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ENVIRONMENTAL ASSESSMENT
TUMALO CREEK BRIDGE TO BRIDGE RESTORATION

SUMMARY

The Bend-Fort Rock Ranger District of the Deschutes National Forest, Oregon, proposes to restore the hydrologic function and stability of Tumalo Creek. The project would begin at the confluence with Bridge Creek and continue downstream to the Skyliner road bridge (FS 4601) near the Skyliner Lodge. Hydrologic stability would be achieved by restoring the channel dimension (i.e., channel width and depth), pattern (i.e, channel length and curvature), and profile (i.e., channel slope) identified from reference stream condition. The proposed activities would be implemented in multiple phases to restore nearly 2.8 miles of stream.

Alternative 2 (Modified Proposed Action) focuses on: 1) reducing the substantial loss of soil, vegetation, and fish habitat; 2) maintaining or improving wetlands and wildlife habitat; and 3) enhancing downstream channel stability, including private land with residences near the stream. This alternative would:

- Reduce stream bank erosion and sedimentation.
- Reduce the loss of wetlands.
- Improve water quality.
- Improve fish habitat.
- Reconnect the creek to the floodplain.
- Restore riparian vegetation.

Based upon the effects of the alternatives and public input, the responsible official (District Ranger) will decide whether or not to initiate Tumalo Creek stream restoration activities. All activities would occur within or immediately adjacent to Tumalo Creek.

DOCUMENT STRUCTURE

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into FIVE parts:

- ***Introduction:*** Includes information on the history of the project proposal, the purpose of and need for the project, the agency's proposal for achieving that purpose and need, and public involvement.
- ***Alternative Discussion:*** Provides a detailed description of the alternatives for achieving the stated purpose. Alternatives were developed based on significant issues raised by the public and Forest Service. A comparison table of the activities of each alternative is included. Mitigation measures that would prevent adverse effects to the environment, through alternative implementation, are listed.
- ***Affected Environmental and Environmental Consequences:*** Describes the existing condition of each resource and the effects each alternative would have on the environment. The effects of the No Action Alternative provide a baseline for evaluation and comparison of the other alternatives.
- ***Preparers and Agencies and Persons Consulted:*** Provides a list of preparers and agencies consulted during the development of the environmental assessment.
- ***Appendices:*** The appendices provide more detailed information to support the analyses presented in the environmental assessment.

INTRODUCTION

The Bend-Ft. Rock Ranger District of the Deschutes National Forest has analyzed for the Tumalo Creek Bridge to Bridge Restoration Project, stream restoration located near Bend, Oregon**.** The project would include rehabilitation activities to improve stream channel stability in and adjacent to approximately 2.8 miles of Tumalo Creek.

The project area is located approximately 10 miles west of Bend, Oregon (**Figure 1, page 5),** between Skyliner Lodge and Tumalo Falls and within the Bridge Creek Fire (1979) area. The Forest Plan allocates one (1) management area, Scenic Views (MA-9) within the project area: The legal description is Township 18 South, Range 10 East, Sections 8, 9, and 10. There are no inventoried (RARE II) roadless areas or known Threatened or Endangered species within the project area. The project area, approximately 2.8 miles of Tumalo Creek, is within Riparian Reserves of the Northwest Forest Plan (NWFP). Riparian-dependent resources receive primary emphasis and activities are regulated to maintain or enhance aquatic and riparian resources within Riparian Reserves. This project was included in the list of recommendations for actions in the Bend Watershed Analysis (1998).

WATERSHED OVERVIEW

Tumalo Creek is a tributary to the Deschutes River. The project area is located approximately 14 river miles upstream from the confluence located near Tumalo State Park north of Bend. The project area lies within the 20,745 acre 6th field Upper Tumalo Creek subwatershed, a part of the larger 37,713 acre 5th field Tumalo Creek watershed. The Upper Tumalo Creek subwatershed is relatively undisturbed from past management activities, other than the 1979 Bridge Creek Fire Road densities are low and timber harvest activity has been light other than salvage associated with the fire. The 5th field Tumalo Creek watershed includes large areas of private and other non-federal lands, primarily within the only other 6th field subwatershed located within the watershed, Lower Tumalo Creek. Development and disturbance to the landscape is greater within this subwatershed than in the Upper Tumalo Creek subwatershed. Nearly all of the stream flow of Tumalo Creek is diverted for irrigation approximately 2.5 miles above the confluence with the Deschutes River.

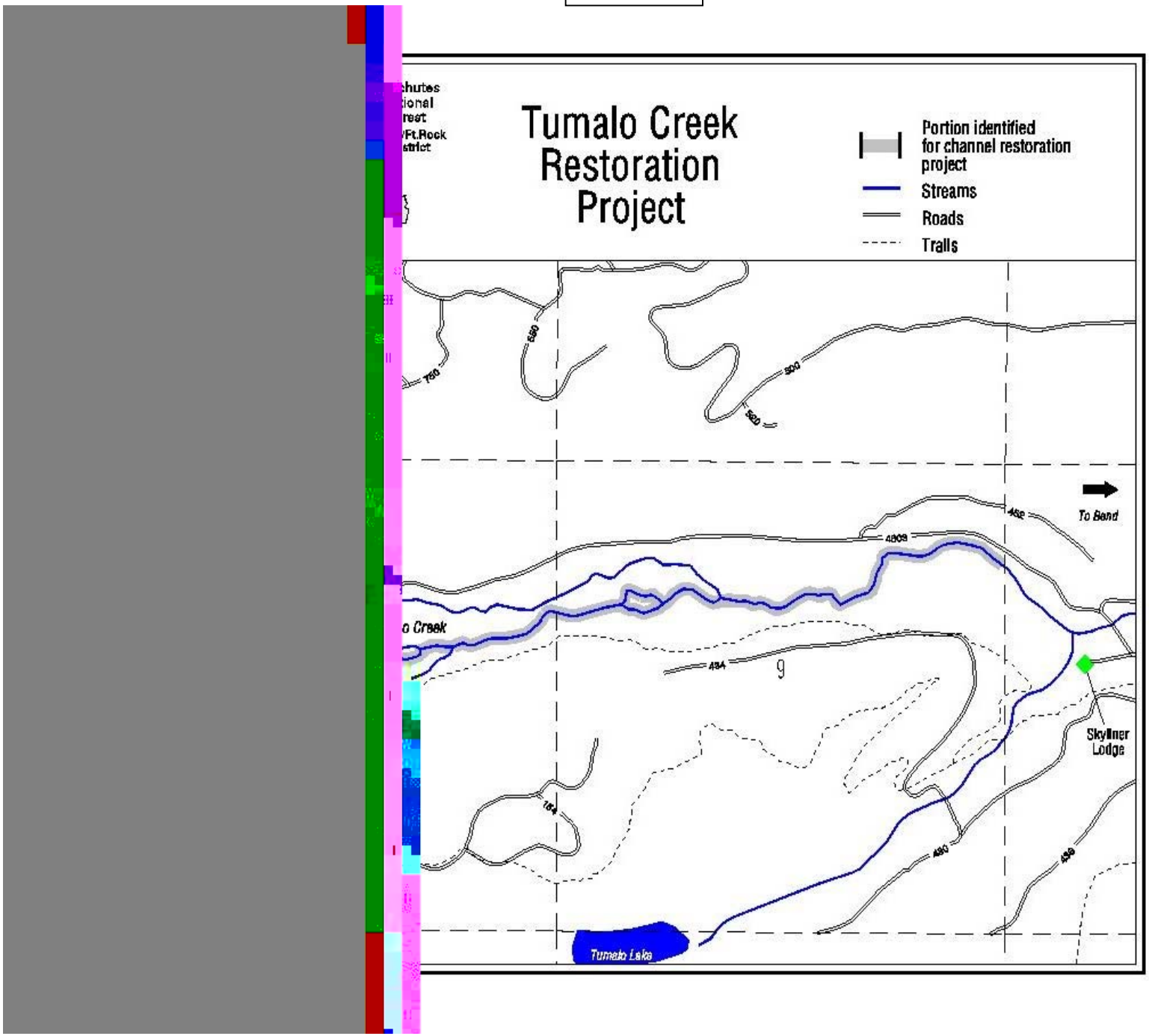
The Upper Tumalo Creek subwatershed has been recognized as a Tier II Key Watershed in the Northwest Forest Plan (NWFP) because of high water quality and not listed as an impaired water body under the 2002, 303(d) EPA approved listing. Bridge Creek flows into Tumalo Creek at the upper end of the project area. The Bridge Creek drainage is the Bend Municipal Watershed and is among the purest for a surface water system in the United States (Prowell, 1998, personal communication). The natural hydrology of Tumalo Creek has been altered upstream of the proposed project area. Upstream flow from springs on the Middle Fork of Tumalo Creek (up to 17 cubic feet per second (cfs) during the summer) is diverted to Bridge Creek. Some of this water re-enters Tumalo Creek at the mouth of Bridge Creek or downstream near Shevlin Park. Stream flow within Crater Creek (from an adjoining watershed), is diverted via canal to the Middle Fork of Tumalo Creek during the summer months (up to 20 cfs). Several private residences downstream of the project area own water rights on Tumalo Creek for domestic use.

Stream discharge is largely influenced by snowmelt and precipitation from tributaries. Groundwater discharge from springs is also a significant contributor. Tumalo Creek and its tributaries (Bottle Creek, Bridge Creek, Happy Valley Creek, Middle Fork, North Fork, Rock Creek, South Fork, Spring Creek, and several unnamed springs) are unusual for Upper Deschutes Basin streams, responding immediately to rain-on-snow events with large increases in flow. Steep valley slopes, exceeding 60 degrees in some areas, contribute to the sudden flow increases, as do somewhat impermeable glaciated soils that underlie a relatively thin layer of Mazama ash, but to a lesser degree. Stream flows typically peak at 200-300 cfs during the spring snow melt. Bankfull discharge (1.5 to 2 year return interval) found within the proposed project reach is estimated at 280 to 300 cfs. Winter flows are usually around 75 cfs.

The beneficial uses of Tumalo Creek are: Municipal and domestic water supply; agriculture (livestock and irrigation); non-contact recreation (hunting, aesthetic quality); water contact recreation; resident fish and aquatic

life; wildlife; spawning and rearing salmonid habitat; groundwater recharge; and freshwater. Beneficial uses are documented after the criteria developed by the Oregon Department of Environmental Quality in (Oregon Administrative Rules; 1998 Compilation) Statewide Water Quality Management Plan; Beneficial Uses, Policies, Standards, and Treatment Criteria for Oregon. A beneficial use is a resource or activity that would directly benefit from a change in water quality or quantity.

Figure 1


Tumalo Creek Restoration Project
Portion identified for channel restoration project
Streams
Roads
Trails
To Bend
Skyliner Lodge
Tumalo Lake
9

Purpose Of And Need For Action

Purpose and Need

The Tumalo Creek project has been initiated in response to concerns and opportunities regarding changes in stream dynamics as a result of the 1979 Bridge Creek Fire, subsequent management actions, and flooding. Present trends are substantial loss of soil, vegetation, wetlands, and quality of fish habitat, and these trends will continue under existing conditions. Excessive bedload from this disturbed portion of watershed could compromise channel stability in areas downstream, including private land with residences near the stream.

The purpose of the proposed project is 1) to reverse the downward trend of channel instability to an upward trend of a stable channel and 2) promote community awareness of watershed management and restoration through outreach to recreational users and established partnerships with the Upper Deschutes Watershed Council, Cascade Science School, and Summit High School.

There is a need to reduce: 1) sediment input for improved sediment transport; 2) fine sediment volumes within gravels to benefit fish and aquatic invertebrates; 3) the excessive loss of land and vegetation; and 4) the likely merger of the channel with the South Fork of Tumalo Creek and the potential loss of several acres of spring-fed wetlands.

There is a need to improve: 1) water quality; 2) the physical integrity of the aquatic system; and 3) riparian vegetation. These improvements would benefit fish and wildlife species, including the redband trout (Forest Service Region 6 Sensitive Species) and the Cascades frog (U.S. Fish and Wildlife Service Species of Concern).

Desired Condition

The desired condition is a channel that would adjust naturally across the floodplain and maintain a stable pattern, profile, and dimension. The large woody material and the riparian vegetation would function to maintain channel stability, balanced sediment transport, water quality, floodplain function, wetlands, and provide fish and wildlife habitat. The desired condition is a reversal of the current downward trend of Tumalo Creek functioning in an at Risk Condition.

Existing Condition

The channel within the fire area is unstable. Sediment load has increased, exceeding the streams capability of moving it through the system. Water forced around areas of sediment deposition in the channel causes increased bank erosion and channel widening. Streamside vegetation is being undercut and sloughing into the channel. This trend will continue until the sediment can be moved effectively. The stream averages 45-50 feet width as opposed to 32 feet prior to the fire. Over 15,000 cubic yards (1,500 dump truck loads) of sediment has been added to the channel from widening. The channel has made substantial migrations, increasing sediment loads by an additional 30,000 to 45,000 cubic yards.

