using streambank restoration techniques. Railroad grade and other legacy berms within the floodplain are composed almost entirely of floodplain soil which had been scraped up from the valley floor to construct the grade and berms. Because of this, many of the floodplains adjacent to the railroad grade lack a suitable soil for hardwoods.

Legacy berms associated with log weirs were not modified within the project area. However, log weirs that were removed and wood placed in proximity to those weirs as part of the 2011 work would be modified to effectively interact with the stream channel, facilitate deposition, and activate side channels that were disconnected due to the railroad grade and log weir legacy berms.

Phase III (October 15-November 12)

Riparian hardwood planting would entail planting of approximately 5,000 willows, 5,000 dogwood and 5,000 cottonwoods initially. Planting would occur in clusters. The focus in the fall would be on planting cut stakes, however rooted stock may be available and utilized. Planting focus areas include newly activated floodplains and side channels, as well as any streambank restoration areas. Planting strategy is two-fold with one planting focusing on maximizing stream shade and the other planting located on outside meanders to facilitate stream channel meandering on both mainstem Camp Creek and within newly activated side channels following legacy berm removal.

Planting would occur in the fall once hardwoods enter dormancy. Between October 15 and October 31st on normal years, rainfall returns and a two week window ideal for planting occurs. Seeding of native seed

on bare soil areas would also occur during this time. A mini or small-tracked excavator would be utilized for planting with the capability to auger or dig holes and trenches for planting

Fencing: A combination of electric fencing, hog panel configurations with a narrow internal width, and potential rest of gather pasture would be utilized for hardwood protection. Electric fencing and hog panel costs were submitted as part of the grant application for this project through the Oregon Watershed Enhancement Board.

Electric fencing, hog panel maintenance, and set up would be the responsibility of aquatic staff and not the permittee. Because of the projects proximity to National Forest System Road 3600000, it is anticipated that maintenance, set up, and monitoring should be generally straightforward. It is also anticipated that with strong coordination with pasture riders, any downed electric fence could be reported to Forest Service staff and addressed in an appropriate manner. Designated monitoring areas would not be fenced, however it should be noted that because livestock may concentrate in these areas, this use should be addressed accordingly as part of the end of year monitoring and standard checks.

Four existing livestock crossings within reach 4 and Cougar are identified for improvement and hardening.

The existing wildlife exclosure within this reach is in disrepair with portions falling down. As part of the work for this reach, the wildlife exclosure would be rebuilt and expanded to the toeslope of the valley. An Oregon Watershed Enhancement Board grant covering construction and materials has been submitted as part of the Camp Creek Valley Restoration Project. A dispersed campsite with a user-created road adjacent to the exclosure would be modified but still available for use following project work (relocation of recreation impacts).

Metrics Associated with Actions:

- Total reach length: 1.3 miles
- Reconnected floodplain: 26.842 acres
- Miles of side channel activated: 2.5 miles
- Primary wood structures (20 trees per structure): 24 structures
- Secondary structures (10 trees per structure): 21 structures

Table 3. Reach 4 grade and berm removal in acres, miles, and feet.

Reach 4 Grade/Berm Removal	Acres	Miles	Feet
	1.382	0.402	2122.56
	0.448	0.134	707.52
	0.987	0.307	1620.96
	1.764	0.368	1943.04
Total	**4.581**	**1.211**	**6394.08**

- Electric fencing: 1.47 miles, 42 acres
- Panels: 75, 10x5 narrow wildlife exclosure panel design
- Tree tipping unit area: 7.659 acres

Wildlife Exclosure Replacement (relocation of recreation impacts)

- Linear feet: 4,540.8 feet
- Acres: 14.5 acres

Camp Creek Reach 5:

Phase 1 (June 15-July 15)

Work within Camp Creek reach 5 would entail tipping of trees from the identified tipping unit starting June 15th. The majority of these trees would be utilized within reach 5 to meet wood requirements. Some trees may be used in Trail Creek, tipping placed trees from either the units nearby or from outside the primary shade zone to create log jams (within the first 0.4 mile of the stream to incorporate Steelhead Critical Habitat). The majority of the work on Trail Creek will be at its confluence with Camp Creek. Trees may also be tipped in Cougar Creek (0.5 miles) to further restore the stream's confluence with Camp Creek and to move both streams towards meeting wood requirements, though it is less likely because work has been done in Cougar Creek Reach 1 in the past. Old log jams on Cougar Creek will not be moved or adjusted. Trees will not be harvested within the primary shade zone. Trees along the tipping units in Cougar and Trail Creek will not be harvested if they are close enough to the stream to be future instream large wood (typically meaning a 100-foot buffer will be left between the harvest unit and the stream). Trees harvested in the riparian habitat conservation area of Cougar Creek will utilize a legacy skid trail. A grapple skidder would be utilized to move trees to desired locations in addition to a flatbed truck which may be required to move these trees in proximity of wood structures. Potential staging areas are identified in the map.

One D10 bulldozer would be utilized to grade floodplain, road berm, and railroad grade (legacy berms) to desired elevations within specified locations. This work would occur prior to the instream work window. Activation of floodplain and side channels would not occur during this period. This work would also occur at the tributary confluences of Trail and Cougar Creeks which have had their alluvial fans altered by legacy berms. Legacy berm removal metrics for reach 5 are summarized in Table 4.

There are fences along most of the riparian habitat conservation area units. These fences will need to be taken down for project activities and then put back up after. During fence repair, the unit 3 fence (near Cougar Creek confluence) may be moved higher up and off the floodplain.

Phase II (July 15-August 15)

Instream work would involve one to two excavators building primary and secondary wood structures, floodplain wood placement, and post/anchor structures, completing finishing touches on off-channel work. Pools would also be excavated associated with these structures. Within over-widened sections of Camp Creek in the project area, fill from legacy berms would be utilized to reduce the width of the existing channel by half using streambank restoration techniques. Railroad grade and other legacy berms within the floodplain are composed almost entirely of floodplain soil which had been scraped up from the valley floor to construct the grade and berms. Because of this, many of the floodplains adjacent to the railroad grade lack a suitable soil for hardwoods.

Legacy berms associated with log weirs were not modified within the project area. However, log weirs that were removed and wood placed in proximity to those weirs as part of the 2011 work would be modified to effectively interact with the stream channel, facilitate deposition, and activate side channels that were disconnected due to the railroad grade and log weir legacy berms.

Phase III (October 15-November 12)

Riparian hardwood planting would entail planting of approximately 5,000 willows, 5,000 dogwood and 5,000 cottonwoods initially. Planting would occur in clusters. The focus in the fall would be on planting cut stakes, however rooted stock may be available and utilized. Planting focus areas include newly activated floodplains and side channels, as well as any streambank restoration areas. Planting strategy is two-fold with one planting focusing on maximizing stream shade and the other planting located on outside meanders to facilitate stream channel meandering on both mainstem Camp Creek and within newly activated side channels following legacy berm removal.

Planting would occur in the fall once hardwoods enter dormancy. Between October 15 and October 31st on normal years, rainfall returns and a two week window ideal for planting occurs. Seeding of native seed on bare soil areas would also occur during this time. A mini or small-tracked excavator would be utilized for planting with the capability to auger or dig holes and trenches for planting.

Fencing: A combination of electric fencing, hog panel configurations with a narrow internal width, and potential rest of gather pasture would be utilized for hardwood protection. Electric fencing and hog panel costs were submitted as part of the grant application for this project through the Oregon Watershed Enhancement Board.

Electric fencing, hog panel maintenance, and set up would be the responsibility of aquatic staff and not the permittee. Because of the project's proximity to National Forest System Road 3600000, it is anticipated that maintenance, set up, and monitoring should be generally straightforward. It is also anticipated that with strong coordination with pasture riders, any downed electric fence could be reported to Forest Service staff and addressed in an appropriate manner. Designated monitoring areas would not be fenced, however it should be noted that because livestock may concentrate in these areas, this use should be addressed accordingly as part of the end of year monitoring and standard checks.

Metrics Associated with Actions:

- Total reach length: 1 mile in Camp Creek, possible 0.4 miles in Trail Creek, 0.5 miles in Cougar Creek
- Reconnected floodplain: 19.905 acres
- Miles of side channel activated: 1.3 miles
- Primary wood structures (20 trees per structure): 14 structures
- Secondary structures (10 trees per structure): 12 structures

Table 4. Reach 5 grade and berm removal in acres, miles, and feet.

Reach 5 Grade/Berm Removal	Acres	Miles	Feet
	0.274	0.076	401.28
	0.304	0.12	633.6
	0.465	0.119	628.32
	0.506	0.044	232.32
	0.988	0.334	1763.52
	0.372	0.031	163.68
Total	**2.909**	**0.724**	**3822.72**

- Electric fencing: 0.85 miles, 4488 linear feet, 23 acres
- Panels: 75, 10x5 narrow wildlife exclosure panels
- Tree tipping unit area: 5.9 acres in the Camp riparian habitat conservation area, possibly 17 acres in the Trail riparian habitat conservation area, and possibly 14 acres in the Cougar riparian habitat conservation area

Lick Creek Reach 1:

Log weir removal and wood placement occurred within the lower half mile of Lick Creek during 2011. Work was centralized where only log weirs were present. Existing legacy berms that straighten Lick Creek and also prevent floodplain inundation (Figure 18) were not addressed during this time. This section of Lick Creek has one of the highest densities of spawning steelhead redds within the Camp Creek watershed over the last 10 years. Work would entail removal of legacy berms, activation of side channels, placement of in-channel, floodplain, and side channel wood, modification of existing wood and log weirs from 2011 (Figure 19), and planting of riparian hardwoods (specifically cottonwood, dogwood, and willow). Legacy berm removal within this area would not be to the extent of that of Camp Creek reaches 3, 4, and 5 as no railroad grade berm is present within this area.

