

Crooked Creek Restoration Project

Emigrant Creek Ranger District, Malheur National Forest

Anticipated Project Start Date: May 2017

Action Plan

The goal of this project is to restore hydrologic processes and aquatic habitat along Crooked Creek in compliance with the National Environmental Policy Act (NEPA) under the Aquatic Restoration Environmental Analysis (tiered to ARBO). Crooked Creek shows extreme conifer encroachment, lack of Large Woody Debris (LWD), and headcutting. The specific objectives are to:

- Reduce conifer encroachment into meadow habitat
- Stabilize incised stream channel to reestablish water storage capacity, flood control, aquatic organism passage and habitat
- Increase water quantity and quality through conifer/juniper tree thinning within riparian zone
- Reduce sedimentation from sloughing head-cuts and mitigate erosion to improve water quality
- Improve/increase riparian and aquatic vegetation for fish and wildlife habitat

Treatment disturbances include:

- Felling trees along the floodplain
- Placement of Large Woody Debris in stream channel
- Installation of Analogous Beaver Dam (ABD's)

Mitigation measures include:

- Pre-implementation fish survey to verify presence/absence
- Place block net upstream of project site to prevent fish presence during implementation
- Fish salvage in the project area in conjunction with ODFW, moving captured fish above the project area temporarily
- Establishing natural entrained sediment filters (ABD's and LWD placements) along downstream reaches
- Ensuring fish passage availability according to ODFW guidelines



2016 photo of Crooked Creek showing deep incision, headcut, conifer encroachment, and unstable banks.



Representative stream restoration using root wads and large wood completed in Camp Creek 2015

Project Description

The project consists of 5 Analogous Beaver Dam (ABD) in an approximate 2 mile section of Crooked Creek, as well as Large Woody Debris (LWD) placement and headcut stabilization in an area that totals 70 acres and includes 1.6 miles of Crooked Creek, and 0.4 miles of an unnamed Category 1 tributary to Crooked Creek. The project area includes up to 150 feet on both sides of the streams (see map). Riparian vegetation planting will be incorporated into the entire project area as needed. The current condition of Crooked Creek diminishes water quality and quantity in the Silvies River watershed and adversely affects riparian vegetation and aquatic habitat. No action on this stream would result in continued detrimental impacts to the water source, riparian vegetation and aquatic life.