Large depositional areas have formed near logjams. The stream is beginning to erode vertically through the accumulated deposition (down cut). Gradient changes of up to 7 feet have formed. This down cutting is moving upstream (headcut). When headcuts occur, the stream channel becomes incised (deeper), and the stream becomes vertically contained within the channel. Under normal, undisturbed conditions, water would leave the banks during a flood event and enter the floodplain, releasing energy and preventing damage to the channel and its banks. When the channel becomes incised, excess water and the associated energy cannot be released into the floodplain. The resulting stream flow is capable of eroding banks when kept within the channel. Headcuts also result in the lowering of the water table, and removing water from adjacent riparian and wetland areas.

A distance of less than 30 feet presently separates Tumalo Creek from the South Fork of Tumalo Creek. There is potential for the two streams to join approximately one-half (½) mile upstream of the current junction. This could result in extensive erosion, totaling nearly 5,400 cubic yards of soil and loss of a low gradient, 13-foot wide stable

stream system. Tributary streams are also in jeopardy of joining with Tumalo Creek at points upstream of the current junctions. If mergers of these channels occur, several acres of wetlands associated with the springs would be at risk of being drained.

Alternative 2 (Modified Proposed Action)

The following proposed activities were developed to satisfy the stated purpose and need for action, while meeting applicable standards and guidelines that apply to planning on the Deschutes National Forest. Further discussion of alternatives begins on page 12. **All measurements in this document are approximate**.

- Heavy equipment, such as excavators and front-end loaders, would be used to shape the new channel with meanders. Pools would be created or enhanced in association with large wood or boulder structures.
- Sediments (gravels, cobbles) would be relocated within the channel to attain the desired physical characteristics such as sinuosity, slope, width, and depth.
- Unstable stream banks would be sloped away from the stream to improve stability and improve the rooting medium for planted vegetation.
- Structures incorporating large woody material and boulders would be strategically placed to maintain pool scouring during high stream flow events, provide channel and stream bank stability, and provide fish habitat. Materials for structures would be from off-site sources. Approximately 300 pieces of large woody material/mile would be added to the stream, including pieces added to the floodplain to dissipate energy during flood events.
- Re-planting would occur near the stream, on approximately 12 acres, upon completion of stream rehabilitation work. Nearly 40,000 native riparian shrub and tree species would be planted and seeding with native grass species would also occur. The revegetation effort would involve volunteer labor from the community.
- Newberry's Gentian would be planted to re-introduce this sensitive plant species to historical habitat.
- The project would be implemented in three (3) on-the-ground phases, beginning Fall 2004 with expected completion in 2006. Each phase would rehabilitate approximately one-third (1/3) of the 2.8 mile project. Work would begin within the most upstream portion of the project area and proceed downstream.

The following were guidelines for the development of the proposed activities:

- Streams within and near the 6th field Upper Tumalo Creek sub-watershed were surveyed and used as reference reaches to assist in predicting stable physical characteristics for Tumalo Creek.
- Past aerial photographs were also used to obtain pre-fire conditions (i.e. sinuosity) as reference conditions.

Decision To Be Made

Based on this analysis, the District Ranger, Bend-Ft. Rock Ranger District, Deschutes National Forest, will decide whether to:

1. Improve stream stability with stream bank log placement, redistribution of bed materials, revegetation of stream banks, and stream realignment.
2. Improve fish habitat by improving in-stream conditions to provide pool habitat, shade, and hiding cover for fish, and habitat for invertebrates.
3. Rehabilitate temporary routes used for access into the project area through scarification and vegetation replanting.

Availability Of The Planning Record

The Official Planning Record is on file at the Bend/Fort Rock Ranger District office located at 1230 NE 3rd Street, A-262, Bend, Oregon. Specialist reports that are summarized in this document may be found in their entirety in the Official Planning Record.

Documents Tiered To

- 1990 Deschutes National Forest Land and Resource Management Plan (**Forest Plan**) and its accompanying Final Environmental Impact Statement as amended by the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens): "The National Forest Land and Resource Management Plan (Forest Plan or Plan) was developed to guide all natural resource management activities and establish standards/guidelines for the Deschutes National Forest. The Purpose of the Plan is to provide for the use and protection of Forest resources, fulfill legislative requirements, and address local, regional, and national issues and concerns." The Forest Plan provides direction for enhancement of fisheries and wildlife habitat (RP-5). This includes management of woody debris and riparian vegetation to: 1) maintain or enhance stream channel and bank structure, and 2) provide structural fish habitat to meet the objectives for resident fish populations provided for in the Forest Plan (RP-10).
- 1994 Northwest Forest Plan (NWFP): Management objectives of the Aquatic Conservation Strategy of the NWFP include: 1) maintenance and restoration of the physical integrity of aquatic systems, including stream banks; 2) maintenance and restoration of water quality to support healthy aquatic, riparian, and wetland ecosystems; and 3) maintenance and restoration of the sediment regime under which the aquatic system evolved.

Documents Incorporated By Reference

- 1998 Deschutes National Forest Noxious Weed Control EA: "Together, the EA and IWMP (Integrated Weed Management Plan) represent an effort to manage noxious weeds on the Deschutes National Forest in a manner consistent with direction provided in the Regional Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation, its Record of Decision, and the associated Mediated Agreement."
- 1998 Bend Watershed Analysis: Intended to develop a scientifically based understanding of the interaction of processes and landscape patterns within the watershed. The analysis serves as a guide for the type and priority of future restoration and management activities. Management recommendations of the Bend Watershed Analysis (1998) conducted by the Deschutes National Forest included restoring stream stability to Tumalo Creek within the Bridge Creek Fire area.

Management Direction

Forest Plan

The following is a summary of the Management Allocation (MA) associated with the project area as allocated in the Deschutes National Forest Land and Resource Management Plan (Forest Plan):

- **Scenic Views** (MA 9): Provide Forest visitors with high quality scenery that represents the natural character of Central Oregon. The Standards and Guides are oriented primarily towards vegetation management because the visual resource is most often affected by timber management activities with the majority dealing with vegetative changes in the landscape (Page 4-121, Forest Plan).

Northwest Forest Plan

- **Riparian Reserve:** Designated under the Northwest Forest Plan for "restoring and maintaining the ecological health of watersheds and aquatic systems on public lands". Designating Riparian Reserves is a key component of the Aquatic Conservation Strategy described in the Northwest Forest Plan (NWFP). Riparian Reserves are lands along streams, wetlands, unstable areas, and potentially unstable areas where special standards and guidelines direct land use. Riparian Reserve widths from the Northwest Forest Plan will be adopted for this project. Categories of Riparian Reserves that apply to this project are listed below:

Fish bearing streams: Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100 year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest. Tumalo Creek, South Fork of Tumalo Creek, and the small tributary springs are all fish-bearing streams.

Wetlands greater than 1 acre: Riparian Reserves consist of the wetland and: the area to the outer edges or riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland greater than 1 acre, whichever is greatest.

Wetlands less than 1 acre: At a minimum, the Riparian Reserve must include the wetland and the area from the edges of the wetland to the outer edges of the riparian vegetation.

The Bend Watershed Analysis was completed in September 1998, which included the proposed project area. The analysis incorporated 4 sub-watersheds for a total of 61,660 acres, but watershed layers have been changed since that time. The project area now lies within the 37,713 acre 5th field Tumalo Creek watershed (1707030105). The Bend Watershed Analysis identified a trend of decreasing channel and stream bank stability within the Bridge Creek Fire area, and recommended management action to remedy the condition. The proposed project would contribute to restoring the 5th field watershed. Conditions within 2.8 miles of Riparian Reserve along Tumalo Creek would be improved out of the total of 15.5 miles of Tumalo Creek below the confluence with Bridge Creek that are located within the 5th field watershed.

Other Summarized Pertinent Direction Provided For By Law Or Agreements

- **Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands):** Direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands.
- **Programmatic Agreements For Managing Cultural Resources:**
  - 1995 NFS No. 94-06-59-16. Programmatic Agreement Among The United States Department Of Agriculture, Forest Service, Pacific Northwest Region (Region 6), The Advisory Council On Historic Preservation Officer Regarding Cultural Resources Management On National Forests In The State Of Oregon. Appendix B, Ecology, Range, and Watersheds #4. c, e, and f. Undertakings Exempt From Case-By-Case Review.
  - Updated Oregon PA for Forest Service Undertakings and Region 5/CDF/SHPO/CHP PA on Cost Share/Grants for National Fire Plan Implementation. Central Oregon Heritage Group, Projects Exempt from S106 Compliance Review. Archaeological Sites, Exemptions #12, #14, and #29.
  - Management direction for cultural resources is found in the Deschutes National Forest Resource Management Plan, in the Forest Service Manual section 2360, in federal regulations 36CFR64 and 36CFR800, and in various federal laws including the National Historic Preservation Act of 1966 (as amended), the National Environmental Policy Act, and the National Forest Management Act. Existing management is to consider the effects to cultural resources when projects are within the Forest's jurisdiction. Further direction indicates that the Forest will determine what cultural resources are present, evaluate each resource for eligibility to the National Register of Historic Places (Register) and protect or mitigate effects to resources that are eligible.

Botany

- The Botany Biological Evaluation documents the review and review findings of Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) as Endangered or Threatened; (2) designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, FSM 10/89 R-6 Supplement 47 2670.44, and the Endangered Species Act (ESA) of 1973 (Subpart B; 402.12, Section 7 Consultation).
- Proposed Endangered, Threatened, or Sensitive (PETS) plant species considered in this evaluation are those listed in FSM 2670.4 R-6 Interim Directive No. 90-1, April 1999, (for plants) as suspected or documented to occur on the Deschutes National Forest (Appendix A).

- Forest Service Manual (FSM) direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.03, 29 November 1995).

Permits

Limited duration activities are allowed to exceed the standard if a Section 401 or 404 permit has been granted. The following permits have been received for Phase 1 of this project and are filed in the Official Record. Permits for Phase 2 and 3 will be applied for in 2005. Required operating conditions are anticipated to be similar to those issued in 2004.

- Oregon Department of State Lands: General Authorization for Fish Habitat and Wetlands Restoration and Enhancement.
- Department of the Army, Corps of Engineers: Stream and Wetland Restoration.

Public Involvement/Scoping Process Used

A Forest Service letter requesting public involvement was provided in January of 2004 to approximately 55 individuals, businesses, and organizations that have expressed an interest in the project development process. Included in the mailing was The Bulletin, the local newspaper that reported on the proposed actions. The scoping letter was also placed on the United States Forest Service (**USFS**) web site. The proposed Tumalo Creek project was included in the Central Oregon Schedule of Projects in the 2004 spring edition. This notification, through quarterly mailings, reaches approximately 3,200 interested individuals and groups. A field trip was held on June 7, 2004. Nine (9) members of the public attended.

Comments Received

Seven (7) letters, e-mails, or phone comments were received in response to the public scoping of the project that was made available to the public in January 2004.

All comments received have been assessed as to their relevance to each of the resources being addressed within the Tumalo Creek project area. Some comments have been addressed in the proposed action and analysis of the effects of actions. Some comments were used to explore alternatives that were not further developed. Internal Forest Service comments and analysis were also used in the development of alternatives. The following comments were in support of or statements regarding the project:

- Because the damage has been done on Tumalo Creek, we're now faced with a choice of 1) leave it be or 2) fix it. Although we wish we didn't have to, we feel the best approach from a fish/water quality/vegetation standpoint is to go in and fix it.
- Doesn't like the project. What is occurring is a natural event – natural for a stream to migrate.
- In total support of the outlined proposal.
- In general, support stream restoration projects. Urge caution in implementation. Proposal seems overly invasive. Natural ecological processes, such as fire, vegetation succession, flooding, and stream channel movement should all be considered at multiple scales in developing alternatives for this project.

Other Comments And Concerns

Other comments and concerns were identified that are outside the scope of the purpose and need, are opinions, or provide no scientific evidence.

Comment: The use of heavy equipment is likely to cause soil compaction in riparian areas and release sediments loads into the stream that are higher than is occurring now. ***Response:*** *Limiting the number of passes across areas*

of heavy equipment access would not likely cause detrimental soil compaction. Heavy equipment would do most work during low water and within the stream channel. A temporary increase in sedimentation is expected and will decrease as areas of channel and stream bank activities become stabilized. Temporary access routes into the project area are on flat terrain, largely well-drained upslope soils that have been previously disturbed from past restoration projects. The routes would be immediately rehabilitated upon completion of each phase of the project.