Metrics Associated with Actions:

- Total reach length: 0.40 miles
- Miles of side channel activated: 0.21 miles
- Primary wood structures (20 trees per structure): 12 structures
- Secondary wood structures (10 trees per structure): 4 structures
- Floodplain reconnected : 5.5 acres

Cottonwood Creek Reach 1:

Work entails legacy berm removal and grading of the confluence with Camp Creek along with wood placement using an excavator and D10 bulldozer. Individual key wood pieces would be tipped using an excavator for 0.16 miles upstream from the confluence with Camp Creek (Figure 5) within the riparian habitat conservation area and trees would be obtained onsite. Legacy berm modification and wood placement using an excavator would occur on the remaining 0.06 miles (Figure 3 and Figure 4). A culvert replacement would be included under a separate aquatic checklist.

Metrics Associated with Actions:

- Total project miles: 4.52 miles
- Primary wood structures (20 trees per structure): 9 structures
- Secondary wood structures (10 trees per structure): 2 structures
- Individual key wood piece area length: 0.16 miles (~50 individual wood pieces)
- Legacy berm modification length: 0.06 miles
- Confluence roughness: 25 trees, 6-12 inch diameter at breast height (streambank stabilization)
- Project total estimated large trees (>18 inch dbh): 1,460
- Project total estimated small trees (6-18 inch dbh): 515

Project-Specific Project Design Criteria

The following project-specific project design criteria apply to this proposal:

- Implementation of this project is pending State Historic Preservation Office consultation. Contact heritage.
- Invasive plants occur in tipping areas and reach 4. Work closely with botany. Early communication is best.
- There will be short term negative effects, but long term benefit to aquatics. This project meets ARBO II requirements, so ARBO II reporting must be completed.
- In heavily impacted areas, restrict heavy equipment to areas that have already been impacted to avoid new impacts to areas that have not previously been impacted.
- Prior to implementation, coordinate with permit holder to ensure authorized improvements will be protected from project activities. Contact information is attached.
- Contact 811 for line location prior to ground disturbing activities.
- Adhere to the Malheur Road Rules for hauling heavy equipment.
- Consult with district fire management officer for Industrial Fire Precaution Level restrictions for use of heavy equipment.
- Follow silviculture treatment for tipping.

Figures

Figure 1 Cottonwood Creek confluence with Camp Creek

Figure 2 Cottonwood Creek looking downstream from culvert replacement site towards confluence with Camp Creek

Figure 3 Cottonwood Creek near legacy berm removal area

Figure 4 Cottonwood Creek at legacy berm removal location

Figure 5 Cottonwood Creek within individual key wood placement and boulder modification area

Figure 6 Camp Creek reach 5 railroad grade with separated floodplain looking downstream

Figure 7 Camp Creek reach 5 legacy berm

Figure 8 General channel conditions and hardwood community within Camp Creek reach 5

Figure 9 General channel conditions, Camp Creek reach 5 near confluence of Trail Creek

Figure 10 Railroad grade along Camp Creek reach 5 looking upstream near confluence with Cougar Creek

Figure 11 General characteristics of abandoned/separated floodplain due to railroad grade levee, Camp Creek reach 5

Figure 12 Railroad grade levee with wildlife exclosure fence, Camp Creek reach 4 (west side of stream)

Figure 13 Floodplain east side of wildlife exclosure Camp Creek reach 4

Figure 14 Abandoned floodplain on west side of railroad grade and outside wildlife exclosure, Camp creek reach 4 (wildlife exclosure is proposed to be expanded to valley toe slope)

Figure 15 Active beaver dam complex within wildlife exclosure, Camp Creek reach 4

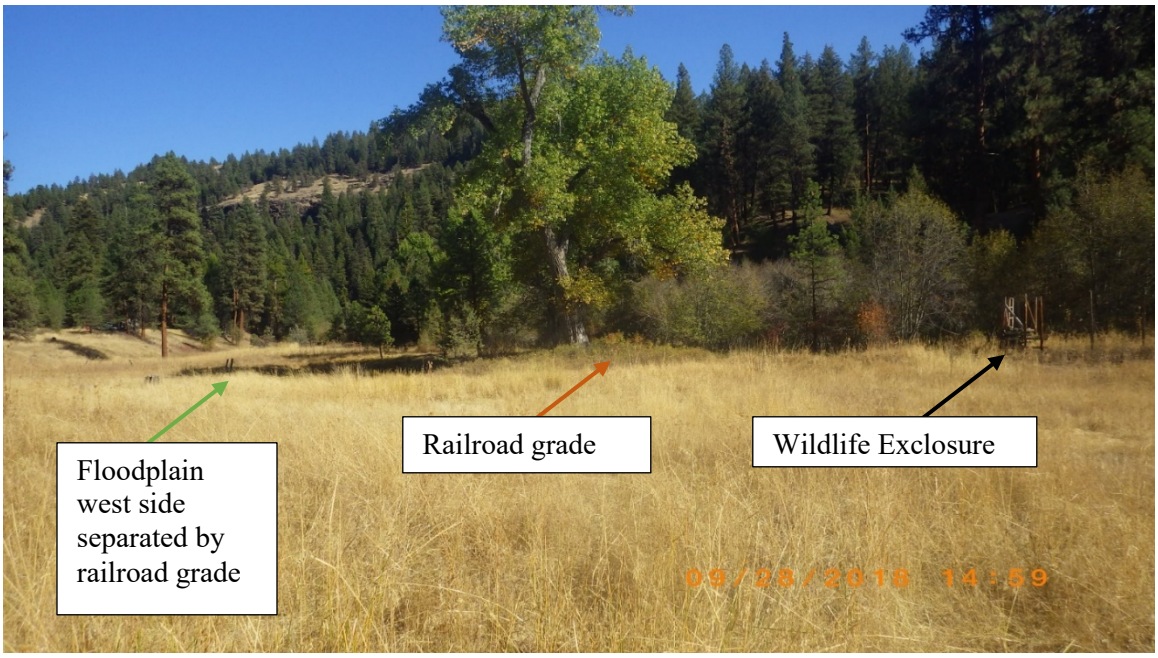

Figure 16 Camp Creek reach 4 west side of valley floodplain separated by railroad grade (Camp Creek is located where all the vegetation is)

Figure 17 Railroad grade levee going up middle of valley, Camp Creek reach 4

Figure 18 Lower Lick Creek floodplain separated by log weir berms

Figure 19 General characteristics of lower Lick Creek where log weirs and wood were placed in 2011, but legacy berms were in place locking the channel in a straight line

Appendix to the Aquatic Restoration EA

Implementation Description

Project Title: _Camp Valley Restoration_

Project Number: __01032019_____

Category: Category: 2 – Large wood and boulder placement, tree removal for large wood projects; 3 – Legacy structure removal; 4 – Channel reconstruction / relocation; 5 – Off-and side-channel habitat restoration; 6 – Streambank restoration; 7 – Set-back or removal of existing berms, dikes, and levees; 8 Reduction/Relocation of Recreation Impacts 9 – Livestock fencing, stream crossings, and off channel livestock watering; 14 – Riparian vegetative planting; 16 – Beaver habitat restoration.

The following information will guide actions for this project that is taking place within the bounds of the Decision Notice for the 2014 Malheur National Forest Aquatic Restoration Environmental Analysis to maintain that all conservation measures, guidelines, and project design criteria are met under this guiding document.

Much of the information below is reproduced from the Decision Notice for Aquatic Restoration Project Appendix A (pages 7 through 44), and may cite project design criteria numbers, literature, or other documents not referenced further in this proposal document. Please refer to the Decision Notice for more information.