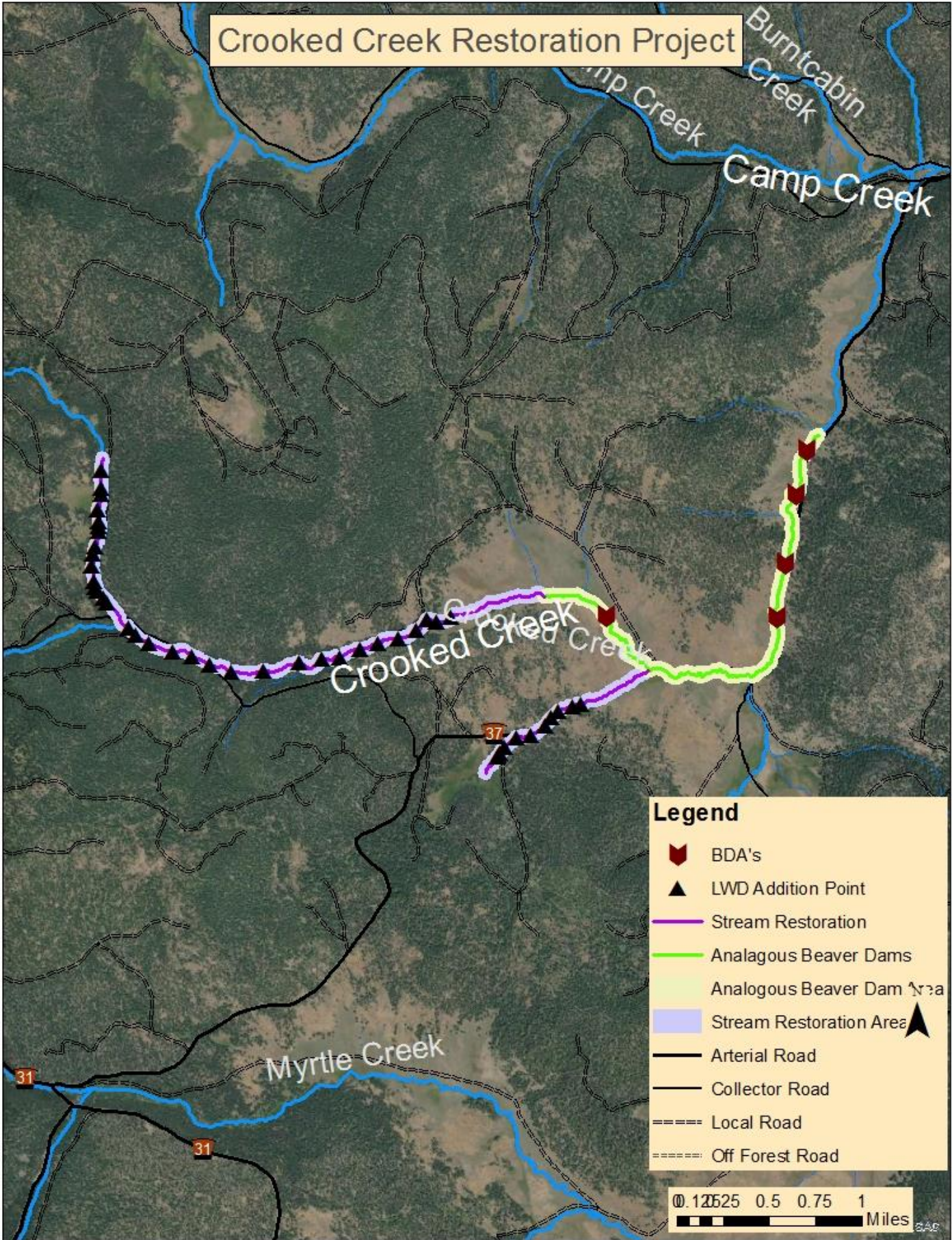
The goal of this project is to restore the riparian ecosystem and water quantity and quality within Crooked Creek through conifer thinning, LWD placement, Analogous Beaver Dam installation, and riparian hardwood planting. Phase 1 of the project involves tree thinning, Analogous Beaver Dam installation, and Large Woody Debris placement slated for April-September 2017. Phase 2 consists of seeding and planting along all sections of Crooked Creek that show a need, and is slated for fall 2017/spring 2018. To meet the project goal and objectives, juniper, pine and fir trees <21" dbh will either be cut or tipped over, and placed within the channel or set up as slash barrier to retard grazing access. Placing large wood within the stream increases both channel complexity for aquatic habitat and obstacles for trapping sediment needed to aggrade incised channels. Analogous Beaver Dams will be installed by driving vertical timbers into the streambed and associated streambank, these structures will comply with ODFW fish passage requirements. For LWD project design criteria, refer to Category 2 and Category 6 of the Aquatic Restoration Environmental Assessment (attached). No boulder or gravel placement will be incorporated into this project. For ABD design criteria refer to Category 16 of the Aquatic Restoration EA (attached) as well as ODFW guidance. By introducing LWD and ABD's, the water table elevates and will reconnect with the floodplain allowing the stream to function properly during low and high flow events. This process drowns non-riparian species that have encroached within the floodplain and fosters natural riparian plant growth. Supplemental planting of aspen, willow, alder, dogwood, and other endemic riparian species along the channel banks will augment the reestablishment of riparian vegetation within the ecosystem. An excavator will be used to install Analogous Beaver Dams, tip trees, and place large

wood within the channel. Chainsaws will be used to cut vegetation intended to build slash barriers and to supplement large wood material to be placed in the channel.

The thinning treatment applies to selected category 1 RHCAs sites within the 300 ft. buffer on each side a stream where stand densities are excessive and impact proper riparian and floodplain process and function. Treatments would include felling all juniper up to 21" and most pine and fir up to 21" DBH while maintaining riparian management objectives (RMOs). Any created biomass will be left on site as downed wood, utilized as large wood for stream restoration and/or slash barriers, or piled and burned or jackpot burned in areas of light fuel loads.