Comment: Perhaps a less dramatic use of heavy equipment – combined with replanting, in-stream structures, and manual manipulation – could push this stream in the right direction for stabilization, without taking it all the way to the planned state. In fact, stream dynamics will continue to play a part in shaping this area, and it will be impossible to keep the channel in a static stat that conforms to the project plan. ***Response:*** *It is agreed that stream dynamics will always continue to reshape this area. The fire and subsequent salvage logging in this area altered the dynamics so substantially that the main fork and south fork of Tumalo Creek are quickly converging. The ramifications from these streams converging upstream of the present confluence would likely alter downstream stream dynamics in a way that would threaten private property. The 2.8-mile reach of Tumalo Creek will not be completely restored. To do less, than what is proposed, would not likely meet the purpose and need of long-term stream stability.*

Comment: Very concerned with the important ecological values found in roadless areas. While not far from a road, this section of Tumalo Creek is located in a roadless area of more than 1,000 acres, albeit unprotected as such. Roadless values such as water quality; healthy soils; fish and wildlife refugia; centers for dispersal, recolonization, and restoration of adjacent disturbed sites; reference sites for research; and non-motorized, low-impact recreation should not be compromised in the implementation of this project. ***Response:*** *This project is emphasizing enhancement of stream and riparian habitat, including habitat for fish, wildlife – both vertebrates and invertebrates, and plants. Not only would habitat be improved for terrestrial concerns, habitat in the form of water quality and riparian soils and vegetation would be greatly improved. It is an overall concern to take into consideration the benefits that would be presented for all resources, not just stream health. Care would be taken to protect not only sensitive sites for plants and invertebrates, but cultural sites as well. Low impact recreation, such as fishing and day hiking, would likely be improved over the long term.*

Comment: Avoid timber harvest, roads, mining, development and motorized recreation in roadless areas $\geq$ 1,000 acres or any roadless area adjacent to existing wilderness or parks and all inventoried roadless areas. ***Response:*** *Proposed projects are to disclose the purpose and need of a project, proposed activities, and the effects of the proposed activities to the environment. The scoping letter did not mention timber harvest, mining, development, or motorized recreation. These activities are beyond the scope of the purpose and need of this project.*

Comment: Special status species (Fish and Wildlife) surveys must be completed prior to developing NEPA alternatives and before the decision is determined. On-the-ground field reconnaissance surveys must be done and used to develop NEPA alternatives. ***Response:*** *All surveys, for not only fish and wildlife, but stream, botany and cultural resources as well, have been completed. It is important to provide input on projects from all resources (Interdisciplinary Team) that provides for a multiple resource management plan. Mitigation measures and project design allow for the protection and/or enhancement of habitat, sites, and resources.*

Comment: Project analysis should separately discuss Riparian Management Objectives (under PACFISH and INFISH) and how the proposed alternatives will impact these objectives. Any commercial harvest activities or road construction in key watersheds or municipal watersheds should be avoided in order to protect water quality. ***Response:*** *The project area is outside of the range of lands managed under PACFISH and INFISH. However, it is within the range of the Northwest Forest Plan, which includes Riparian Reserves as a component of the Aquatic Conservation Strategy. Riparian Reserves are discussed on pages 9 and 10. As discussed previously, no harvest or road construction activities are proposed for this project. As part of any project, all proposed activities must be disclosed.*

Comment: A full range of action alternatives should be considered for this project. These alternatives should include wildlife enhancement, restoration, old growth protection (minimum fragmentation), and non-motorized recreation. ***Response:*** *The appropriate range of alternatives has been considered for this proposed project. The following section under Alternative Discussion describes the proposed alternatives and those alternatives that were considered but eliminated from further analysis. This project would be a stream restoration project that will enhance fish habitat. Wildlife habitat would likely be enhanced for the long-term as well, although wildlife habitat restoration is not within the scope of this proposed project. Old growth protection is outside the scope of this project although some large remnant Engelmann spruce (Picea engelmannii) are along the creek with potential for being lost to stream meander and erosion. Recreational use of the immediate project area includes fishing, hiking, cross country skiing, and wildlife viewing. Recreational activities are outside the scope of this project.*

ALTERNATIVE DISCUSSION

This section provides discussion of a no action alternative and one (1) action alternative. A brief discussion of alternatives that were considered and responds to why they were eliminated from further analysis is included.

Alternatives Considered But Eliminated From Detailed Analysis

An alternative was considered but eliminated from further analysis because it did not address channel instability that has occurred since the 1979 fire. The alternative considered placing large wood instream and replanting riparian vegetation throughout the 2.8-mile project area without restructuring the sinuosity, slope, and cross-sectional area in many areas. Instream woody material density would have been similar to numbers observed in reference reaches surveyed in nearby streams. Native riparian hardwoods and conifers would have been planted along stream banks.

This alternative was similar to project activities that were implemented in 1990-92 within the same project area, which emphasized providing overhead cover for fish. This approach failed to address channel and bank instability. Fish habitat, channel conditions, and stream bank conditions have continued to deteriorate. In some areas large woody material accumulated in large, cross-channel jams, resulting in streambed depositional features that resulted in lateral channel migration. Several small projects were undertaken in the early 1990's to plant native vegetation. Planting efforts largely failed because of the channel instability resulting in high bank stress. Monitoring of this earlier effort suggested that a more technical and intense approach was needed to restore Tumalo Creek.

Alternatives Considered In Detail

This section presents a detailed description of the alternatives responding to the "Purpose and Need" that are considered to be reasonable and viable by the Decision Maker (District Ranger, Bend-Fort Rock Ranger District). The discussion that describes the affected environment and resources of the area are summaries of detailed specialist reports found in the Project Record located at the Bend-Fort Rock District Office. Alternative 2 (Modified Proposed Action) is designed to move towards the desired condition consistent with the standards and guidelines of the Forest Plan. **All measurements are approximate.**

Alternative 1 (No Action)

This alternative provides a baseline, which compares relative changes and their effects that would occur with implementation of proposed activities in Alternative 2 (Modified Proposed Action). The existing condition is included under the heading "Affected Environment and Environmental Consequences" for each specialty discussion. Under this alternative, the Forest Service would allow Tumalo Creek to continue to develop as is presently occurring. No stream stabilization activities would occur. Current conditions and trends would likely remain unchanged with selection of the No Action Alternative.

Alternative 2 (Modified Proposed Action)

Approximately 2.8 miles of Tumalo Creek have been identified for proposed stream restoration activities. **Table 2 page 15,** provides proposed activity summaries. Refer to **Table 2, page 15** for description and objectives of treatments.

Table 1: Alternative 2 (Modified Proposed Action)	
Restoration Activity	**Alternative 2 (Modified Proposed Action)**
Length of Stream From Bridge to Bridge	3.0 miles
Length of Stream Proposed for Restoration	2.8 miles
Length of Stream to be Located Outside of Existing Channel (Mainly within remnant channels)	0.53 miles/19 percent of 2.8 miles
Log Jam Structures*	77
Log Jam with Vane Structures*	33
Boulder Cross Vanes*	5
Boulder J-Hook Vanes*	5
Side Channels	4
Side-channel Pools w/Debris Jams*	9
Tree and Shrub Planting/Grass Seeding (Acres)	12
Tree and Shrub Planting (Number)	40,000

*** Reference diagrams in Appendix D, page 69.**

The proposed action has been developed to restore hydrologic function and stability of Tumalo Creek between the confluence of Tumalo Creek/Bridge Creek to the Skyliner road bridge (FS 4601) near the Skyliner Lodge. The proposed action would be implemented in multiple phases to restore nearly 2.8 miles of stream. The degree of proposed restoration would vary throughout this 2.8-mile project area based on the current level of instability and the degree of deviation from reference conditions **(Table 3, page 18)**. The restoration design was developed using the range of reference values to best match the topography and existing conditions that would minimize disturbance and cost while achieving a stable channel.

Approximately 81 percent of the channel would remain in the existing channel. The design of the remaining 19 percent of the channel would be located outside of the existing channel, primarily following old meander scars, which indicate previous channel flow. The average deviation of the new channel from the existing channel as measured at the apex of the meander bend is 83 feet with a range of 41 feet to164 feet.

Various structures would be utilized to mimic natural stream features. Material from off site (boulders and trees with root wads) would be used for the structures. Installation would include approximately 77 log jam complex structures, 33 log jam complexes with log vanes, 5 boulder cross vanes, and 5 boulder j-hook vanes.

Logjam complex structures would be located in lower gradient meandering Rosgen C type channels and in most meander bends. The design would consist of five (5) or more key log pieces integrated together to mimic natural structures. A key log would be greater than 18 inches in diameter and greater than 50 foot in length. To prevent downstream movement of these key logs during high flow events, 50 to 80 percent of each key log would be buried into the bank or streambed, and would be overlapped with other key pieces to increase stability. Key pieces are designed to provide a frame or foundation for the additional wood that is wedged in-between the key pieces. The complexes are designed to collect new wood transported down stream and protect stream banks from erosion and meander migration.

Log and boulder structures (Boulder J-hook Vane and Cross Vane) would be located in steeper gradient Rosgen B type channel reaches. The stream substrate is dominated by cobble size substrate. The structures dissipate stream energy downward through the streambed rather then lateral on the banks, which occur in a meandering C type

channel, also creating plunge pools. These structures, along with proper stream dimensions, pattern, and profile, provide a stable stream environment.

Approximately four side/overflow channels would be created to provide flood flow energy dissipation, high flow refugia for fish, low flow fish rearing habitat, wetlands, and wildlife habitat. These channels would be protected from stream recapture by constructing log jam complexes at the mouth and at several locations along the channel. The jams would contain three (3) or more key log pieces that are 12 inches or greater diameter and 50 feet or greater in length, that are keyed into the bank with 50 to 80 percent of the log buried. These key pieces are designed to fully span the side channel and provide a frame or foundation for additional wood that is wedged in between the key pieces (Appendix D – pg 71).

Implementation of the design would include using heavy equipment such as excavators and front-end loaders. Four (4) equipment access locations to the channel have been identified. The equipment would follow the stream channel margins, crossing where necessary, to perform the channel restoration work. The front-end loader and/or excavator would shuttle boulders and logs to the stream edge and move on site depositional material. The excavator would relocate large woody material, move gravel and cobble depositional material, and place boulder and log structures. Some unstable streambanks would be sloped back and pools would be excavated. Dump trucks and log trucks would be used to haul boulders and trees to designated stockpile locations along Forest roads 4601 and 4603.

Access routes would be rehabilitated through scarification, raking, spreading of brush and downed wood, reseeding, and replanting. Native plant species, approved by Deschutes National Forest botanists, would be used for revegetation and reseeding activities.

Approximately 40,000 riparian shrub and tree species, that are indigenous to the drainage, would be planted adjacent to the stream totalling approximately 12 acres. Seed and stock would be taken from on-site when possible. If not available, seed or stock would be taken from nearby locales within the same drainage. If seed or stock is not available at or near site, a source would be utilized from the appropriate Central Oregon seed zone. No non-native species or non-seed zone species would be planted. The plant species designated for planting are Engelmann spruce (*Picea engelmannii*), western larch (*Larix occidentalis*), mountain alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), various willow (*Salix* spp.), Douglas spiraea (*Spiraea douglasii*), black cottonwood (*Populus trichocarpa*), twinberry *(Lonicera involucrata),* serviceberry *(Amelanchier alnifola.),* three currant species *(Ribes lacustre, cereum, and viscosissimum.),* Quaking aspen (Populus tremuloides), and various sedges (*Carex spp*.) and native grasses.

Implementation would occur during the fall, when soils are drier and stream flow is reduced. All applicable Water Quality Best Management Practices would be adhered to. Project implementation would be in accordance with the conditions listed in the Oregon Department of State Lands (DSL) and Army Corps of Engineers Fill/Removal permits. **Table 2** describes the proposed restoration activities.

Table 2: Description of Proposed Restoration Activities

Activity Type	Design	Objectives
Stream Channel Relocation	Approximately 81 percent of the channel would remain in the existing channel; 19 percent would be located outside of the existing channel. New channels would mostly be located in old meander scars, indicators of previous stream flow.	Developed using the range of reference values to best match the topography and existing conditions to minimize disturbance and cost while achieving a stable channel.
Log Jam Structures	Placed in lower stream gradients and, in most cases, in meander bends. Designed with 5 or more key log pieces greater than 18 inches in diameter and >50 foot in length, with 50-80 percent of the log buried in the bank. Key pieces would provide a	Designed to catch and store wood as new wood is transported down the stream. These structures protect banks in C type channel from bank erosion and meander migration through energy dissipation in meander bends.

Table 2: Description of Proposed Restoration Activities		
Activity Type	**Design**	**Objectives**
	frame or foundation for additional wood wedged between the key pieces (Figures 1,2, pg 69-71).	Provide fish habitat. These log and boulder structures along with proper stream dimensions, pattern, and profile provide a stable stream environment, allow riparian vegetation to establish, and recruit large wood.
Boulder Structures	Boulder J-hook vane and Cross-vane: Placed in the steeper gradient sections where stream substrate is dominated by cobble size material. Three to four foot diameter boulders would be used. (Figure 3, pg 72).	Dissipate stream energy downward through the streambed rather then lateral on the banks. Occur in a meandering B type channel. Plunge pools mimic nature and provide bank stability, bed elevation control, and create fish habitat.
Side Channels	Protected by log jam complexes from the main stream at the mouth and several locations along the side channel. Designed with 3 or more key log pieces greater than 12 inches in diameter and >50 foot in length, with 50-80 percent of the log buried in the bank. Key pieces would fully span the side channel and provide a frame or foundation for additional wood wedged between the key pieces. Side channels would include pools dug downstream from logjams. The excavated material could be used in narrowing the side channel and securing the logjam.	Provide flood flow energy dissipation, high flow refugia for fish, low flow rearing habitat, wetlands, and wildlife habitat. The pools would add to the complexity of the stream system and create fish rearing, invertebrate, and wildlife habitat.

Gentiana newberryi (Newberry Gentian), a plant species on the Regional Forester's sensitive list, has historically been present in the project area. Apparently, floods during the past ten years have eliminated at least two of three known populations. At present it is uncertain if any population continues to exist in the project area. It is proposed to re-introduce or supplement what Newberry Gentian may still exist with new plants. Re-introduction would most likely involve seed collection and propagation and planting a site that is likely to support this species.