Program Administration

1. Integration of project design criteria and conservation measures and terms and conditions into project design and contract language
    a. This document is to outline the conservation measures and project design criteria that will be used during project implementation to remain compliant with the aquatic restoration biological assessment as well as ARBO II.
2. Project notification: The following information will be provided to the National Marine Fisheries Service (NMFS) Level 1 aquatics members 30 days prior to implementation as a Project Notification Form 7.

    a. Action identifier – 01032019
    b. Project name – Camp Valley Restoration
    c. Location – : T10S, R32E, sec. 25, 35, and 36; T11S, R32E, sec. 2, 3, 10, and 16
    a. USGS Quad: Cougar Rock, Susanville

Table 5. Project location information

Project location	**Camp Valley Restoration**	
Stream name	Camp Creek	
6th field HUC	Camp Creek	
Location	Latitude (decimal degrees)	Longitude (decimal degrees)
Camp Creek Reach 5 (Top)	44.625	-118.859
Camp Creek Reach 5 (Bottom)	44.635	-118.845
Camp Creek Reach 4 (Top)	44.648	-118.837
Camp Creek Reach 4 (Bottom)	44.664	-118.81
Camp Creek Reach 3 (Top)	44.666	-118.808
Camp Creek Reach 3 (Bottom)	44.673	-118.801
Cottonwood Creek Reach 1 (Top)	44.654	-118.833
Cottonwood Creek Reach 1 (Bottom)	44.654	-118.828
Lick Creek Reach 1 (Top)	44.658	-118.806

Project location	Camp Valley Restoration	
Lick Creek Reach 1 (Bottom)	44.662	-118.809

b. Agency contact – Dan Armichardy, darmichardy@fs.fed.us
c. Timing – 6/15/19-10/31/19, instream work July 15-August 15
d. Activity category – 2 – Large wood and boulder placement, tree removal for large wood projects; 3 – Legacy structure removal; 4 – Channel reconstruction/relocation; 5 – Off- and side-channel habitat restoration; 6 – Streambank restoration; 7 – Set-back or removal of existing berms, dikes, and levees; 8- Relocation/Reduction of Recreation Impacts; 9 – Livestock fencing, stream crossings and off channel livestock watering; 14 – Riparian vegetative planting; 16 – Beaver habitat restoration.
e. Project description – Project description is available in the Proposed Action and Implementation Plan section above.
f. Species affected –
    i. Listed species: Middle Columbia River steelhead
    ii. Critical Habitat: Middle Columbia River steelhead
    iii. MIS Species: Steelhead and redband trout
g. Date of submittal –To be completed in Spring of 2019, at least 30 day prior to implementation
h. Site assessments – Assessment for contaminants is not required at these locations.
i. Review – NMFS fish passage review and Restoration Review Team review are not required.
j. Verification – _____
k. SOD project notification – _____

3. Minor Variance: Minor variances may be requested during October 15-Nov 15 to allow planting of riparian hardwoods on newly activated floodplains and off channels with equipment.
4. NMFS Fish Passage Review and Approval: This work does not require review by the NFMS level 1 team member.
5. Restoration Review Team: This work does not require review by the restoration review team.
6. Project Completion Report: To be completed after implementation
7. Annual Program Report: This project will be completed within 1 year, completion and annual reporting will occur in the winter of FY20 before February 15th.

General Aquatic Conservation Measures

8. **Technical skill and planning requirements:**
    a. An appropriately qualified fisheries biologist or hydrologist will be involved in the design of this project.
    b. The scope of this project is limited in both space and context. Field evaluations and site-specific surveys will require little work. Appropriate time will be allotted for these actions, prior to implementation. Planning and design will involve appropriate expertise.
    c. The assigned fisheries biologist or hydrologist will make sure that any applicable conservation measures and project design criteria are met through the contracting process.

9. **Climate change:** due to the small scale of this work, future climate changes impacts will not have dramatic effects on this work
10. **In-water work period:** In-stream activities will occur between July 15th and August 15th.
11. **Fish passage:** Not applicable.
12. **Site assessment for contaminants:** In developed or previously developed sites, such as areas with past dredge mines, or sites with known or suspected contamination, a site assessment for contaminants will be conducted on projects that involve excavation of greater than 20 cubic yards

of material. The action agencies will complete a site assessment to identify the type, quantity, and extent of any potential contamination. 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. The assessment may include the following:

a. Review of readily available records, such as former site use, building plans, records of any prior contamination events.
b. Site visit to observe the areas used for various industrial processes and the condition of the property.
c. Interviews with knowledgeable people, such as site owners, operators, occupants, neighbors, local government officials, etc.
d. Report that includes an assessment of the likelihood that contaminants are present at site.

13. **Pollution and erosion control measures:** Implement the following pollution and erosion control measures:
    a. **Project contact:** Identify a project contact (name, phone number, an address) that will be responsible for implementing pollution and erosion control measures.
    b. List and describe any hazardous material that would be used at the project site, including procedures for inventory, storage, handling, and monitoring; notification procedures; specific clean-up and disposal instructions for different products available on the site; proposed methods for disposal of spilled material; and employee training for spill containment.
    c. Temporarily store any waste liquids generated at the staging areas under cover on an impervious surface, such as tarpaulins, until such time they can be properly transported to and treated at an approved facility for treatment of hazardous materials.
    d. Procedures based on best management practices to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum product, or other hazardous materials generated, used, or stored on-site.
    e. Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities. Ensure that materials for emergency erosion and hazardous materials control are onsite (for example, silt fence, straw bales, oil-absorbing floating boom whenever surface water is present).
    f. Best management practices to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action area.
    g. No uncured concrete or form materials will be allowed to enter the active stream channel.
    h. Steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

14. **Site preparation:**
    a. **Flagging sensitive areas:** Prior to construction, clearly mark critical riparian vegetation areas, wetlands, and other sensitive sites to minimize ground disturbance.
    b. **Staging area:** Establish staging areas for storage of vehicles, equipment, and fuels to minimize erosion into or contamination of streams and floodplains.
        i. No topographical restrictions: Place staging area 150 feet or more from any natural water body or wetland in areas where topography does not restrict such a distance.
        ii. Topographical restrictions: Place staging area away from any natural water body or wetland to the greatest extent possible in areas with high topographical restriction, such as constricted valley types.
    c. **Temporary erosion controls:** Place sediment barriers prior to construction around sites where significant levels of erosion may enter the stream directly or through road ditches.

Temporary erosion controls will be in place before any significant alteration of the action site and will be removed once the site has been stabilized following construction activities.

d. **Stockpile materials:** Minimize clearing and grubbing activities when preparing staging, project, or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration. Materials used for implementation of aquatic restoration categories (for example, large wood, boulders, and fencing material) may be staged within the 100-year floodplain.
e. **Hazard trees:** Where appropriate, include hazard tree removal (amount and type) in project design. Fell hazard trees when they pose a safety risk. If possible, fell hazard trees within riparian areas towards a stream. Keep felled trees on site when needed to meet coarse large wood objectives.

15. **Heavy equipment use:**
    a. **Choice of equipment:** Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (for example, minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, or temporary mats or plates within wet areas or sensitive soils).
    b. Fueling and cleaning and inspection for petroleum products and invasive weeds:
        i. All equipment used for instream work will be cleaned for petroleum accumulations, dirt, plant material (to prevent the spread of noxious weeds), and leaks repaired prior to entering the project area. Such equipment includes large machinery, stationary power equipment (for example, generators and canes), and gas-powered equipment with tanks larger than 5 gallons.
        ii. Store and fuel equipment in staging areas after daily use.
        iii. Inspect daily for fluid leaks before leaving the vehicle staging area for operation.
        iv. Thoroughly clean equipment before operation below ordinary high water or within 50 feet of any natural water body or areas that drain directly to streams or wetlands and as often as necessary during operation to remain grease free.
    c. **Temporary access roads:** Existing roadways will be used whenever possible. Minimize the number of temporary access roads and travel paths to lessen soil disturbance and compaction and impacts to vegetation. Temporary access roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. When necessary, temporary access roads will be obliterated or revegetated. Temporary roads in wet or flooded areas will be restored by the end of the applicable in-water work period. Construction of new permanent roads is not permitted.
    d. **Stream crossings:** Minimize number and length of stream crossings. Such crossings will be at right angles and avoid potential spawning areas to the greatest extent possible. Stream crossings shall not increase the risk of channel re-routing at low and high water conditions. After project completion, temporary stream crossings will be abandoned and the stream channel and banks restored.
    e. **Work from top of bank:** To the extent feasible, heavy equipment will work from the top of the bank, unless work instream would result in less damage to the aquatic ecosystem.
    f. **Timely completion:** Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork (including drilling, excavation, dredging, filling and compacting) as quickly as possible. During excavation, stockpile native streambed materials above the bankfull elevation, where it cannot reenter the stream, for later use.

16. **Site Restoration:**
    a. **Initiate rehabilitation:** Upon project completion, rehabilitate all disturbed areas in a manner that results in similar or better than pre-work conditions through removal of

project related waste, spreading of stockpiled materials (soil, large wood, trees, etc.) seeding, or planting with local native seed mixes or plants.

b. **Short-term stabilization:** Measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques. Short-term stabilization measures will be maintained until permanent erosion control measures are effective. Stabilization measures will be instigated within three days of construction completion.

c. **Revegetation:** Replant each area requiring revegetation prior to or at the beginning of the first growing season following construction. Achieve reestablishment of vegetation in disturbed areas to at least 70 percent of pre-project levels within three years. Use an appropriate mix of species that will achieve establishment and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site. Barriers will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

d. **Planting manuals:** All riparian plantings shall follow Forest Service direction described in the Regional letter to Units, Use of Native and Nonnative Plants on National Forests and Grasslands May 2006 (Final Draft), and/or Bureau of Land Management (BLM) Instruction Memorandum No. OR-2001-014, Policy on the Use of Native Species Plant Material.

e. **Decompact soils:** Decompact soil by scarifying the soil surface of roads and paths, stream crossings, staging, and stockpile areas so that seeds and plantings can root.