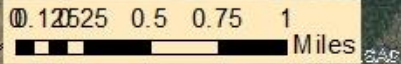
Direct questions/comments to Craig Hemping (541) - 573 - 4369 or Howard Richburg (541) - 573 - 4322

Crooked Creek Restoration Project



Legend

- BDA's
- LWD Addition Point
- Stream Restoration
- Analogous Beaver Dams
- Analogous Beaver Dam Area
- Stream Restoration Area
- Arterial Road
- Collector Road
- Local Road
- Off Forest Road



**Forest Aquatic Restoration Project
NEPA Compliance and Implementation Checklist**

Project Number: _____

Date: April 2017

Category: Fish Passage Restoration, Large Wood, Boulder, and Gravel Placement, Streambank Restoration, Juniper Tree Removal

Location: Crooked Creek, Emigrant Creek RD, Malheur NF T18S R30E Sec. 33 NE ¼ NW ¼ 44.031183 -119.116563

Project Description: Crooked Creek Channel Restoration

Heritage

x - Specific PDC for Heritage addressed (Heritage Surveys; Avoidance areas).

Botany

x - Specific PDC for Botany addressed (Sensitive Plant Surveys).

x - Specific PDC for Nox. Weeds addressed.

Land Management Consistency

- | | |
|----------------------------------|---|
| <input type="checkbox"/> 4A | Big Game Winter range |
| <input type="checkbox"/> 6A & 6B | Wilderness |
| <input type="checkbox"/> 7 | Scenic Area |
| <input type="checkbox"/> 8 | Special Interest Areas |
| <input type="checkbox"/> 9 | Research Natural Areas |
| <input type="checkbox"/> 10 | Semi-Primitive Non-Motorized Recreation Areas |
| <input type="checkbox"/> 22 | Wild and Scenic River |
| <input type="checkbox"/> | Inventoried Roadless Areas |

Comments:

Table 1. Projects Design Criteria and Forest Plan compliance checklist.

I have reviewed this project and have determined it is within the Project Design Criteria identified for my resource.			
Resource	Signature	Date	Comments
Heritage	/s/ Alyson Kral	03/04/17	Project R2017060402003
Botany/Weeds	/s/ Lisa Foster	01/17/17	Project will improve degraded special habitat. No rare species. Weed PDC's important.
Wildlife	/s/ Roy Sutcliffe	01/17/17	Maybe issues with nesting birds if done in June – early July
Fish*	/s/ Craig Heping	01/27/17	Fish Biologist or Hydrologist will be onsite during implementation
Hydrology*	/s/ Jordan Van Sickle	01/27/17	Follow PDC's, have hydrologist or fish biologist on site for implementation
Range	/s/ Joe Lee	01/18/17	Notify district range staff prior to implementation
Soils	/s/ Jordan Van Sickle	01/27/17	Follow PDC's have soil scientist on-site during excavation
Recreation	/s/ Eric Amsted	01/17/17	If the fence blocks creeks access from any prominent dispersed camp sites, build access into the fence (gate, stile, etc.)
Lands and Special Uses/Minerals	/s/ Stacia Kimbell /s/ Hannah Grist	02/13/17	No Lands Special Uses were located within the proposed project vicinity. No mine claims present. There is high fossil potential in the area but ground disturbing work won't likely unearth any fossils since it will be focused within the riparian area.
Engineering	/s/ John Laliberte	02/13/17	Engineering has concerns that altering water flows with woody debris may adversely affect sections of the stream that are presently encroaching on the road prism This project needs field review by engineering before implementation. The proximity of the stream restoration project to the road prism and crossings on the 37 and 3760 roads may have long term effects on the road fill. We also need to review the structure design and location before approval.
Fuels / Fire	/s/ Tim Boyce	02/13/17	Scatter slash concentrations <9" DBH
Silviculture	/s/ Travis Swaim	01/26/17	Adhere to prescription

* Ensure that an experienced fisheries biologist or hydrologist is involved in the design of all projects covered by Aquatic Restoration Biological Opinion II. The experience should be commensurate with technical requirements of a project.

Line Officer Signature: /s/ Christy Cheyne

Date: 3/13/2017

Category and Associated Project Design Criteria

Category 2. 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 mimic 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 1.5x bankfull channel width, while logs without rootwads should be a minimum of 2.0x 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:
 - a Use of adequate sized wood sufficient for stability
 - b Orient and place wood in such a way that movement is limited
 - c Ballast (gravel or rock) to increase the mass of the structure to resist movement
 - d Use of large boulders as anchor points for the large wood
 - e 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 (<12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.

b. Engineered Logjams

These structures are 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 >25% 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.

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 (e.g., 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.

Category 6. 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, bull dozers, 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.

Category 16. 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 (e.g., 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.