EXISTING CONDITION AND ENVIRONMENTAL CONSEQUENCES

The Existing Condition and Environmental Consequences section provides the scientific and analytical basis for alternative comparison. Probable effects are discussed in terms of environmental changes from the current condition and include qualitative as well as quantitative assessments of direct, indirect, and cumulative effects. This section describes the beneficial and/or adverse impacts to the environment that would occur if the various alternatives were implemented.

For more detailed and supporting documentation, please refer to the following specialist reports in the Appendices in the Official Record located at the Bend-Fort Rock District Office.

Appendix A: Hydrology Report
Appendix B: Fisheries Report
Appendix C: Cultural Report
Appendix D: Botany Report

Other supplemental and/or supporting documentation is located in the appendices of this EA and are referred to in the appropriate discussions within the Existing Condition and Environmental Consequences section of this environmental assessment.

MITIGATION MEASURES (Design Criteria) and BEST MANAGEMENT PRACTICES

Alternatives are designed to be consistent with the desired condition specified in the Forest Plan and the standards and guidelines contained within. Many Forest Plan Standard and Guidelines were applied in the design of the alternatives and are not listed here. The following Mitigation Measures and Best management Practices would be applied to reduce or prevent undesirable effects to resources. If implementation or layout problems or opportunities are encountered, the appropriate specialist will be consulted.

Mitigation Measures

Fisheries

1. To have the least impact on fisheries, follow the Oregon Department of Fish and Wildlife instream work period guidelines of July 1 – October 31 as described in the fill and removal permits issued by the Army Corps of Engineers and the Oregon Division of State Lands. Exceptions to these time periods require specific approval from the Corps and State of Oregon.
2. The contractor hired for instream work would be required to operate equipment in a manner as to minimize damage to the streambed and the streambank. A Forest Service hydrologist or Fisheries Biologist would monitor the contractor's actions at all times.
3. Heavy equipment would take frequent breaks from instream operations during the workday to allow turbidity levels returns to normal levels within 15-30 minutes after the equipment ceases to operate.
4. Use existing roads, whenever possible. Rehabilitate new temporary access routes immediately following completion of project activities.
5. Adhere to requirements of the fill/removal permits issued by the Army Corps of Engineers and the Oregon Division of State Lands.

Wildlife

6. When the newly created habitat is in a suitable condition for the Crater Lake tightcoil snail, survey bi-annually for a period of 10 years following completion of each phase of the project. Monitoring would help determine the presence of and how quickly the species may be able to migrate into these new habitats.
7. To protect a golden eagle nest site near the project area, there shall be no disturbing activity such as continued operation of heavy equipment during the nesting period of February 1 – July 31, per the forest plan (LRMP standard and guideline WL-3). This standard and guideline requires a ¼ mile buffer for the nest site, but due to the openness of the area, a line of sight buffer is recommended.

Botany

8. All equipment used will be clean, and free of obvious weed parts.
9. All equipment leaving the site will be washed prior to its next assignment.
10. Monitor for two years following project completion, map new weed sites, and treat weeds as necessary.

Cultural

11. Known cultural sites within proposed units would be flagged for avoidance prior to implementation of proposed activities. Establish a fifteen-meter buffer zone around the site that would be potentially affected by proposed restoration activities.
12. During sub-surface positioning of logs for wood structures, a professional archaeologist would be on-site during ground disturbing activities to monitor areas of known sites and for the presence of buried deposits of cultural resources.
13. If cultural sites were found during project implementation, ground-disturbing activities would cease until the site is evaluated. Following evaluation, the project could continue by 1) site avoidance; 2) data recovery prior to work continuance; or 3) modification of work activity to reduce or eliminate the effects.

Scenic

14. To protect scenic resources: large woody material would be placed in a manner that mimics natural accumulations; boulders would be of the color and size representative of Tumalo Creek; the majority of boulders used instream would be underwater and arrangements would resemble naturally occurring structures.

Best Management Practices

To protect water quality and riparian resources, General Water Quality Best Management Practices (BMPs) and Deschutes National Forest Land and Resource Management Plan, and NWFP Standards and Guidelines (S&G) would be adhered to during project implementation. Applicable BMPs, and S&Gs are listed below (FP = forest plan, NWFP = Northwest Forest Plan):

1. Servicing and Refueling of Equipment (BMP T-21): Service and refueling areas shall be located away from streams and wet areas to prevent pollutants such as fuels and lubricants from being discharged into streams.
2. General Guidelines for the Location and Design of Roads (BMP R-1): Design, locate, and clearly define access routes and material staging areas so as to minimize the area of disturbance. Equipment movement outside of these areas will not be allowed (FP S&Gs SL-5 and RP-20). Minimize temporary road locations in Riparian Reserves (NWFP S&G RF-2a). Minimize passes of equipment on designated access routes. There are 3 anticipated entry or exit points, which would be the width of the equipment, approximately 10 feet. The travel routes would total approximately 1500 feet in length.
3. Timing of Construction Activities (BMP R-3): Equipment should only be operated when the ground conditions are such that excessive damage would not occur. The disruption to the hydrologic flow paths, including the interception of surface flows, would be minimized (NWFP S&G RF-2e). Stream access would occur in early fall (September/October) when soil moistures are the lowest and would result in the least damage (compaction, puddling)
4. Obliteration of Temporary Roads and Landings (BMP R-23): The temporary roads for project activities would be rehabilitated following activity completion when conditions are favorable. Rehabilitation actions could include scarification, raking, spreading downed wood, reseeding with native seed stock, and transplanting trees. Areas not successfully revegetated would be treated until stabilized. To discourage the public from driving these routes, place logs onto designated access routes, taking into consideration the visual appearance. (FP S&G SL-1, SL-5, RP-20).
5. Protection of Wetlands (BMP W-3): Wetlands adjacent to the stream would be avoided as much as possible. Access routes would be designated to minimize impacts to wetland areas as much as possible (FP S&G WT-1).
6. Oil and Hazardous Substance Spill Contingency Plan and Spill Prevention Control and Countermeasure (SPCC) Plan (BMP W-4): A hazardous spill contingency plan would be required prior to implementation. The plan identifies a course of actions to be taken in the event of an accidental spill.

Hydrologic Resource

WATER RESOURCES AND STREAM MORPHOLOGY

Existing Condition:

Table 3, page 19 displays the comparison of a few of the features of physical reference condition, acquired from pre-fire/salvage aerial photos, fish habitat surveys, reference stream surveys, and reference stream surveys. Other more complex reference measurements can be found in the Hydrology specialists report in Appendix A, Official Record. With a natural disturbance and without salvage logging large wood debris could have exceeded 200 to 300 pieces per mile as dead trees fell and accumulated in the stream channel. The large wood and wood jam complexes, that naturally exist in this type of low gradient stream system, dissipate energy in the meander bends, helping reduce bank erosion and maintaining a stable channel pattern and profile. Downed wood on the floodplain also dissipates flood flow energy when flows exceed stream banks, such as during rain-on-snow events.

The channel width reference condition ranges from 30 to 35 feet with an average of 31 feet; the existing condition ranges from 31 to 100 feet with an average of 45 feet. The width/depth ratio reference condition ranges from 14-19, averaging 16; the existing condition ranges from 17-181 with an average of 41. The reference condition of large wood (greater than 20 inches in diameter; greater than 35 foot long) is 110 to 140 pieces of per mile; the existing condition, the results of the 1979 and the subsequent riparian area salvage logging left 19 pieces per mile of instream wood.

Table 3: Reference* and Present Conditions of Tumalo Creek		
Stream Characteristics	**Reference Conditions (Average)**	**Present Conditions (Average)**
Stream Width (Feet)	30 to 35 (31)	31 to 100 (45)
Width/Depth Ratio (Feet)	14:1 to 19:1 (16:1)	17:1 to 181:1 (41:1)
Large Woody Debris (Pieces Per Mile)	110 to 140	19

A majority of the stream reach is unstable, the channel is widening, and meander migration is lengthening the channel causing more erosion and channel changes than pre-fire conditions. The excessive erosion and associated channel movement does not allow riparian vegetation to become established and mature to provide the necessary root strength and future large wood recruitment to create a stable channel. With the lack of large wood and proper channel pattern, dimension, and profile the system is continuing to degrade and increasing the risk of nearby stable tributaries and wetlands.

Turbidity is usually relatively low with seasonal increases during spring snowmelt, rain on snow, or heavy storm events. Stream banks and unstable hill slopes along Tumalo Creek and the tributary stream Bridge Creek contribute sediment during these times. The average summer temperatures rarely exceed 60 F. During the winter, extensive icing occurs within the channel.

Water temperatures remain relatively cool in Tumalo Creek, even in the summer months, generally less than 60º F. Although there is no continuous water temperature record before the fire, it is anticipated that summer water temperatures have increased and winter water temperatures have decreased with the loss of streamside cover.

The Rosgen classification of streams is based on morphology to set categories of discrete stream types so that consistent, reproducible descriptions and assessments of condition and potential can be developed. Assessments can be extrapolated to similar stream reaches across geographic ranges (Rosgen, 1996). A streams behavior can be predicted from the morphological data gathered, providing a reference for restoring streams that are not "behaving" as they should. Some of the natural factors that determine how a stream "behaves" are slope, valley width and sideslope, flow regimes, and parent geological materials. Using the Rosgen classification system, the stream would be classified as a "C-4" channel type, with some intermittent "C-3" or "B-3", under natural, undisturbed conditions (Refer to page 2 of the Hydrology Report, Official Record, for a detailed discussion of the classifications).

Excessive stream bank erosion is causing the stream system to become overloaded with sediment, resulting in an increase in the width/depth ratio within the "C-4" channel reaches. Small reaches within the project area are beginning to transform to a "D" channel, considered unstable (Rosgen, 1996).

In other areas, downcutting of the channel has resulted in "F" channel types, which are incised and unable to properly utilize the floodplain during high flow events. Vertical, unstable stream banks are typical of this stream type.

The results of intensive field surveys conducted during 2003 are provided in **Table 4, page 20** showing the existing percentage of the various Rosgen stream types. Even though 29% is a "C" stream type the average width to depth ratio is 27, which is wider and shallower than the reference condition of 14-19. Existing conditions and reference conditions can be found in Appendix D of the Hydrology Report.

Table 4: Existing Rosgen Stream Types Within Tumalo Creek.	
Rosgen Stream Type*	**Percent by length**
B_3	3.5
B_4c	7.5
B_3c	2.6
C_4	29.4
D_4	30.2
F_3	13.1
F_4	13.8
Total	**100.0**

* **Rosgen Stream Types: C-4 channel types –** well-developed floodplains, slightly entrenched, sinuosity generally greater than 1.4, slope of less than 2%, riffle/pool sequences, width/depth ratio generally greater than 12:1, dominant substrate is gravel. Aggradation/degradation processes are active. Rates of lateral migration are influenced by the presence and condition of riparian vegetation. Changes in bank stability, watershed condition, or flow regime that cause an exceedance of a channel stability threshold can significantly alter and de-stabilize channels of the "C" type stream. **B channel types –** moderately entrenched, have low channel sinuosity, have a width/depth ratio greater than 12:1, lack pools, and generally rapids with pocket water. Streambank erosion and aggradation/degradation rates are low. **D channel types** – braided, very high width/depth ratios, excessive deposition, high streambank erosion rates, and poor fish habitat, and considered unstable. **F channel types** – entrenched stream that does not allow flood flows to access the flood plain.

Aerial photographs (1959, 1979, 1981, and 2000) were used to evaluate changes that occurred prior to and after the fire. Data obtained from the 2003 field surveys were used to compare with aerial photo data. The 1979 photo was used as baseline for data (and to be utilized in the restoration design) because the photo was taken following the fire and before salvage logging had taken place. **Table 5** provides channel length, slope, and sinuosity values for the various years. A 1.4 percent change occurred between 1959 and 1979. A 3.2 percent change occurred from 1979 to 2000, more than doubling the 20 years prior to the fire, indicating channel instability. The 2003 channel values are believed to be an over estimate because of the precision used to get the numbers compared to the aerial photos. However, they do indicate a continued deviation from 2000.

Table 5: Aerial photograph measurements of channel length, slope, and sinuosity and the percent deviation from the 1979 aerial photo.						
	Channel			**% Deviation from 1979**		
Aerial Photo	**Length (ft)**	**Slope (ft/ft)**	**Sinuosity**	**Length**	**Slope**	**Sinuosity**
2003*	15746.7	0.0136	1.28	5.4	-5.1	5.4
2000	15427.0	0.0139	1.25	3.2	-3.1	3.2
1981	14999.7	0.0143	1.22	0.4	-0.4	0.4
1979	14941.5	0.0143	1.21	0.0	0.0	0.0
1959	14738.6	0.0145	1.20	-1.4	1.4	-1.4

* 2003 data obtained from on the ground surveys.

Alternative 1 (No Action)

Direct and Indirect Effects: Lack of riparian vegetation development and wider and shallower channel dimensions would cause an increase in the surface area for solar radiation. The increase in solar radiation would increase summer water temperatures and winter water temperatures would decrease with an increase in surface area and decrease in depth. Turbidity and movement of stream bed material would remain higher than pre-fire levels as streambanks would continue to erode as the channel moves across the valley. Over a period of several decades, some eroding streambanks may eventually heal naturally and sediment would be reduced from these areas. Other areas may not heal naturally in the foreseeable future, and sediment inputs would continue to be above historic levels at these areas. Water temperatures would be expected to remain above that of pre-fire levels until vegetation matures.