17. **Monitoring:** Monitoring will be conducted by action agency staff, as appropriate for that project, during and after a project to track effects and compliance with this opinion.

    a. **Implementation:**
        i. Visually monitor during project implementation to ensure effects are not greater (amount, extent) than anticipated and to contact Level 1 representatives if problems arise.
        ii. Fix any problems that arise during project implementation.
        iii. Regular biologist/hydrologist coordination if biologist/hydrologist is not always on site to ensure contractor is following all stipulations.

    b. **401 Certification**: To minimize short-term degradation to water quality during project implementation, follow current 401 Certification provisions of the Federal Clean Water Act for maintenance or water quality standards described by the following: Oregon Department of Environmental Quality (Oregon BLM, Forest Service, and BIA); Washington Department of Ecology (Washington BLM); and the Memorandum of Understanding between the Washington Department of Fish and Wildlife (WDFW) and Forest Service regarding Hydraulic Projects Conducted by Forest Service, Pacific Northwest Region (WDFW and USDA-Forest Service 2012); California, Idaho, or Nevada 401 Certification protocols (BLM and Forest Service).

    c. **Post project:** A post-project review shall be conducted after winter and spring high flows.
        i. For each project, conduct a walk through/visual observation to determine if there are post-project affects that were not considered during consultation. For fish passage and revegetation projects, monitor in the following manner:
        ii. Fish Passage Projects: Note any problems with channel scour or bedload deposition, substrate, discontinuous flow, vegetation establishment, or invasive plant infestation.
        iii. Revegetation: For all plant treatment projects, including site restoration, monitor for and remove invasive plants until native plants become established.

iv. In cases where remedial action is required, such actions are permitted without additional consultation if they use relevant PDC and aquatic conservation measures and the effects of the action categories are not exceeded.

18. **Work Area Isolation, Surface Water Withdrawals, and Fish Capture and Release**: Isolate the construction area and remove fish from a project site for projects that include concentrated and major excavation at a single location within the stream channel. This condition will typically apply to the following aquatic restoration categories: Fish Passage Restoration; Dam, Tidegate, and Legacy Structure Removal; and Channel Reconstruction/Relocation.

    a. **Isolate capture area:** Install block nets at up and downstream locations outside of the construction zone to exclude fish from entering the project area. Leave nets secured to the stream channel bed and banks until construction activities within the stream channel are complete. If block nets or traps remain in place more than one day, monitor the nets or traps at least on a daily basis to ensure they are secured to the banks and free of organic accumulation and to minimize fish predation in the trap.
    b. **Capture and release:** Fish trapped within the isolated work area will be captured and released as prudent to minimize the risk of injury, then released at a safe release site, preferably upstream of the isolated reach in a pool or other area that provides cover and flow refuge. Collect fish in the best manner to minimize potential stranding and stress by seine or dip nets as the area is slowly dewatered, baited minnow traps placed overnight, or electrofishing (if other options are ineffective). Fish must be handled with extreme care and kept in water the maximum extent possible during transfer procedures. A healthy environment for the stressed fish shall be provided—large buckets (five-gallon minimum to prevent overcrowding) and minimal handling of fish. Place large fish in buckets separate from smaller prey-sized fish. Monitor water temperature in buckets and well-being of captured fish. If buckets are not being immediately transported, use aerators to maintain water quality. As rapidly as possible, but after fish have recovered, release fish. In cases where the stream is intermittent upstream, release fish in downstream areas and away from the influence of the construction. Capture and release will be supervised by a fishery biologist experienced with work area isolation and safe handling of all fish.
    c. **Electrofishing:** Use electrofishing only where other means of fish capture may not be feasible or effective. If electrofishing will be used to capture fish for salvage, NMFS's electrofishing guidelines will be followed (NMFS 2000).
        i. Reasonable effort should be made to avoid handling fish in warm water temperatures, such as conducting fish evacuation first thing in the morning, when the water temperature would likely be coolest. No electrofishing should occur when water temperatures are above 18 ºC or are expected to rise above this temperature prior to concluding the fish capture.
        ii. If fish are observed spawning during the in-water work period, electrofishing shall not be conducted in the vicinity of spawning fish or active redds.
        iii. Only direct current (DC) or pulsed direct current shall be used.
        iv. Conductivity less than 100, use voltage ranges from 900 to 1100. Conductivity from 100 to 300, use voltage ranges from 500 to 800. Conductivity greater than 300, use voltage to 400.
        v. Begin electrofishing with minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized and captured. Turn off current once fish are immobilized.
        vi. Do not allow fish to come into contact with anode. Do not electrofish an area for an extended period of time. Remove fish immediately from water and handle as described above (PDC 20b). Dark bands on the fish indicate injury, suggesting a reduction in voltage and pulse width and longer recovery time.

vii. If mortality is occurring during salvage, immediately discontinue salvage operations (unless this would result in additional fish mortality), reevaluate the current procedures, and adjust or postpone procedures to reduce mortality.

d. **Dewater construction site:** When dewatering is necessary to protect species or critical habitat, divert flow around the construction site with a coffer dam (built with non-erosive materials), taking care to not dewater downstream channels during dewatering. Pass flow and fish downstream with a by-pass culvert or a water-proof lined diversion ditch. Diversion sandbags can be filled with material mined from the floodplain as long as such material is replaced at end of project. Small amounts of instream material can be moved to help seal and secure diversion structures. If Endangered Species Act (ESA) listed-fish may be present and pumps are required to dewater, the intake must have a fish screen(s) and be operated in accordance with NMFS fish screen criteria described below (in part e. iv) of this section. Dissipate flow energy at the bypass outflow to prevent damage to riparian vegetation or stream channel. If diversion allows for downstream fish passage, place diversion outlet in a location to promote safe reentry of fish into the stream channel, preferably into pool habitat with cover. Pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel.

e. Surface water withdrawals:

i. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate. Where ESA-listed fish may be present, diversions may not exceed 10 percent of the available flow and fish screen(s) will be installed, operated, and maintained according to NMFS's fish screen criteria (NMFS 2011e).

ii. For the dewatering of a work site to remove or install culverts, bridge abutments etc., if ESA-listed fish may be present, a fish screen that meets criteria specified by NMFS (2011e) must be used on the intake to avoid juvenile fish entrainment. If ESA-listed salmon, steelhead, eulachon, or green sturgeon may be present, the action agencies will ensure that the fish screen design is reviewed and approved by NMFS for consistency with NMFS (2011e) criteria if the diversion (gravity or pump) is at a rate greater than 3 cubic feet per second (cfs). NMFS approved fish screens have the following specifications: (1) An automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and (2) a round or square screen mesh that is no larger than 2.38 mm (0.094 inches) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069 inches) in the narrow dimension.

f. **Stream re-watering:** Upon project completion, slowly re-water the construction site to prevent loss of surface water downstream as the construction site streambed absorbs water and to prevent a sudden release of suspended sediment. Monitor downstream during re-watering to prevent stranding of aquatic organisms below the construction site.

Applicable Project Design Criteria

Project Design Criteria for Aquatic Restoration Activity Categories

2. Large Wood, Boulder, and Gravel Placement

Large wood, boulder, and gravel placement includes large wood and boulder placement, engineered log jams, porous boulder structures and vanes, gravel placement, and tree removal for large wood projects.

Such activities will occur in areas where channel structure is lacking due to past stream cleaning (large wood removal), riparian timber harvest, and in areas where natural 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. Equipment such as helicopters, excavators, dump trucks, front-end loaders, full-suspension yarders, and similar equipment may be used to implement projects.

a. **Large wood and boulder projects:**

i. Place large wood 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, windthrow, 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 bank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic forces.

v. The partial burial of large wood 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. Large wood includes whole conifer and hardwood trees, logs, and rootwads. Large wood size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees 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 width.

vii. Structures may partially or completely span stream channels or be positioned along stream banks.

viii. Stabilizing or key pieces of large wood must 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 large wood increases stability.

ix. Anchoring large wood – Anchoring alternatives may be used in preferential order:

1. Use of adequate sized wood sufficient for stability
2. Orient and place wood in such a way that movement is limited
3. Ballast (gravel or rock) to increase the mass of the structure to resist movement
4. Use of large boulders as anchor points for the large wood
5. Pin large wood with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B) or for other streams with very low width to depth ratios (less than 12) an additional 60 percent ballast weight may be necessary due to greater flow depths and higher velocities.

b. **Engineered logjams:** are structures designed to redirect flow and change scour and deposition patterns. To the extent practical, they are patterned after stable natural log jams and can be either unanchored or anchored in place using rebar, rock, or piles (driven into a dewatered area or the streambank, but not in water). Engineered log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the log jam. While providing valuable fish and wildlife habitat they also redirect flow and can provide stability to a streambank or downstream gravel bar.

i. **NMFS fish passage review and approve:** For engineered log jams that occupy greater than 25 percent of the bankfull area, the action agencies will ensure that the action is individually reviewed and approved by NMFS for consistency with criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011e).
ii. Engineered log jams will be patterned, to the greatest degree possible, after stable natural log jams.
iii. Grade control engineered log jams 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 large wood that will be relied on to provide streambank stability or redirect flows must be intact, solid (little decay). If possible, acquire large wood with untrimmed rootwads to provide functional refugia habitat for fish.
v. When available, trees 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 large wood and boulders may constitute the dominant means of placement, and key boulders (footings) or large wood can be buried into the stream bank or channel
vii. Angle and offset: The large wood portions of engineered log jam structures should be oriented such that the force of water upon the large wood 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. Wood members that are oriented parallel to flow are more stable than members oriented at 45 or 90 degrees to the flow.
viii. If large wood anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections. If hydraulic conditions warrant use of structural connections, such as rebar pinning or bolted connections, may be used. Rock may be used for ballast but is limited to that needed to anchor the large wood.

c. **Porous boulder structures and vanes:**

i. Full channel-spanning boulder structures are to be installed only in highly uniform, incised, bedrock-dominated channels 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.), 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 channel-forming flow events (approximately a 1.5-year flow event).
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. Plunges shall be kept less than 6 inches in height.
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 large wood.

d. **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.
iii. Gravel to be placed in streams shall be a properly sized gradation for that stream, clean, and non-angular. When possible, use gravel of the same lithology as found in the watershed. Reference the 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 would cause stranding during future flood events. Crushed rock is not permitted.
v. After gravel placement in areas accessible to higher stream flow, allow the stream to naturally sort and distribute the material.
vi. 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.
vii. Imported gravel must be free of invasive species and non-native seeds. If necessary, wash gravel prior to placement.

e. **Tree removal for large wood projects:**
i. Live conifers and other trees can be felled or pulled/pushed over in a Northwest Forest Plan (USDA and USDI 1994a) Riparian Reserve or PACFISH/INFISH (USDA-Forest Service 1995; USDA and USDI 1994b) riparian habitat conservation areas (RHCA), and upland areas (for example, late successional reserves or adaptive management areas for northern spotted owl and marbled murrelet critical habitat) for in-channel large wood placement only when conifers and trees are fully stocked. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows.
ii. Danger trees and trees killed through fire, insects, disease, blow-down and other means can be felled and used for in-channel placement regardless of live-tree stocking levels.
iii. Trees may be removed by cable, ground-based equipment, horses or helicopters.
iv. Trees may be felled or pushed/pulled directly into a stream or floodplain.
v. Trees may be stock piled for future instream restoration projects.
vi. The project manager for an aquatic restoration action will coordinate with an action-agency wildlife biologist in tree-removal planning efforts.

3. Dam, Tidegate and Legacy Structure Removal

Dam, tidegate and legacy structure removal includes removal of dams, tidegates, channel-spanning weirs, legacy habitat structures, earthen embankments, subsurface drainage features, spillway systems, outfalls, pipes, instream flow redirection structures (for example, drop structure, gabion, and groin), or similar devices used to control, discharge, or maintain water levels. 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. Any instream water control structures that impound substantial amounts of contaminated sediment are not proposed. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. **Dam removal:**

i. **Design review:**

1. **NMFS fish passage review and approve:** The action agencies will ensure that the action is individually reviewed and approved by NMFS for consistency with criteria in NMFS (2011e).

2. **Restoration review team:** The action agencies will ensure that the action is individually reviewed by the restoration review team.

ii. Dams greater than 10 feet in height require a long-term monitoring and adaptive management plan that will be developed between the services and the action agency.

iii. At a minimum, the following information will be necessary for review:

3. A longitudinal profile of the stream channel 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.

4. A minimum of three 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.

5. Sediment characterization to determine the proportion of coarse sediment (greater than 2 millimeters) in the reservoir area.

6. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Reservoirs with a d35 greater than 2 millimeters (65 percent of the sediment by weight exceeds 2 millimeters in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 millimeters (65 percent of the sediment by weight is less than 2 millimeters 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.

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.

b. **Tide gate removal:** This action includes the removal of tide gates.

i. **NMFS fish passage review and approve:** For projects that constrain tidal exchange, the action agencies will ensure that the action is individually reviewed and approved by the NMFS for consistency with criteria in NMFS (2011e).

ii. Follow Work Area Isolation, Surface Water Withdrawals, and Fish Capture and Release (PDC 20). If a culvert or bridge will be constructed at the location of a removed tide gate, then the structure should be large enough to allow for a full tidal exchange.

c. **Removal of legacy structures:** This action includes the removal of past projects, such as large wood, boulder, rock gabions, and other in-channel and floodplain structures.

d. If the structure being removed contains material (large wood, boulders, concrete, etc.) not typically found within the stream or floodplain at that site, remove material from the 100-year floodplain.

e. If the structure being removed contains material (for example, large wood or boulders) that is typically found within the stream or floodplain at that site, the material can be reused to implement

habitat improvements described under the Large Wood, Boulder, and Gravel Placement activity category in this opinion.
f. If the structure being removed is keyed into the bank, fill in "key" holes with native materials to restore contours of stream bank 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 to fill in "key" holes.
g. 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.
h. 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.
i. 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. If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts.
j. If the structure is being removed because it has caused an over-widening of the channel, consider implementing other ARBO II restoration categories to decrease the width to depth ratio of the stream to a level commensurate with the geomorphic setting.

4. Channel Reconstruction/Relocation

Channel reconstruction/relocation projects include reconstruction of existing stream channels through excavation and structure placement (large wood and boulders) or relocation (rerouting of flow) into historic 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 resulting from watershed disturbances. This activity type will be implemented to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. **General project design criteria:**
   i. **Design review:**
      1. **NMFS fish passage review and approve** – The action agencies will ensure that the action is individually reviewed and approved by NMFS for consistency with NMFS (2011e).
      2. **Restoration Review Team** – The Action Agencies will ensure that the action is individually reviewed by the Restoration Review Team.
   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 would naturally occur at that stream and valley type.
      3. To the greatest degree possible, remove nonnative 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 poolriffle stream types, while roughened channels and boulder step structures shall be preferentially used in step-pool and cascade stream types.
6. Material selection (large wood, 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 or other appropriate design guidance documents (USDA-Forest Service 2008).

iii. **Project documentation**: Prior to the design review, the project contact will provide NMFS and the restoration review team with the following documentation:

1. Background and problem statement
    a. Site history.
    b. Environmental baseline.
    c. Problem description.
    d. Cause of problem.
2. Project description
    a. Goals/objectives.
    b. Project elements.
    c. Sequencing, implementation.
    d. Recovery trajectory –how does it develop and evolve?
3. Design analysis
    a. Technical analyses.
    b. Computations relating design to analysis.
    c. References.
4. River restoration analysis tool: The river restoration analysis tool (restorationreview.com) was created to assist with design and monitoring of aquatic restoration projects. The following questions taken from the tool must be addressed in the project documentation:
    a. Problem identification
        i. Is the problem identified?
        ii. Are causes identified at appropriate scales?
    b. Project context
        i. Is the project identified as part of a plan, such as a watershed action plan or recovery plan?
        ii. Does the project consider ecological, geomorphic, and socioeconomic context?
    c. Goals and objectives
        i. Do goals and objectives address problem, causes, and context?
        ii. Are objectives measurable?
    d. Alternatives/options evaluation
        i. Were alternatives/options considered?
        ii. Are uncertainties and risk associated with selected alternative acceptable?
    e. Project design
        i. Do project elements collectively support project objectives?
        ii. Are design criteria defined for all project elements?

iii. Do project elements work with stream processes to create and maintain habitat?
iv. Is the technical basis of design sound for each project element?

f. Implementation
i. Are plans and specifications sufficient in scope and detail to execute the project?
ii. Does plan address potential implementation impacts and risks?

g. Monitoring and management
i. Does monitoring plan address project compliance?
ii. Does monitoring plan directly measure project effectiveness?

h. Monitoring: Develop a monitoring and adaptive plan that has been reviewed and approved by the restoration review team and the services. The plan will include the following:
i. Introduction
ii. Existing monitoring protocols
iii. Project effectiveness monitoring plan
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

Off- and side-channel habitat restoration projects will be implemented to reconnect historic 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. These project types will increase habitat diversity and complexity, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refuge for fish during high flows. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. **Review and approve:** When a proposed side channel will contain greater than 20 percent of the bankfull flow, 16 the action agencies will ensure that the action is reviewed by the restoration review team and reviewed and approved by NMFS for consistency with criteria in NMFS (2011e).
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 10 percent of volume) of naturally accumulated sediment within historical channels. There is no limit as to the amount of excavation of anthropogenic fill within historic 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.