The project area would either remain in a functioning at risk – downward or non-functioning system (e.g., if it becomes entrenched). The channel would remain in an unstable condition. The dimension, pattern, and profile would remain out of balance. The width/depth ratio would continue to increase, and the channel would continue to braid and aggrade behind channel-wide logjams.

Alternative 2 (Modified Proposed Action)
Direct and Indirect Effects: The proposed activities would reduce bank and stream bed erosion, reduce the loss of wetlands, improve water quality, reconnect the creek to the floodplain, restore riparian vegetation, and improve fish habitat.

Hydrologic stability would be achieved by restoring the appropriate channel dimension, pattern, and profile identified from reference stream condition, and would be neither aggrading or degrading. The width/depth ratio would be restored for the proper stream type. Braided areas (D-4 channel types) would be converted to single channel "C-4" types. Sediment would be transported through the system. Entrenched "F" type channel would be reshaped and reconnected to the floodplain to form either a narrower, steeper "B" type channel or a lower gradient meandering "C" type channel. The stream channel would be lengthened by approximately 390 feet, the stream gradient would be decreased from 1.36 percent to 1.33 percent, and stream energy would be decreased.

Wood and rock structures would be used to create the necessary roughness to protect the banks from eroding while allowing flood flows to access the flood plain and dissipate stream energy. Overflow- and side-channels would also allow for stream energy dissipation and allow riparian vegetation to become established. Implementation of the proposed treatments would result in a trend of Tumalo Creek being a functioning at risk – upward system in the short term. Some of the structures would create plunge pools that would mimic natural pools.

Instream equipment work would temporarily increase stream turbidity above the state standard of 10 percent above background levels. Increases in turbidity would be observable for approximately 1-2 miles downstream from the project area. Domestic use of Tumalo Creek (most water rights owners are 0.5 mile or more downstream of the downstream end of the project area) may experience increased turbidity during periods of instream equipment work. Work would be halted every 2-3 hours for 15-30 minutes, which would regularly reduce stream turbidity. Turbidity would decrease to background levels within 30 minutes after removal of equipment from the stream channel, based on observation of past instream restoration projects.

Fall implementation, when soils are less moist and stream flows are reduced, would decrease impacts to soils and vegetation and facilitate effective instream equipment operation.

Cumulative Effects: Long term turbidity and bedload movement would be expected to decrease throughout the entire length of Tumalo Creek as streambanks are stabilized. Turbidity peaks, with high flow events, would be decreased with improved bank stability.

Streambank stabilization would lead to increased streamside vegetation. As the vegetation matures, shading of the stream would increase, which would decrease summer water temperatures and raise winter temperatures. In the long term, the stream should reach proper functioning condition.

WETLANDS AND FLOODPLAINS
Existing Conditions: Tumalo Creek flows into and meanders across a glacial outwash valley bottom. Within this valley bottom, approximately 100 acres of wetlands can be divided into two main wetland types: 1) scrub shrub and (2) emergent (Cowardin, et. al. 1979). A shrub type wetland is located throughout the valley with it being narrower at the upper end and widens out as the stream gradient decreases and the valley widens. The shrub components consist primarily of mountain alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), various willow (*Salix* spp.), and Douglas spiraea (*Spiraea douglasii*). Engelmann spruce and white fir are scattered throughout this brush component. The depth to groundwater ranges from 1-5 feet with the vegetation becoming saturated and inundated

with water every 1-2 years. As the valley widens, stream gradient decreases, and the ground water is closer to the surface an emergent wetland vegetation occurs that consists of various sedges (*Carex spp*.) and native perennial grasses. The emergent depth to groundwater ranges from 1-3 feet with vegetation becoming saturated and inundated with annual springime flows.

Ponderosa pine, lodgepole pine, and brush species are established on interspersed dry rises within the floodplain. Several springs and beaver ponds have created a diverse wetland between Tumalo Creek and Forest Road 4603. The floodplain width varies from 200-600 feet.

Tumalo Creek has widened from an estimated average of 32 feet to 45 feet (Table ***B, page 15). This equates to a loss of 13 feet of stream bank/riparian habitat or 3.25 acres of associated wetlands within the 2.8 mile project area.

Log jams have caused water to backup and use a high flow channel at the upper end of the project area. All flows have been re-routed down the high flow channel since 2001 or early 2002. The change in flow to the high flow channel has decreased the stream length from 800 to 600 feet (25 percent) and increased the gradient, causing the channel to downcut and widen from approximately 19 feet to 35 feet or more. The newly created channel comes within approximately 25-30 feet of the South Fork of Tumalo Creek (South Fork) approximately one half mile upstream from the current confluence. The distance between the two channels is decreasing with a high risk that two channels will merge and the South Fork would carry the main stem flows.

A high risk exists on another meander that would drain beaver ponds and spring water directly into the main channel. The side stream that currently drains the ponds and springs is approximately 0.3 miles downstream from the meander. The distance of bank separating the nearest pond and mainstream channel is 7.5 feet with a water elevation difference of 2.5 feet (pond is higher). Approximately 63 percent (11.5 feet) of the stream bank was lost between 1999 and 2000.

Alternative 1 (No Action)

Direct and indirect Effects: Degradation and loss of wetlands and riparian areas would continue at a higher rate than pre-fire due to a decrease of stream bank stability. The stream bank loss estimate does not take into consideration the amount of wetlands and riparian habitat being lost due to channel migration and the lowering of the water table caused by channel entrenchment. This post salvage increase in the rate of wetland and riparian loss through channel widening and meander migration is expected to continue.

Failure of unstable logjams, with associated large amounts of deposition that presently span the channel, may result in the channel becoming incised (downcut). Downcutting would likely result in the water table to lower approximately 2-3 feet. This could result in draining and/or shrinking the wetland and changing wetland species composition. If the channel becomes incised, the stream would not be able to dissipate floodwaters onto the floodplain effectively. Lowering of the water and streambed elevation is expected to cause emergent vegetation to become shrub vegetation as the water table drops.

If the main stem is routed down the South Fork, which is lower in elevation than the main stem, the 13 foot wide channel would most likely widen to at least 32 feet would probably reach an average width of 45 feet because of channel instability. If the South Fork channel reaches a width of 32 feet, bank loss would correspond to a loss of 1.7 acres of riparian habitat and wetlands.

The meander bend near the spring/beaver dam complex will continue eroding until it creates a new confluence for this spring water approximately 0.3 miles upstream of the current confluence. The new confluence would drain water that is currently maintaining approximately 15 acres of wetlands.

Alternative 2

Direct and Indirect Effects: The proposed restoration activities would re-establish floodplain connectivity by eliminating entrenched stream sections. The stream would not become downcut because of the proper placement of wood and rock structures (hydraulic controls). There would be short-term (2 years) adverse affects to floodplain vegetation and soils as a result of heavy equipment crossing the floodplain and working within the stream. Vegetation would be crushed and soils compacted along the travel routes for equipment, approximately 1500 feet in length and 10 feet wide, affecting less than one-half acre. The floodplain would continue to function in the short-term in having the ability to dissipate floodwaters. Adherence to mitigation measures **(Page 15)** would minimize short-term effects to soils and vegetation. Proposed activities would have no long-term, adverse affects to floodplains.

Restoring the channel to a stable sinousity and width to depth ratio would impact approximately 1-2 acres of wetlands. The current rate of wetlands and riparian loss would be stabilized. The restoration activities would create, restore, and enhance approximately 20-80 wetland acres.

Cumulative Effects: Restoration of the stream to a stable system would allow the stream to utilize its floodplain during high flow events. The wetland water table would be maintained through a stable stream channel.

Fisheries Resource

Existing Condition:

FISH AND AQUATIC INVERTEBRATE POPULATIONS: Tumalo Creek historically supported native inland Columbia basin redband trout (*Oncorhyncus mykiss gairdneri*), and is speculated to have supported bull trout (*Salvelinus confluentus*). Under existing conditions, fish species inhabiting the proposed project area are rainbow trout (*Oncorhynchus mykiss*), and eastern brook trout (*Salvelinus fontinalis*), the latter being more abundant. Surveys indicate an approximate ratio of 75 percent brook trout and 25 percent rainbow trout. Tumalo Creek was stocked 1948 to 1972 with rainbow and brook trout (ODFW, 1996). The present fish populations self-sustaining. There has likely been some hydridization between rainbow and the native redbands. This has been observed in other areas in the Upper Deschutes Basin based on genetic analysis. The genetic status of the Tumalo Creek rainbow is not known at this time.

Surveys conducted by the Forest Service and Oregon Department of Fish and Wildlife (ODFW) during the past 15 years indicate that the majority of the fish sampled are relatively small (less than 8 inches total length). Brook trout reproduce at high rates and can overpopulate a lake or stream. The spring high water flow regime favors the fall spawning brook trout over the spring spawning rainbow trout, because higher flows can dislodge eggs buried in stream gravels. Fishing use within the proposed project area is low.

There are several habitat features within the project area that would be favorable to sustaining a population of bull trout, should an introduction attempt be made. Cool water temperatures throughout the year are within the range preferred by bull trout. Water temperatures drop during the fall and winter (2 to 4 degrees Celcius (C)) within the ranges conducive to initiate spawning and provide egg survival. Instream large woody debris densities are likely below historic densities. Rearing habitat and refuge from high flows exist in tributary springs and beaver ponds. . Spawning gravels are abundant, but survival of embryos may be limited by fine sediment volumes within and downstream of the proposed project area. The fluctuating streamflows, including the occasional fall rain-on-snow event when embryos would be buried in the gravel, may limit the sustainability of a bull trout population in Tumalo Creek. In addition, the well-established population of the brook trout may preclude any introduction efforts due to the high potential for hybridization with this non-native species.

Aquatic macroinvertebrate monitoring indicates a diverse and abundant invertebrate community. Samples collected from 1991 to 1998 indicated a decreasing trend in abundance and diversity until 1996. An increase corresponds to floods during 1995 and 1996. Gravel interspace habitat used by macroinvertebrates were likely flushed of fine

sediment, providing more available space. Primary production and invertebrate abundance can be reduced by fine sediment, affecting available forage for fish (Meehan, 1991). Macroinvertebrate populations vary from year to year, and can be responsive to spring flushing periods. There are no known threatened, endangered, or sensitive species present within the proposed project area.

HABITAT CONDITIONS: Within the project area, the lack of pool habitat is a major habitat feature likely limiting the fish population. Pools are important habitat for resting, hiding, and feeding. Spawning typically occurs in the gravels of the tail-out of a pool. A 1996 three (3) mile stream survey observed that 86.4 percent of the habitat type units were riffle, 7.1 percent pools, and 5.4 percent braided channels.

Streambank erosion and a widening of the channel are evident throughout the proposed project area. Undercut banks for overhead cover are nearly non-existent. The 2003 summer surveys of width/depth ratios revealed a range of 17.1 to 84.8, indicating a channel that has become grossly over-widened, shallower and less diverse. Water temperatures generally increase as width/depth ratios increase, but changes may be offset by an increase in shade as the canopy matures. Past monitoring has indicated that summer water temperatures rarely exceed 13º C. Rainbow and brook trout generally prefer temperatures less than 20 to 21º C, but can tolerate higher temperatures for limited durations (Scott and Crossman, 1973). Preferences and tolerances vary with populations.

The presence of instream large woody material (LWM) is a key ecological component of streams, and functions in the following ways: 1) provides fish with overhead protection from predators; 2) initiates scour in the streambed resulting in pools, which are important feeding/resting areas; 3) retain spawning gravels; 4) serve as habitat for aquatic invertebrates that fish prey upon; 5) and supply nutrients for aquatic plants. Most of the potential LWM recruitment from the streambanks was lost in the fire and subsequent salvage logging. Pine trees, approximately 20-30 feet in height and 8 inches diameter at breast height, are occasionally being undercut and falling into the stream. These trees are too small to provide ideal fish habitat or improve channel stability. The 1996 survey documented 109 pieces of LWM per mile, 19 pieces per mile greater than 12 inches diameter (West, 1996), despite the efforts that restored several hundred trees to the channel in 1990 to 1992. In undisturbed reaches upstream of the proposed project area, densities averaged 180 pieces per mile, including 69 pieces per mile greater than 12 inches diameter and 35 feet long (Ptomey, 1993). Much of the LWM placed within the project area in 1990-92 is now in accumulations at the margin of the channel, and was not included in the survey count. These accumulations would be available as fish habitat only when bankfull flows are exceeded.

Riparian vegetation is an important element of channel stability and fish habitat, providing: 1) leaf detritus (nutrient supply); 2) insect production (nutrient supply); 3) overhead cover; 4) shade; 5) insulation during cold winter months; 6) and bank stability (Meehan, 1991). The riparian zone is also important in controlling the amount of sediment and nutrients reaching the stream from upslope sources. Riparian vegetation in the project area is dominated by mountain alder and willow, having difficulty re-establishing on streambanks due to channel instability. Plants are continually undercut and uprooted. The mountain alder underwent a period of die-back from an unknown cause, but in recent years has re-sprouted from the roots.