6. Streambank Restoration

Streambank restoration will be implemented through bank shaping and installation of coir logs or other soil reinforcements as necessary to support riparian vegetation; planting or installing large wood, trees,

shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats; or a combination of the above methods. Such actions are intended to restore banks that have been altered through road construction, improper grazing, invasive plants, and more. Benefits include increased amounts of riparian vegetation and associated shading, bank stability, and reduced sedimentation into stream channels and spawning gravels. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. Without changing the location of the bank toe, restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of benches in consolidated, cohesive soils.
b. Complete all soil reinforcement earthwork and excavation in the dry. When necessary, use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots.
c. Include large wood to the extent it would naturally occur. If possible, large wood should have untrimmed root wads to provide functional refugia habitat for fish. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
d. Rock will not be used for streambank restoration, except as ballast to stabilize large wood.
e. 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, stream channels, etc.
f. Do not apply surface fertilizer within 50 feet of any stream channel.
g. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
h. 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

Set-back or removal of existing berms, dikes, and levees will be conducted to reconnect historic fresh-water deltas to inundation, stream channels with floodplains, and historic estuaries to tidal influence as a means to increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows. Other restored ecological functions include overland flow during flood events, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves. Such projects will take place where estuaries and floodplains have been disconnected from adjacent rivers through drain pipes and anthropogenic fill. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

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 capital projects to the extent possible.
   iii. To the extent possible, remove nonnative 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, openings will be created with breaches. Breaches shall be equal to or greater than the active channel width to reduce the potential for channel avulsion 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. Elevations of dike/levee setbacks shall not exceed the elevation of removed structures.
vi. 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:**

i. Project implementation shall be conducted in a sequence that will not preclude repairing or restoring estuary functions once dikes/levees are breached and the project area is flooded.
ii. Culverts and tide gates will be removed using the design criteria and conservation measures, where appropriate, as described in Work Area Isolation, Surface Water Withdrawals, & Fish Capture and Release (PDC 20) and Fish Passage Restoration (PDC 21) above.
iii. 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.
iv. 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.
v. 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. When required, use PDC in Channel Reconstruction/Relocation (PDC 24).
vi. 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.

8. Reduction/Relocation of Recreation Impacts

Is intended to close, better control, or relocate recreation infrastructure and use along streams and within riparian 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. The primary purpose is to eliminate or reduce recreational impacts to restore riparian areas and vegetation, improve bank stability, and reduce sedimentation into adjacent streams. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. Design remedial actions to restore floodplain characteristics – elevation, width, gradient, length, and roughness- in a manner that closely mimics, to the extent possible, those that would occur naturally at that stream and valley type.
b. To the extent possible, non- native fill material shall be removed from the floodplain to an upland site.
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 as possible.

e. Consider de-compaction of soils and vegetation planting once over burden 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 32) below.

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

Livestock fencing, stream crossings and off-channel livestock watering facilities 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. Such projects promote a balanced approach to livestock use in riparian areas, reducing livestock impacts to riparian soils and vegetation, streambanks, channel substrates, and water quality. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.

a. **Livestock fencing:**
   i. Fence placement must allow for lateral movement of a stream and to allow establishment of riparian plant species. To the extent possible, fences will be placed outside the channel migration zone.
   ii. Minimize vegetation removal, especially potential large wood recruitment sources, when constructing fence lines.
   iii. Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.
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 must not be located in areas where compaction or other damage can occur to sensitive soils and vegetation (for example, wetlands) due to congregating livestock.
   iii. To the extent possible, crossings will not be placed in areas where ESA-listed species spawn or are suspected of spawning (for example, pool tailouts where spawning may occur), or within 300 feet upstream of such areas.
   iv. Existing access roads and stream crossings will be used whenever possible, unless new construction would result in less habitat disturbance and the old trail or crossing is retired.
   v. Access roads or trails will be provided with a vegetative 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 (for example, 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 project design criteria listed for Stream Simulation Culvert and Bridge Projects under Fish Passage Restoration (PDC 21).

ix. Stream crossings and water gaps will be designed and constructed to a width of 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 or 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 or riparian pastures.

c. **Off-channel livestock watering facilities:**

i. The development of a spring is not allowed if the spring is occupied by ESA-listed species.

ii. Water withdrawals must not dewater habitats or cause low stream flow conditions that could affect ESA-listed fish. Withdrawals may not exceed 10 percent of the available flow.

iii. Troughs or tanks fed from a stream or river must have an existing valid water right. Surface water intakes must be screened to meet the most recent version of NMFS fish screen criteria (NMFS 2011e)(NMFS 2011e)(NMFS 2011e)(NMFS 2011e)(NMFS 2011e)(NMFS 2011e)(NMFS 2011e), 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.

iv. 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.

v. 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.

vi. Minimize removal of vegetation around springs, wet areas.

vii. When necessary, construct a fence around the spring development to prevent livestock damage.

14. Riparian Vegetation Planting

Riparian vegetation planting includes the planting of native riparian species that would occur under natural disturbance regimes. Activities may include the following: planting conifers, deciduous trees, and shrubs; placement of sedge, rush mats, or both; and gathering and planting willow cuttings. The resulting benefits to the aquatic system can include desired levels of stream shade, bank stability, stream nutrients, large wood inputs, increased grasses, forbs, and shrubs, and reduced soil erosion. Equipment may include excavators, backhoes, dump trucks, power augers, chainsaws, and manual tools.

a. Experienced silviculturists, botanists, ecologists, or associated technicians shall be involved in designing vegetation treatments.

b. Species to be planted will be of the same species that naturally occur in the project area. Acquire native seed or plant sources as close to the watershed as possible.

c. Tree and shrub species, willow cuttings, as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in terraces (abandoned flood plains), or where such plants are abundant.

d. Sedge and rush mats should be sized to prevent their movement during high flow events.

e. Concentrate plantings above the bankfull elevation.

f. Removal of native and non-native vegetation that will compete with plantings is permitted.

g. Exclosure fencing to prevent utilization of plantings by deer, elk, and livestock is permitted.

16. Beaver Habitat Restoration

Beaver habitat restoration includes installation of in-channel structures to encourage beavers to build dams in incised channels and across potential floodplain surfaces. The dams are expected to entrain substrate, aggrade the bottom, and reconnect the stream to the floodplain.

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 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 (Pollock et al. 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, and alder) and building exclosures (such as temporary fences) to protect and enhance existing or planted riparian hardwoods until they are established (Malheur National Forest and the Keystone Project 2007).

ii. Maintain or develop grazing plans that will ensure the success of beaver habitat restoration objectives.

iii. As a means to restore desired vegetation (for example, aspen, willow, alder, and cottonwood) associated with quality beaver habitat, follow project design criteria in the *Riparian Vegetation Treatment (controlled burning) b. Noncommercial thinning associated with Moderate-severity burns* category.

Project Design Criteria by Resource

Fisheries and Hydrology

Fisheries and hydrology resources will follow all mitigation measures and project design criteria for aquatic restoration activities as shown in the 'Aquatic Restoration Project Categories, Program Administration, General Aquatic Conservation Measures, and Project Design Criteria for Aquatic Restoration Activity Categories on the Malheur National Forest.'

Additional Aquatic project design criteria were developed for the following elements: tree tipping and felling, juniper treatments, tree hauling, and prescribed burning.

General For Inside Riparian Habitat Conservation Areas

All snags will be maintained within the RHCA unless deemed a hazard to the restoration activity.

Tree Tipping and Tree Felling for Large Wood Projects

Source trees being extracted (either by tipping or felling) as part of this project for instream restoration will not be harvested from within the primary shade zone.

Table 6. Primary shade zone width slope distance (feet), based on adjacent hillslope (percent)

Hillslope less than 30 percent	Hillslope 30 to 60 percent	Hillslope greater than 30 percent
50 feet	55 feet	60 feet

The Temperature Implementation Strategies allow the distances in the above table to be less (but not less than 25 feet.) if any of the following conditions applies:

- The trees are located on a south facing slope (175 to 185 degree azimuth) and therefore do not provide stream shade;
- An appropriate level of analysis is completed and documented, such as shade modeling, using site-specific characteristics to determine the primary shade tree width; and/or
- Field monitoring or measurements are completed to determine the width where optimum angular canopy density (65 percent or greater) is achieved (see TMDL Implementation Strategies).
- If trees are being felled for safety reasons they can be felled towards the stream.
- Source trees should come from but are not limited to: over or fully stocked upland and riparian stands, hazard trees, trees generated from administrative sites (maintenance, expansion, or new construction), and hardwood restoration.

There is no DBH (diameter at breast height) restriction for large wood, but consider the following before removing and placing trees:

Diameter:

- The key to establishing a logjam is utilizing larger diameter wood that resists decay. These pieces of wood are often called "key pieces," and serve as the anchors for the logjam structure. Wood can improve fish habitat only if the wood is large enough to stay, influence flow patterns, and sediment sorting. Larger diameter wood retains its size longer as abrasion and decay occurs over the years. Larger diameter wood is more effective in creating pools and complex channels that improve fish populations. The minimum diameter required for a key piece of wood depends on the bankfull width of the stream is found in the following table:

Table 7. Bankfull widths and minimum diameter of logs to be considered key pieces

Bankfull width* (in feet)	Minimum diameter* (inches)
0 to 10	10
10 to 20	16
20 to 30	18
Over 30	22

*This table was taken from '1995 A Guide to Placement of Large Wood in Streams.

Length:

- The length of the wood is also important to stability. To be considered a key piece a log with a rootwad still attached should be at least 1 1/2 times (1.5 times) the bankfull or a log without a rootwad should be twice (2 times) the length of the stream's bankfull width. As the best fish habitat is formed around jams composed of three to seven logs, at least two key pieces should be used at each structure.
- Mimic natural accumulations of large woody debris based on stream type, valley setting, and community type and ensure future large woody debris recruitment
- Tailholds as part of tree tipping operations are permitted across perennial, intermittent and ephemeral streams, but the use of protective straps will be required to prevent tree damage.