During May, 1979, a cursory stream survey was completed on Tumalo Creek two months prior to the fire, including the proposed project area (Satterthwaite, 1979). Streamside cover was primarily old growth conifers and alder. Shade was estimated to be moderate (40 to 60 percent). Pool habitat was estimated to be 10 to 20 percent. The best fish habitat was found in pools below woody debris accumulations and beneath undercut banks. The fish population was assessed as low density.

Alternative 1 (No Action)

Direct and Indirect Effects: Without restoration activities, fish habitat, including redband trout habitat, would be expected to decline as the channel becomes less stable, the stream width/depth ratio increases, and habitat decreases. Riparian vegetation would continue to have difficulty re-establishing due to channel instability. Established riparian vegetation would continue to become undercut and uprooted. Fine sediment volumes would

increase with accelerated bank erosion, decreasing egg/embryo success within spawning areas and filling pools. Cover would continue to decline as LWM decays or moves downstream during flood events. Some hiding cover would be replaced from upstream LWM.

Macroinvertebrate habitat would be expected to decline and community abundance and diversity decrease with an increase in fine sediments in the substrate. Populations would undergo fluctuations in abundance and diversity with differences in annual flow regimes, climate, and other variables. There would be a downward trend in populations over time, reducing available fish forage.

Alternative 2

Direct Effects: The Biological Evaluation (Appendix A, page 37) determined that the project would have beneficial effects to redband trout and their habitat. Channel restoration would increase the abundance, diversity , and quality of salmonid fish habitats throughout the 2.8-mile reach, including that of the sensitive species redband trout.

Wood and boulder structures would provide pool habitat for fish and invertebrate habitat. Pool habitat would increase from a present condition of approximately 7 percent of the proposed project area to 15-20 percent, approximating pre-fire conditions. The increase would primarily be pools created at the outside of meander bends associated with newly created logjams. An increase in fish spawning habitat would occur as pool habitat, and the associated tail-outs, are increased.

The decrease in the width/depth ratio from an average of 41 to an average of 14-19 would increase available fish habitat. An increase in stream depth would increase available streambed to be occupied by fish. The increase in large woody material from the present 19 pieces per mile to over 100 pieces per mile (>12" diameter and 35 feet long) would increase hiding cover for fish and maintain depth in pools. The placement of smaller pieces of wood intertwined with large pieces would add complexity and diversity to habitat. Instream woody material also provides habitat and forage for the aquatic invertebrate community, such as insects, crustaceans, and flatworms. Placement of large wood structures and J-hook boulder structures would reduce erosion of stream banks, allowing development and re-establishment of newly planted riparian plant species.

Approximately 1500 feet of new or improved side channel habitat would be created within the project area, including the placement of large wood structures for habitat. Rearing habitat for juvenile fish, especially the fry life stage, would be improved. The side channels would provide refugia from predators and high stream flows.

The reduction in stream bank erosion and the stabilization of the channel would reduce the inputs of fine sediments (<0.25" diameter). The increase in turbidity and suspended sediments associated with instream equipment work would temporarily decrease foraging opportunity for fish and may cause some gill abrasion to fish. The aquatic invertebrate populations would be temporarily reduced. The diversity and abundance of invertebrate populations reduced from operation of heavy equipment should quickly recover after project completion (1-2 years) because of the short life cycles of most species. The equipment would take frequent breaks from operating during the workday. Past projects have shown that turbidity returns to normal levels within 15-30 minutes after the equipment ceases to operate.

Indirect Effects: Channel restoration activities would reduce the input of fine sediments by several hundred cubic yards annually. The fish population within the proposed project area is expected to increase over time with an improvement in habitat. The actual increase is unpredictable.

Fine sediments would be flushed out of the gravels in areas the heavy equipment instream work, improving habitat long-term for invertebrates and spawning gravels for fish. The relatively steep gradient and stability of the channel downstream of the proposed project area would be expected to carry sediments through the stream with limited deposition.

As the riparian community and associated forest matures, the increase in shade would lead to cooler water temperatures. Biological productivity in the stream, which is already partially limited by cool temperatures, would decrease to pre-fire levels. Decreased sunlight would inhibit the growth of algae and other periphyton that are an integral part of the food web. Aquatic invertebrate community structure may change with an increase in shade. Populations of species dependent on algae may decrease. Populations of species that collect or gather organic matter may increase.

Cumulative Effects: The Bridge Creek Fire, associated timber salvage, and the modified flow regime to meet irrigation and drinking water demands have adversely affected fish and fish habitat. The proposed activities would restore fish habitat damaged in the fire and subsequent salvage operation.

Present activities include a road paralleling the project area, trail system, and associated recreational use. The proposed action would not have cumulative adverse effects that may be occurring to fish or fish habitat as a result of these uses. The proposed activities would reduce overall erosion and sedimentation that is occurring within the project area. With an improvement in fish habitat and fish populations, recreational fishing would be expected to improve.

The proposed activities would not increase any adverse effects that may occur as a result of any potential future silvicultural and fuels activities, such as ponderosa pine thinning and brush clearing on the valley slopes and valley bottom within the Bridge Creek Fire area.

Wildlife Resource

Desired Condition: The desired condition for this project area is to provide a functioning, stable, stream and riparian habitat condition for the diversity of wildlife species that utilize it.

Existing Condition: A wide variety of wildlife species utilize the habitat immediately adjacent to and surrounding the Tumalo Creek Bridge to Bridge Restoration Project. Because riparian areas such as this provide three essential survival elements for wildlife (food, cover, and water), nearly 80% of terrestrial wildlife species are either associated or dependent upon these areas to meet their habitat needs. Mammals such as deer and elk are commonly found in these areas, along with many avian species, some of which are totally dependent upon this riparian habitat. These areas also provide a tremendous amount of biomass (small rodentia) to the food web and provide habitat for amphibians and Survey and Manage mollusk species. Several specially designated wildlife species or their habitats are applicable to the proposed project area. Designations include Management Indicator Species, Ecological Indicators, and Species of Concern.

THREATENED, ENDANGERED, CANDIDATE, SENSITIVE, PROPOSED, AND SPECIES OF CONCERN: Sixteen species of wildlife (ten birds, four mammals, one amphibian, and one mollusk species) classified as threatened, endangered, candidate, sensitive, or proposed, Table 6, page 26 may occur on the Bend/Ft. Rock Ranger District. The proposed project area was evaluated to determine which species might occur based on the presence of required habitats and known locations. The following wildlife/habitats have been reviewed ("x", na = not applicable) to determine if the project/activity would have any negative effects on listed, proposed, candidate or sensitive species in order to meet the requirements for a biological evaluation. Several field reviews have occurred with past projects on Tumalo Creek. Only those species or habitats with an "X" occur within or adjacent to the project area and could potentially be affected by the project/activity.

Table 6 lists threatened, sensitive, candidate, and species of concern animal species that are either known to occur or may potentially occur on the Bend-Ft Rock District of the Deschutes National Forest.

Table 6: Threatened, Endangered, Candidate, Sensitive, Proposed, And Species Of Concern			
Species	**Common Name**	**Federal Classification***	**Status**
Mammals			
Gulo gulo luteus	California wolverine	S, SOC	N/A
Lynx canadensis	Canada lynx – Lynx Analysis Unit	T	N/A
Lynx canadensis	Canada lynx – Key Lynx Area	T	N/A
Martes pennanti	Pacific fisher	C	N/A
Sylvilagus idahoensis	Pygmy rabbit	S, SOC	N/A
Birds			
Agelaius tricolor	Tricolored blackbird	S	N/A
Bucephala albeola	Bufflehead	S	N/A
Centrocercus urophasianus phaios	Greater sage grouse	S, SOC	N/A
Coturnicops noveboracensis	Yellow rail	S	N/A
Falco peregrinus anatum	American peregrine falcon	S	N/A
Haliaeetus leucocephalus	Northern bald eagle	T	N/A
Histrionocus histrionicus	Harlequin duck	S, SOC	N/A
Podiceps auritus	Horned grebe	S	N/A
Podiceps grisegna	Red-necked grebe	S	N/A
Strix occidentalis caurina	Northern spotted owl	T	N/A
Strix occidentalis caurina	Northern spotted owl Critical Habitat	T	N/A
Strix occidentalis caurina	Northern spotted owl Nesting, Roosting, Foraging Habitat	T	N/A
Amphibians			
Rana pretiosa	Oregon spotted frog	C	N/A
Mollusk			
Pristiloma arcticum crateris	Crater Lake tightcoil snail	S	X

T=Threatened, **S**=USFS Region 6 Sensitive, **C**=USFWS Candidate species, **SOC**=USFWS Species of Concern

Crater Lake tightcoil snail

Existing Condition: Suitable habitat exists for the Crater Lake tightcoil snail, a recently listed sensitive species (previously a Survey and Manage Species). Field surveys for the Crater Lake tightcoil snail (*Pristiloma arcticum crateris*), were conducted on May 16th, June 3rd, and October 15th, 2003, within the proposed project area and was found on two of the visits. This is the only known stream system that is occupied by the Crater Lake tightcoil snail on the Bend/Fort Rock Ranger District. Suitable habitat consists of wet habitat on the undersides of woody debris, among mosses, rushes and other low vegetation. Suitable habitat would be considered as very stable, perennially wet riparian edges around wetlands, springs, seeps and streams and damp forest floor litter, especially where it has accumulated at the bases of shrubs and against logs (Duncan et al 2003). Only areas with constant water levels that create perennially saturated habitat year-round are suitable, and may be occupied (per discussion between Mark Lehner, USFS biologist and Nancy Duncan, BLM biologist).

Much of the area that would be restored is not considered perennially saturated habitat throughout the year. Many areas of the riparian habitat have changed to a dry condition from downcutting of the stream.

Alternative 1 (No Action)

Direct and Indirect Effects: Management would continue under current Forest Plan direction. There would be no effect to threatened, endangered, proposed, candidate, sensitive, or specially designated species. Long term, additional erosion of stream banks would result in the continued loss of streamside and riparian vegetation that many wildlife species use. This would be especially critical to the Crater Lake tightcoil snail, which spends its lifetime in riparian areas. Habitat and species loss would continue to occur, possibly separating populations of the snail along this stream.

Alternative 2 (Modified Proposed Action)

Direct and Indirect Effects: Approximately 1-2 acres of wetland habitat would be impacted by the implementation of this project. Approximately 20 feet of this is perennially wet, with the rest being seasonally wet areas that are not suitable habitat. It is likely that some suitable habitat and individuals of the Crater Lake tightcoil snail would physically be destroyed during restoration work along the stream banks, having a short-term, negative effect on the snail population. Long-term, restoration activities would help to create additional suitable habitat and create a more stable stream system, benefiting population viability for the future along this stream system.

MANAGEMENT INDICATOR SPECIES, SPECIAL HABITATS, ECOLOGICAL INDICATORS, AND SPECIES OF CONCERN: The following wildlife/habitats, **Table 7**, have been reviewed to determine if the project/activity will have any negative impacts on LRMP Management Indicator Species (MIS), Northwest Forest Plan species and habitats, ecological indicator species, special habitats, and Eastside Screens species and habitats. Only those species or habitats with an "X" occur within or adjacent to the project area and could potentially be impacted by the project/activity. Those marked with "na" do not apply to the project area.

Table 7: Management Indicator Species

MIS Species/Habitats:

Deer
- Transition Rng. - X
- Summer Rng. - na
- Winter Rng. - na
- Fawning Habitat – X

Elk
- Transition Rng. – X
- Summer Rng. - na
- Winter Rng. – na
- Calving Habitat – X
- Key Elk Habitat- na

Raptors - X
Woodpeckers - na
Great Blue Heron - na
Waterfowl- na
California Wolverine – na (See BE)
American Marten - na
Western Big-Eared Bat - na
Logs/Down Wood spp. - na
**Special Habitats - X

Species of Concern (USFWS)

Northern Goshawk - na
Black Tern – na
Harlequin Duck – na (see BE)
Olive-Sided Flycatcher - na
Tri-Colored Blackbird – na (see BE)
Western Sage Grouse – na (see BE)
Ferruginous Hawk – na
Pygmy Rabbit – na (see BE)
Pacific Western Big-Eared Bat – na
Small-Footed Myotis – na
Long-Eared Myotis – na
Long-Legged Myotis -na
Yuma Myotis – na
Fringed Myotis – na

California Wolverine- na (see BE)
Pacific Fisher- na (see BE)
Preble's Shrew – na
Northern Sagebrush Lizard – na
Tailed Frog – na
Cascades Frog – X

Northwest Forest Plan:

Snags – na (matrix)
Course Woody Debris – na (matrix)
Riparian Reserves - X
Late Successional Reserves - na
Green Tree Retention – na (matrix)
LOS Retention – na (matrix)
Bats – na (matrix)

Eastside Screens (sales only): na

Northern Goshawk - na
Riparian - na
LOS Forest - na
Connectivity - na
Logs/Snags - na

*** Note**: northern spotted owl, peregrine falcon and bald eagle are addressed by the BE. Includes golden eagle, northern goshawk (also a SOC), red-tailed hawk, Cooper's hawk, sharp-shinned hawk, great gray owl, and osprey. **** Note:** Special habitats include: caves, cliffs, old-growth forest, riparian, wetlands, and snags.

Alternative 1 (No Action)
Direct and Indirect Effects: There would be no impacts to Management Indicator Species, Special Habitats, Ecological Indicators, and Species of Concern. In the long term, additional erosion of stream banks would result in the continued loss of streamside and riparian vegetation, lowering the quality of this habitat and reducing the number of species that could utilize the habitat.

Alternative 2 (Modified Proposed Action)
Direct Effects: The disturbance created by human activity and operation of the heavy machinery would have short-term impact on local wildlife species. Most animals would be able to avoid the area during the duration of the project. Restoration activities would occur during the fall for three (3) seasons, taking place when there are no conflicts with nesting birds or breeding amphibians. Most wildlife species are preparing or are in the process of moving to wintering habitats.

When complete, new habitat would have been created and the stream habitat would be stabilized, providing more suitable riparian habitat with a higher overall water table. It is expected that there would be a 20-40 percent increase in the number of acres of wetlands created, restored, and enhanced.

GOLDEN EAGLE: A historic golden eagle nest site is located over 0.25 miles outside of the project area but, because of the openness of the area, the nest occurs within 0.5 mile line-of-site. The reproductive season for golden eagles is February 1 to July 31. This project would take place during the fall, outside of the reproductive season for golden eagles. No direct impacts are expected to occur.

NEOTROPICAL MIGRATORY BIRDS: Shrub habitat for the willow flycatcher and yellow warbler occurs adjacent to the stream. This project would remove some of this habitat, but it would occur outside of the nesting season. No direct impacts are expected to occur to neotropical migratory birds.

CASCADES FROG AND WESTERN TOAD: Breeding habitat is available either within or adjacent to Tumalo Creek. Project activities would occur within habitat but would occur outside of the critical breeding and egg laying period for these species. No direct impacts are expected to occur to these amphibians.

Indirect Effects: Short term, restoration activities would remove habitat adjacent to the stream. Long term, activities would help to create additional riparian/wetland habitat and a more stable stream system. Deer and elk that utilize the area during the fawning and calving period would benefit from the long term increase of cover adjacent to the stream. More nesting habitat would be created for neotropical migratory birds with riparian stabilization. Amphibians would benefit from improved side channel habitat and reduced stream bank erosion.

This project would benefit wildlife species by creating a more stable stream environment that will improve and increase riparian habitat acres.

Cumulative Effects: Stabilization of the stream channel would benefit species located downstream with a reduction in stream bank erosion and associated loss of riparian habitat. The proposed activities would reduce the effects that have resulted from the Bridge Creek Fire, although any effects from outside the project area would continue. The long-term effects would be similar immediately upstream with the gradual reduction of headcuts that, if not restored, could change riparian habitat.

Cultural Resources

Desired Condition: The desired condition can be derived from the implied goals of the Forest Plan Standards and Guides and the Monitoring Plan: 1) Know the location and extent of all cultural resources; 2) Evaluate each site for eligibility to the National Register of Historic Places (Register); and 3) Develop management plans for eligible properties to provide protection for the resource.

Existing Condition: A GIS analysis for previous surveys and sites was completed for the current project. The analysis shows the planning area has been previously surveyed. Four sites are located in the project area and could potentially be affected by the undertaking. The sites have not been evaluated and are potentially eligible for the Register.

Alternative 1 (No Action)

Direct and Indirect Effects: This is the current management alternative. Under this alternative none of the proposed actions would be implemented and there would be no restoration impacts to cultural resources. The probability of continued erosion could potentially affect cultural resources. Previously unknown sites that are currently below the ground surface could be exposed or washed downstream, destroying sites.

Alternative 2 (Proposed Action)

Direct and Indirect Effects: There are four known cultural sites within the project area. Three of these sites are not within the project activity areas and would have no direct, indirect, or cumulative effects to them. The remaining site lies adjacent to an activity area.

Restoring hydrologic function and stability to Tumalo Creek would prevent the site adjacent to activities from being potentially destroyed by erosion and high water events associated with stream flow. The proposed stream restoration activities are not expected to affect cultural resources if mitigation measures are followed. A fifteen-meter buffer zone surrounding this site would have no ground disturbance from project activities **(Mitigations, page 17)**.

Cumulative Effects: Excavating to position trees and rock structures below the ground surface could potentially damage unknown cultural sites and/or associated components.

The alternatives would be expected to have no effect on cultural resources if mitigation measures are followed (Mitigations, page 16).

Botany Resource

PROPOSED, ENDANGERED, THREATENED, AND SENSITIVE (PETS) SPECIES

Proposed, Endangered, Threatened, or Sensitive (PETS) species considered in this evaluation are those listed in FSM 2670.4 R-6 Interim Directive No. 90-1, March, 1991 as suspected or documented to occur on the Deschutes National Forest. The following twenty-six plants **(Table 8, page 31)** are currently on the Regional Forester's Sensitive Species List (May 13, 1999) for the Deschutes National Forest, Bend/Fort Rock Ranger District.

Table 8: Regional Forester's Sensitive Species List – Deschutes National Forest				
Scientific Name	**Common Name**	**Listing Status[1]**	**Bend/Fort Rock Ranger District[2]**	**Probability in Project Area**
Agoseris elata	Tall agoseris	ONHP List 2	S	Low
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress	Species Of Concern ONHP List 1	---	No
Arnica viscosa	Shasta arnica	ONHP List 2	D	No
Artemisia ludoviciana ssp. *estesii*	Estes' artemisia	Species Of Concern ONHP List 1	D	Low
Aster gormanii	Gorman's aster	Species Of Concern ONHP List 1	S	No
Astragalus peckii	Peck's milk-vetch	Species Of Concern ONHP List 1	S	No
Botrychium pumicola	Pumice grape-fern	Species Of Concern ONHP List 1	D	No
Calamagrostis breweri	Brewer's reedgrass	ONHP List 2	S	Low
Calochortus longebarbatus var. *longebarbatus*	Long-bearded mariposa lily	Species Of Concern ONHP List 1	S	Low
Carex hystricina	Porcupine sedge	ONHP List 2	S	Low
Carex lasiocarpa var. *americana*	Slender sedge	ONHP List 2	D	Low
Carex livida	Pale sedge	ONHP List 2	S	Low
Castelleja chlorotica	Green-tinged paintbrush	Species Of Concern ONHP List 1	D	No
Cicuta bulbifera	Bulb-bearing water-hemlock	ONHP List 2ex[3]	S	No
Collomia mazama	Mt. Mazama collomia	Species Of Concern ONHP List 1	S	No
Gentiana newberryi* var. *newberryi	**Newberry's gentian**	**ONHP List 2**	**D**	**Moderate**
Lobelia dortmanna	Water lobelia	ONHP List 2	S	No
Lycopodiella inundata	Bog club-moss	ONHP List 2	S	Low
Lycopodium complanatum	Ground cedar	ONHP List 2	S	Low
Ophioglossum pusillum	Adder's-tongue	ONHP List 2	S	Low
Penstemon peckii	Peck's penstemon	Species Of Concern ONHP List 1	S	No
Pilularia americana	American pillwort	ONHP List 2	S	No
Rorippa columbiae	Columbia cress	Species Of Concern ONHP List 1	S	Low
Scheuchzeria palustris var. *americana*	Scheuchzeria	ONHP List 2	D	Low
Scirpus subterminalis	Water clubrush	ONHP List 3	S	No
Thelypodium howellii ssp. *howellii*	Howell's thelypody	ONHP List 2	S	No

[1] **Species of Concern:** Federal Designation; neither Endangered or Threatened; **ONHP (Oregon Natural Heritage Program) List 1:** Contains species which are endangered or threatened throughout their range or which are presumed extinct; **ONHP List 2:** Contains species that are threatened, endangered or possibly extirpated from Oregon, but more common or stable elsewhere; **ONHP List 3:** Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range; **ONHP List 4:** Contains species of concern that are not currently threatened or endangered.

[2] **D:** Documented; **S:** Suspected.

[3] **Ex** = taxa extirpated from Oregon.

Existing Condition: Resources used to identify potential sensitive plant habitat were aerial photo interpretation, soil resource inventory information, vegetation map information, as well as personal knowledge of the project area. Tumalo Creek has received formal and numerous informal surveys. Surveys were conducted in 1990 and 1991 along the creek. Three *Gentiana newberryi* (Newberry's Gentian) sites were originally found in 1990 within the project area along Tumalo Creek. Two sites, originally estimated to be 25-50 feet from the edge of Tumalo Creek, were swept away in mid-1990s flood events. No other PETS plants and habitat have been found within the project area.

The Newberry's Gentian site that was not swept away is small, less than 20 plants (Pat Joslin, personal communication, 12/10/03), is about 15 feet from the creek's edge and is being invaded by an aggressive seeded grass called intermediate wheatgrass (*Elytrigia intermedia*). A visit in June 2004 did not find this site. It is not clear what has happened to the population. The area is fairly dry and it is possible that continuing down cutting by the stream has lowered the water table to the point where Newberry's Gentian cannot survive.

Alternative 1 (No Action)
Direct and Indirect Effects: There are no known direct or indirect effects to the Newberry's Gentian population from not implementing the proposed action and allowing Tumalo Creek to function as it presently is. Erosion could allow high water events to wash away Newberry's Gentian populations. Down cutting could dry up the areas where populations could or may exist. It is also likely that this remaining population is being weakened by the incursion of the non-native wheatgrass at the site, making it more vulnerable to disturbances.

Alternative 2 (Modified Proposed Action)
Direct, Indirect, and Cumulative Effects: There are no anticipated adverse effects to the Newberry's Gentian population with implementation of the proposed action. Stabilization of the creek channel would likely benefit the known population, removing the threat of being eroded out of existence. Wheat grass would likely continue to compete for on-site resources.

Stabilization of the creek channel would likely benefit Newberry's Gentian habitat by providing areas for colonization that would not be eroded or flooded. By stabilizing the water flow, the water table would rise to where populations could re-establish.

NOXIOUS WEEDS

Existing Condition: There are noxious weeds present within the Tumalo Creek floodplain between the day use area and the bridge near the OMSI Skyliner Lodge, as well as unusually high numbers of a weedy exotic species. The noxious species are spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), and dalmation toadflax (*Linaria dalmatica*). The knapweed is by far the most prevalent noxious weed species present; there are scattered populations along the main road running adjacent to the creek, at both bridges, and in a few locations adjacent to the creek. The toadflax is present in one spot off the road. The Canada thistle is present in scattered locations along both sides of the creek (not adjacent to the creek, however) in wet meadow situations. There is a biocontrol agent (*Urophora carduii*) present in at least one population that has had some success in controlling the thistle.

An unusual situation exists in the project area in that perhaps the most prevalent exotic there, growing essentially all along the length of the creek within the project area, is not a noxious weed but the common dandelion (*Taraxacum officinale*). This species is not a problem elsewhere on the Bend/Ft. Rock ranger district.

Alternative 1 (No Action)
Direct and Indirect Effects: There would be a moderate-risk for the introduction and spread of noxious weeds without stream restoration activities. General vehicle use on the main road through the floodplain and occasional

power line access would allow noxious weeds to invade the project area. Weed management would continue to occur in this area (herbicide use, manual pulling, biocontrol agents released as necessary).

Alternatives 2 (Modified Proposed Action)
Direct, Indirect, and Cumulative Effects: Proposed stream restoration activities would provide a high-risk for the spread of noxious weeds in the planning area. The project area may be directly or indirectly affected should weed seeds and/or parts be accidentally introduced by heavy equipment or in ground that would be disturbed and harboring noxious weed seeds. It is likely that the dandelion populations present will flourish with the ground disturbance that will occur with the project; it is improbable that these plants can be entirely avoided, because they are so prevalent.

The main road is treated with herbicides when necessary. The Canada thistle site has had a Biocontrol agent present for several years, which seems to be working. It does not appear that machinery will be working within known noxious weed sites.

Cumulative Effects: It is likely that the native shrub and tree plantings proposed with the project will help shade out dandelions and any other weeds that may be present. However, the ongoing use of the main road, as well as the occasional use of the power line service road, will ensure that the threat of weed introductions remains fairly high. This is independent of the proposed project.

Prevention Strategy: Prevention of noxious weeds is always the preferred strategy because it is most effective and least costly. In this case, cleaning of equipment is the form of prevention being used.

Recreation Resource

Existing Condition
Developed Recreation **–** There are no developed recreation sites within the planning area.
Dispersed Recreation **–** Dispersed recreation activities include fishing, hiking, cross-country skiing, and wildlife viewing. There are no dispersed campsites within the project area. A camping restriction of 200 feet within the stream is in place between Skyliner Bridge and Tumalo Falls. Some increase in recreation use has likely occurred due to the increase in population and recreation popularity of central Oregon and the Deschutes National Forest. Fishing is the primary summer recreational use of Tumalo Creek in the project area. Most visitors are destined for the Tumalo Falls area.

Some use occurs from educational groups. The Cascade Science School is sponsored by the Oregon Museum of Science and Industry. The school hosts youth-based outdoor education sessions, within and adjacent to the project area. The school operates out of the Skyliner Lodge, occupied under a special use permit issued by the Deschutes National Forest. The majority of the sessions are held during the spring and summer.

Alternative 1 (No Action)
Direct and Indirect Effects: There would be no long-term change to dispersed recreation opportunities. Current dispersed use levels would be expected to increase. It is possible that some dispersed recreational activities could become more limited in the immediate project area with continued erosion along stream banks and meandering of the stream. A new confluence between the South Fork of Tumalo Creek and Tumalo Creek could change fish habitat by increasing stream flow and widening that would reduce stream depth. Recreational fishing would be expected to decrease as fish habitat decreases. Over a period of time, recreational fishing would increase if fish habitat improved naturally.