Juniper Treatments

The majority of the juniper treatment areas would be within the riparian habitat conservation areas and adjoining uplands. For each area evaluated for juniper treatments, interdisciplinary teams would discuss the following questions in order to identify the attributes of an area and select the appropriate treatments:

- What kind of site (potential natural vegetation, soils)?
- Successional state of site?

- Components that need to be restored?
- How units may fit into the overall landscape mosaic?
- Long-term goals and objectives?

Utilize the "Western Juniper Field Guide: Asking the Right Questions to Select the Appropriate Management Actions (Bates et al. 2007, Circular 1321) (see http://pubs.usgs.gov/circ/l 32 l/pdf/circ l 321.pdf).

Tree and Boulder Hauling

- Apply mitigation and best management practices for dust abatement (water, lignosulfonate, calcium, and magnesium chlorides) dry conditions, and erosion control as directed by physical scientist or road engineer (see road maintenance project design criteria #6 for application).
    - Haul on gravel and native-surface roads will be limited to dry conditions.

Haul Restrictions to Prevent Fine Sediment Delivery to Streams

- Haul or maintenance is permitted on roads under the following conditions:
    - During haul, weather conditions are monitored daily for the chance of precipitation by the hydrologist or fish biologist.
    - No rutting of the road surface is occurring, indicating the subsurface is wet.
    - Frozen ground conditions.
    - Haul will cease at any time when the travelway of the road is wet and turbid water or fines are observed moving off the road surface to ditchlines that deliver to stream channels regardless of time of year.

Roads Exempt from Haul Restrictions Include (Due to No Mechanism for Sediment Delivery):

- Paved roads
- Surfaced Ridge top roads
- Surfaced outsloped roads with no ditch or stream crossings

Prescribed Burning and Related Activities

- Mechanical piling and burning of large piles will be restricted to existing roads and landings.
- Include all relevant PDC in silviculture prescriptions and burn plan objectives for all fuel treatment activities within RHCAs.
- Use all available fuel treatments and preparation activities as necessary (for example, multiple entries, slash pull-back, modified ignition methods, locations, timing, and sequence, thinning of small green trees, pruning of green trees and snags, prescribed fire, fire suppression, jack pot burning, etc.) to achieve the specific PDC. Suppression should be used only as a last resort to achieve other PDC.

For Perennial and Fish-Bearing Stream Channels:

- Avoid removing trees along stream banks (for example, don’t cause bank instability or increase erosion).
- Within primary shade zone retain 100 percent of the overstory canopy closure with the exception of hardwood treatment.
- For intermittent. non-fish-bearing stream channels:
    - Within 50 feet of the stream channel backing fire is preferred.
- For the maintenance and use of water sources and draft sites:
    - Minimize disturbance of existing riparian vegetation to the greatest extent practical; in particular, maintain shade, bank stability, and large woody material recruitment potential.

- ♦ Use sediment control measures such as straw bales, filter cloth, or sediment fences when conditions warrant.
- ♦ Maximize maintenance activities during late summer and early fall to best avoid wet conditions.
- ♦ Do not pump from streams that do not have continuous surface flow. When pumping water in all situations from streams, ensure that at least one-half of the original streamflow remains below the pump site.
- ♦ Refuel power equipment, or use absorbent pads for immobile equipment, and prepare concrete at least 150 feet (or as far as possible from the water body where local site conditions do not allow a 150 foot setback) from water bodies to prevent direct delivery of contaminants into associated water bodies.
- ♦ Fisheries, hydrology or other qualified personnel must work with engineering/fire personnel to review proposed activities to minimize potential effects to fish, stream channel conditions, and water quality.
- ♦ Use and develop off-channel ponds outside of stream channels were feasible and appropriate. Work with fire folks to prioritize and decommission unnecessary in-stream drafting sites.
- ♦ Water withdrawal equipment must have a fish screen installed, operated and maintained in accordance to NOAA Fisheries guidelines.

Wildlife

Threatened, Endangered or Sensitive Species

- If wolves become established (denning) while project implementation is occurring, measures will be taken to avoid activity in that vicinity
- If any evidence of wolverines is discovered during project implementation, measures will be taken to provide protection. If a den is found we would protect it from human disturbance.

Raptors

- No activities will occur within currently known goshawk or other raptor nest stands. To conserve nesting habitat and to minimize disturbance to nesting individuals, restrictions would be executed according to the requirements of the species involved.
- With all newly discovered raptor nests, a buffer zone would be established by the wildlife biologist to restrict activities near the nest area during occupancy.
- Where possible, retain trees with inactive nests that may be important to secondary nesters (for example, great gray owl).
- Any snags in riparian areas or uplands will be protected from disturbance, removal, or use in stream restoration activities unless deemed a safety hazard at a specific work site.

Big Game

- Within big game winter range a wildlife biologist will be consulted between December 1 and April 1 to determine if activities should be restricted for big game needs.

Botany

Note: Pre-implementation planning project design criteria are identified.

Rare and Sensitive Plants and Habitats

- ***Pre-Implementation:*** Proposed restoration projects shall be completely surveyed early in the implementation planning process by a qualified botanist or rare plant technician, to identify and assess any sensitive or rare plant populations or habitats.
- ***Pre-Implementation:*** Proposed restoration projects shall develop restoration plans for degraded sensitive species habitats and/or mitigation plans in areas where sensitive plant populations are documented. This shall be accomplished by a journey-level Forest Service botanist in collaboration with the interdisciplinary team and other stakeholders.
- Heavy equipment, vehicle operation, road construction, staging areas, stockpile areas, piling of slash, fence construction, recreation sites, prescribed fires, fire lines, and other operational activities shall not be allowed in any documented sensitive plant sites unless it is for the demonstrated benefit or protection of the site. All sensitive plant populations should be buffered 100 feet from all operational activities where topography does not restrict such a distance. Sensitive plant sites and associated buffers shall be identified as areas to protect.

Sensitive and Unique Habitats

- The integrity of unique habitats shall be maintained. Unique habitats [may] include meadows, rimrock, talus slopes, cliffs, animal dens, wallows, bogs [fens], seeps and springs. This shall be accomplished by incorporating cover buffers approximately 100 feet in width.
- Heavy equipment, vehicle operation, road construction, staging areas, stockpile areas, piling of slash, fence construction, recreation sites, prescribed fires, fire lines, and other operational activities shall not occur within, or at the interface of lithosols (scablands).
- Cutting of old-growth juniper shall be prohibited. Old-growth characteristics include: 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.

Groundwater-Dependent Ecosystems

- The integrity of groundwater-dependent ecosystems shall be maintained. Spring developments shall not dewater groundwater-dependent ecosystems. Spring developments shall not be allowed if the spring is occupied by rare or sensitive plant species, or in peatlands, fens, or where histic soils are present. These sites should be buffered 100 feet from all operational activities where topography does not restrict such a distance, and be identified as areas to protect.
- Heavy equipment, vehicle operation, road construction, staging areas, stockpile areas, piling of slash, fence construction, fire lines, and other operational activities shall not be allowed in springs, seeps, or any other groundwater dependent ecosystem, unless it is for the benefit or protection of the groundwater dependent ecosystems or development of the spring.
- Spring developments should not disturb the spring orifice (point where water emerges). Spring head boxes should be placed in a location that will cause the least amount of disturbance to the soils and vegetation of the groundwater dependent ecosystems. Preferable locations for spring head boxes should be in an established channel downstream from the orifice or a location where flowing water becomes subsurface.
- When necessary, construct fenced exclosures around spring developments to prevent damage from wild ungulates and livestock.
- Spring developments shall have a return flow system to minimize the diversion of surface and subsurface water from the catchment area. Consider using a float valve or similar device to reduce the amount of water withdrawn from the groundwater dependent ecosystems.

- When developing springs, place troughs far enough away from groundwater-dependent ecosystems, wetlands, and other sensitive or unique habitats to prevent erosion, compaction, or degradation to sensitive soils and vegetation due to livestock congregation.

Invasive Plant Species

- ***Pre-Implementation:*** Proposed restoration projects shall be surveyed for invasive plants early in the implementation planning process by a qualified invasive plant specialist /technician, to identify and assess any undocumented invasive plant infestation.
- ***Pre-Implementation****:* For project areas that overlap or are adjacent to invasive plant infestations, assure that there is sufficient time prior to develop a long-term site strategy for control, eradication, and revegetation of the site. This shall be accomplished by a qualified invasive plant specialist in collaboration with the interdisciplinary team and other stakeholders.
- All activities shall be conducted in a manner as to minimize or prevent the potential spread or establishment of invasive species.
- Actions conducted on National Forest System Lands that will operate outside the limits of the road prism, require the cleaning of all heavy equipment (bulldozers, skidders, graders, backhoes, dump trucks, etc.) prior to entering the Malheur National Forest. Cleaning will be inspected and approved by the forest officer in charge of administering the project.
- Assure that all materials are weed-free. Use weed-free straw and mulch for all projects conducted or authorized by the Forest Service on National Forest System Lands. If State certified straw or mulch is not available, individual national forests should require sources certified to be weed-free using the North American Weed Free Forage Program standards or a similar certification process.
- Inspect active gravel, fill, sand stockpiles, quarry sites, and borrow material for invasive plants before use and transport. Treat or require treatment of infested sources before any use of pit material. Use only gravel, fill, sand, or rock that are judged to be weed free by District or Forest weed specialists.
- Prohibit heavy equipment operation, vehicle travel, staging areas, fire-control lines, and any other operational activities in invasive plant infestations, unless the activities are for the express purpose of eradicating the infestation or INV1 and INV2 have been completed.
- Conduct post-implementation monitoring for invasive plants. Continue monitoring, treating, and removing invasive plants until all infestations are eradicated and native plant species are well established.

Native Plant Materials and Revegetation

- ***Pre-Implementation****:* Where the need for native plant materials is anticipated, assure that there is sufficient time for the plant materials specialist to develop a native plant materials plan and/or prescription prior to implementation of planned revegetation, rehabilitation, and restoration projects. This may include allowing for enough time to harvest and store hardwood cuttings, produce suitable quantities of native seed, and/or grow-out container stock.
- Locally adapted, genetically appropriate native plant materials are the first choice for use in revegetation, restoration, and rehabilitation, where timely natural regeneration of the native plant community is not likely to occur. Use a diverse assemblage of species that have the potential to naturally occur in the project area. Acquire native seed or plant sources as close to the watershed as possible. Examples of areas that may need treatment include: habitat restoration efforts, log decks, staging areas, landing zones, temporary roads, slash piles, culvert replacements, severely burned areas, skid trails, decommissioned roads, invasive species treatments, and other disturbances.
- Non-native, non-invasive plant species may be used in the following situations: (1) when needed in emergency conditions to protect basic resource values (for example, soil stability, water quality, and

to help prevent the establishment of invasive species), (2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, (3) if native plant materials are not available or not economically feasible, and (4) in permanently altered plant communities.

- Under no circumstances shall non-native invasive plant species or noxious weeds be used for revegetation.
- Development, review, and/or approval of revegetation, rehabilitation, and restoration prescriptions, including species selection, genetic heritage, growth stage, seed mixes, sowing guidelines, and any needed site preparation, shall be accomplished by a plant materials specialist who is knowledgeable and trained or certified in the plant community type where the revegetation will occur.
- Concentrate plantings above the bank-full elevation. Sedge and rush mats should be placed and sized to prevent their movement during high flow events.
- Newly planted or seeded areas should be protected from animals and activities that may prevent, retard, or slow the establishment and recovery of native vegetation. Site-specific measures may include building fences, piling slash, jackstrawing, closing areas to vehicles, and/or temporarily changing grazing regimes until the desired condition is sufficiently achieved.

Soils

- For projects involving heavy machinery off roads, the project proponents shall inspect the site for existing impacts to the soil. If existing impacts appear to be heavy on the Malheur National Forest or moderate on the Ochoco National Forest, they shall contact a soil scientist, who shall determine what site specific project design criteria are necessary to meet Forest Plan and Forest Service Manual standards and guidelines. (If a soil scientist is not available, a silviculturist or hydrologist can do the work.) If standards and guidelines cannot be met, heavy machinery shall not be used.
- Erosion would be minimized by following General Aquatic Conservation Measures (see section, above) and by implementing the appropriate project design criteria based on the type of activity (see Appendix A).
- Erosion from heavy machinery use would be minimized; by minimizing compaction and puddling, rutting would be minimized.
- For Livestock Stream Crossings and Off-Channel Watering Facilities, out-of-channel erosion would be minimized.
- For Road Erosion Control, erosion would be minimized.
- For Juniper Removal, erosion would be minimized. It is possible that juniper removal would increase ground cover within a few years, and thereby reduce erosion.
- Prescribed fire (including for disposal of slash after juniper removal) can involve only low- and moderate-severity fire, and erosion from fire lines would be minimized, so erosion from prescribed fire would not be significant.

Fire and Fuels

- Mechanical tools may be necessary to prepare fire control lines for these burns, but would be limited, and typically no heavy equipment would be used. Prescribed burns or wildfires could temporarily affect air quality.
- The project design criteria for both Juniper Removal and Riparian Vegetation Treatment (controlled burning) would be followed. National, state, and local policies regarding prescribed fire implementation will be met.
- Activities that are expected to create smoke emissions would follow the State of Oregon Smoke Management Plan. Prior to burning, approval will be obtained from the Oregon Department of Forestry, who determines compliance with the Clean Air Act. State smoke forecasts, which predict

wind direction and smoke mixing height, will be obtained prior to all burning to ensure smoke intrusions will not occur in the local smoke sensitive receptor areas.
- Burning will follow the guidance provided by the Oregon Smoke Management Plan (Directive 1-4-1-601, Operational Guidance for the Oregon Smoke Management Program), which is an agreement between federal land management agencies in northeast Oregon and Oregon Department of Forestry limiting smoke emission amounts. Oregon Department of Forestry monitors activity, and if a limit is reached it will shut down prescribed fire activity.

Heritage Resources

- Compliance with section 106 of the National Historic Preservation Act for activities authorized under this analysis will be completed and concurred with by the Oregon State Historic Preservation Office before any ground disturbing action takes place. For each potential activity the district or zone archaeologist will determine which of the criteria in the 2004 Programmatic Agreement with the Oregon State Historic Preservation Office best fit the particular project. This will vary somewhat project to project based on the scale of the particular activity, the location on the landscape, and the nature of associated cultural resources, if any.
- The district or zone archaeologist will document their findings on a programmatic agreement form with a project description, rationale and location map which will be attached to the Forest Service Heritage Event database. The forest archaeologist will review and sign off on the programmatic review form if concurred with. For appendices A, B and C projects as defined in the 2004 Programmatic Agreement, the Forest will retain the documentation and provide the Oregon State Historic Preservation Office with the annual summary of projects as described in the Preservation Act.
- For full inventories the district or zone archaeologist will complete an inventory report meeting current Oregon State Historic Preservation Office (SHPO) standards which will be reviewed by the forest archaeologist. The forest archaeologist will forward the completed inventory report to the Oregon State Historic Preservation Office for review and concurrence signature or further discussion as appropriate.
- Consultation with Native American tribes is conducted under the terms of the Memorandums of Understanding the Forest has with each individual tribe. The Forest regularly consults with the Burns Paiute Tribe, the Confederated Tribes of the Umatilla Indian Reservation and the Confederated Tribes of Warm Springs Reservation.
- For work requiring a full inventory under the terms of the 2004 Programmatic Agreement any identified cultural resources sites will generally be avoided. For cases where site avoidance is impractical mitigation procedures will be developed in consultation with the Oregon SHPO before project work begins.
- If any previously unidentified cultural resources are located during project implementation, ground disturbing work will be halted until the resources are evaluated by the district or zone archaeologist. If the cultural resources are determined to be potentially eligible for listing on the National Register of Historic Places work will either be permanently halted or a mitigation plan will be developed in consultation with the Oregon SHPO before work continues.

Recreation

- Motorized aquatic restoration methods would not be used within wilderness, wild portions of wild and scenic rivers, and inventoried roadless areas.
- Mechanized aquatic restoration methods would not be used within wilderness or wild portions of wild and scenic rivers.

Grazing

General

- Range and fire specialists and permittees would coordinate activities including scheduling of burning activities in grazing units.
- Utilize the Forest Post-Fire Interim Grazing Guidelines to aid in determining when to resume grazing activities.
- Whenever possible, units to be rested would be burned in the spring of the year to be rested or in the fall prior to the rest year.
- If a rest period is required following a burn the permittee has the option to exclude cattle grazing from those portions of a pasture that were burned through the use of fencing and could continue to graze the unburned areas of a unit.

Protection of Government and Permittee Investments

- All existing structural range improvements (fences, gates, spring developments, etc.) and permanent ecological plots would be contractually protected.
- Maintain structural integrity of range improvements.
- If structural improvements are damaged during project operations they would be repaired to Forest Service standards prior to livestock scheduled use by the party responsible for causing the damage. Repairs would be required of the purchaser if damage were done during thinning or fuel treatment contractors or by force account where appropriate.
- Three or more splices to a single wire within a distance of 20 feet will be replaced with a single splice.
- Fence right-of-ways (6 feet either side of fence), trails, other developments and access to them would be cleared of slash produced by project activities.

Aspen Restoration

- New aspen exclosure fences would have gates installed in proper locations to allow for removal of stray livestock. Aspen fences would be maintained each year and repaired whenever necessary. Plans for aspen exclosures will define when restoration of the protected stand has been achieved and who has responsibility for maintenance of the structure. When fences are no longer needed, aspen fences should be removed.
- Alternate livestock water sources to those being used in aspen stands would be developed off-site before fencing aspen or re-evaluate fencing of the aspen site. Coordinate with range specialist and permittee.

Notification

- During the planning stage of each individual project all potentially impacted grazing permittees will have notice of action and opportunity to provide input that may lessen impacts to their livestock operation well in advance of implementation.
- Prior to implementation all potentially impacted grazing permittees will be given notice of dates when work will start.