Alternative 2 (Modified Proposed Action)
Direct, Indirect, and Cumulative Effects: Cascade Science School students, fishermen, or other recreationists may be displaced in the short-term while the project is implemented. Implementation would be expected to benefit

recreational fishing in the long term by improving fish habitat, which is expected to increase the fish population. In the long term, the Cascade Science Schools may have the opportunity to incorporate the project activities into their educational curriculum. The Cascade Science School will be involved in project monitoring.

Scenic Resource

Affected Environment: The area along Tumalo Creek is managed for Scenic Views under the Deschutes National Forest Land and Resource Management Plan. Landscapes seen from selected travel routes and use areas are managed to maintain or enhance natural appearing landscape characteristics. Under the Scenic Management System[4], noticeable deviations to the landscape must blend with the landscape character of the area being viewed over the long-term (5 years and beyond). Wildfires and subsequent human activities have led to current vegetative conditions that do not meet expectations of visitors. The area had historically been a forest setting. It is now open with young trees and shrubs dominating the foreground views. The middleground and distant viewing areas of the landscape dominate along travel corridors. The existing Scenic Integrity Level within the planning area is classified as Low Scenic Integrity (moderately altered landscape character), equivalent to the Visual Resource Management System (VMS) classification of Modification.

Alternative 1 (No Action)

Direct and Indirect Effects: Under this alternative, the entire length of the project area would not be managed, altered or changed by any management activity. Scenic resources would change only as a result of natural occurrences, or other management actions. Erosional forces would continue at an accelerated rate, potentially leading to the loss of streamside vegetation, including trees. Long stretches of eroding stream bank may be objectionable to some viewers. Access and travel management would remain as is. Forest Plan direction and the Desired Future Condition for Scenic Resources would not be met.

Alternative 2 (Modified Proposed Action)

Direct and Indirect Effects: To the casual observer, results of activities either will not be evident or will be visually subordinate to the natural landscape. Re-routing of the channel would appear natural. The proposed activities are expected to enhance views from the stream corridor for both the short- and long-term. Improved stability of streambanks would result in long term improvement in the vegetative character of the riparian zone, which is more visually acceptable to most viewers than actively eroding streambanks. In the short-term (approximately 3 years), browse protection for plants from big game would be visible and may be objectionable to some users. In the long-term, plant protection devices would either bio-degrade or be removed.

Public Health and Safety

Proposed activities in Alternative 2 would improve public health and safety by reducing loss of downstream, private land. No significant adverse effects to public health or safety have been identified. The effects of implementation of the alternative are well known, not highly controversial, and do not involve any unique or unknown risks. Effects meet or exceed state water quality standards.

Prime Lands

There are no lands within the planning area that are classified as prime farm or rangelands. Proposed activities in Alternative 2 (Modified Proposed Action) would not change areas classified as prime forestland. There would be

[4] The Forest Service has adopted a national policy of using the Scenery Management system (SMS) to describe objectives for scenic resources and visual quality. In addition to retaining many of the basic inventory elements of the Visual Management System (VMS), the newer and updated SMS incorporates an understanding of both natural and human processes that have occurred over time. It provides land managers with a tool for integrating human values with ecosystem management. See "Landscape Aesthetics: A Handbook for Scenery Management" (USDA Agriculture Handbook Number 701, December 1995).

no direct, indirect, or cumulative adverse effect to these resources and thus are in compliance with the Farmland Protection Act and Departmental Regulation 9500-3, "Land Use Policy".

Civil Rights and Environmental Justice

Civil Rights legislation and Executive Order 12898 (Environmental Justice) direct an analysis of the proposed alternatives as they relate to specific subsets of the American population. The subsets of the general population include ethnic minorities, disabled people, and low-income groups. The purpose of the analysis is to determine whether adverse civil rights impacts are anticipated on an underrepresented population. The analysis is to determine also whether disparate or disproportionate impacts associated with the alternatives are anticipated. The benefits from stream restoration does not discriminate between subsets of the general population.

Compliance With State and Local Laws

Implementation of Alternative 1 (No Action) or Alternative 2 (Modified Proposed Action) would be consistent with relevant Federal, State and local laws, regulations, and requirements designed for the protection of the environment including the Clean Air and Clean Water Act. None of the alternatives establishes a precedent for future actions or a decision in principle about a future consideration.

Other Effects and Findings

No designated roadless areas, old growth stands, prime farmland, Wild and Scenic Rivers or parkland would be adversely affected by the proposed activities. No significant irreversible or irretrievable commitment of resources would occur under Alternative 2 (Modified Proposed Action). There would be some negligible irretrievable losses of fugitive dust caused by mechanical operations. There would be an irretrievable loss of sediment over the long term under Alternative 1 (No Action), as existing, unstable stream banks would continue to erode. Fish habitat would likely continue to be degraded with the continuation of headcuts, stream widening, loss of large woody instream cover, and the loss of associated invertebrate forage.

Proposed stream restoration management activities are consistent with the Record of Decision for the Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation and the subsequent Mediated Agreement of 1989 (Refer to Appendix D of the project files at the Bend-fort Rock Ranger District office for further information and a discussion of other National Forest Management Act findings).

Alternative 2 (Modified Proposed Action) is consistent with the goals, objectives and direction contained in the Deschutes National Forest Land and Resource Management Plan and accompanying Final Environmental Impact Statement and Record of Decision dated August 27, 1990 as amended by the Regional Forester's Forest Plan Amendment #2 (6/95) and Inland Native Fish Strategy.

Alternative 2 (Modified Proposed Action) is consistent with the goals, objectives and direction of the Aquatic Conservation Strategy and Riparian Reserve Standards and Guidelines contained in The Northwest Forest Plan (1994). The proposed action is designed to improve the existing conditions of the Riparian Reserves by stabilizing the channel of Tumalo Creek and promoting riparian vegetation establishment.

The Tumalo Creek Bridge to Bridge Restoration Project meets all applicable Project Design Criteria as described in the 2003-2006 Joint Aquatic and Terrestrial Programmatic Biological Assessment. A biological assessment (BA) and/or Level I review are not required.

Compliance with National Forest Management Act (NFMA) Requirements: Alternative 2 is consistent with Forest-wide standards and guidelines, Management Area prescriptions and general management requirements. Forest-wide, habitat improvement work will be pursued based on the contribution of the work to fishery objectives and targets. Improvement work would adopt measures to protect other resources as needed (Deschutes Land and

Resource Management Plan August 1990 FI-4). Within Scenic View Management Areas the results of project activity would not be evident or would be visually subordinate to the natural landscape. (Deschutes Land and Resource Management Plan August 1990 M7-3).

The analysis of effects on species viability found the following: This project is expected to have beneficial effects to *Gentiana newberryi* (Newberry gentian) and redband trout.

This document supports practices that are consistent with direction from the February 3, 1999 Executive Order on Invasive Species (Executive Order #13112). This order requires federal agencies to use relevant programs and authorities to prevent the introduction and spread of invasive species.

Wildlife

If this project proceeds, short-term effects could be direct loss of Crater Lake tightcoil individuals and loss of a small amount of suitable habitat. Long-term effects would be the creation of habitat and a more stable system to reduce/prevent additional loss of habitat from stream bank erosion. If this project does not proceed, there would continue to be short and long-term loss of habitat and species.

To provide long-term habitat for a healthy population of Crater Lake tightcoil snails throughout this lower section of Tumalo Creek, this project must proceed as planned. Otherwise, habitat and species loss would continue to occur, possibly separating populations of the snail along this stream.

LIST OF PLANNING PARTICIPANTS

This section identifies the Forest Service personnel who participated in the analysis and the preparation of the EA. For a list of organizations and individuals contacted during the scoping process, refer to the project file located at the Bend-Ft. Rock Ranger District.

Interdisciplinary Team

Tom Walker	District Fisheries Biologist/Team Leader
David Frantz	Writer/Editor
Lewis Wasniewski	Hydrologist
Shelley Borchert	Wildlife Biologist
Charmane Powers	Botanist
Lucy Hamilton	Archeologist
Gini Stoddard	Geographical Information Systems

Agencies Consulted

Oregon Department of Fish and Wildlife (ODFW)

Personal References

Joslin, Pat, Botanist, Bend/Ft. Rock Ranger District, personal communication 12/10/03.
Milano, Gary, Region 6 Plant Sighting Report for *Gentiana newberryi,* 7/26/90

APPENDIX A

FISHERIES

BIOLOGICAL EVALUATION (BE)

BIOLOGICAL EVALUATION
FISH SPECIES

Tumalo Creek Bridge to Bridge Restoration EA

Summary of Findings:
Redband trout (USFS Region 6 Sensitive Species)
Alternative 1 – May Impact Individuals or Habitat (MIIH)
Alternative 2 – Beneficial Impact (to habitat)

It is Forest Service policy to avoid all adverse impacts to threatened and endangered species and their habitats, except when it is possible to compensate adverse effects through alternatives identified in a biological opinion rendered by the U.S. Fish and Wildlife Service. Measures are to be identified and prescribed to prevent adverse modification or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (FSM 2670.31). Through the biological evaluation pocess (FSM 2672.4), actions and programs authorized, funded, or carried out by the Forest Service are to be reviewed to determine their potential for effects on threatened and endangered species and species proposed for listing (FSM 2670.31). Species classified as sensitive by the Forest Service are to be considered in the National Environmental Policy Act process by conducting biological evaluations to determine their potential effect of all programs and activities on these species (FSM 2670.32). No impacts may be allowed on sensitive species that would result in loss of population viability or create significant trends toward federal listing. The findings of biological evaluations are to be documented in a decision notice, or if applicable, in official files.

The Deschutes National Forest 2003-2006 Programmatic Biological Assessment (BA) established Project Design Criteria to be applied to all projects for listed and candidate species. The goal is to fully implement the criteria to achieve conservation and recovery objectives of Federally listed, proposed, and candidate species so that special protection measures under the Endangered Species Act are no longer necessary.

The following biological evaluation assesses the effects of the proposed action for the Tumalo Creek Bridge to Bridge Restoration Project.

Location and Habitat Description
The Tumalo Creek Bridge to Bridge Restoration project area encompasses approximately 3 miles of Tumalo Creek between Skyliner Bridge and the upper bridge near Tumalo Falls. The entire project area is within the Bridge Creek Fire area. The stream habitat type is predominanatly riffle, with some pools and glides. The substrate type is composed of cobbles, gravels, sand, and boulders. The gradient is 1-2%. Discharge is composed of substantial spring input. Snowmelt is a significant contributor during the spring months. Rain on snow events that cause minor flooding are not uncommon. The canopy is composed of ponderosa and lodgepole pine 20-30 feet in height. Refer to the Environmental Assessment for more detailed information.

Description of Alternatives
Alternative 1: The No Action alternative.

Alternative 2: The proposed action would use heavy equipment to reshape the stream channel, add 400-500 pieces of wood/mile, add boulder structures, and plant approximately 14,000 shrubs and trees/mile. The proposed action is designed to reduce restore channel stability, reduce streambank erosion and associated sediment input, reduce the width-depth ratio, improve fish habitat, and improve riparian vegetation conditions. Heavy equipment such as excavators and front end loaders would place tree and boulder structures, and reshape the channel to achieve the objectives. Varying degrees of restoration would occur within the 2.8 mile reach. More detailied descriptions are available in the Environmental Assessment.

PRE-FIELD REVIEW FOR AQUATIC SPECIES (Habitat Evaluation)
One species of fish listed on the Regional Foresters Sensitive Species List may occur within the project area. **There are no known threatened, endangered, proposed, or candidate fish species within the project area**. The proposed project area was evaluated to determine which species might occur based on the presence of required habitats and known locations. Bull trout are suspected to have once occupied Tumalo Creek, but there is no reliable documentation. The nearest bull trout population is over 30 river miles downstream in the Deschutes River near Lake Billy Chinook. Due to the distance to the nearest bull trout population, mitigation measures protecting water quality in the action alternative, and the impoundment of

the river at Bend which would entrap any suspended sediments generated from the project and alter water quality, there will be no effect to bull trout from any alternative. The project is consistent with the Project Design Criteria (PDC) for bull trout except for it allows operation of heavy equipment within a Riparian Reserve (required for instream work) and the timing of instream work, which is scheduled for the low flow period of fall. For reasons listed above, there will be no effect to bull trout or their habitat although inconsistent with these PDC's.

TABLE 1. THREATENED, ENDANGERED AND SENSITIVE SPECIES

The following fish species listed as sensitive by the Forest Service may occur within the project area:

SPECIES

Redband trout
(Oncorhyncus mykiss gairdneri)

STATUS:

U.S. Fish and Wildlife - not listed
U.S. Forest Service Region 6 - sensitive species
State of Oregon - sensitive species (SV)

HABITAT:

The redband trout has habitat requirements similar to other salmonids. There are both fluvial and adfluvial populations. Optimal water temperatures are 54-64 degrees Fahrenheit, but they have been known to survive temporary exposure up to 85 degrees. In the stream environment, they seek cover provided by large woody material, undercut banks, boulders, depth, and turbulence. They can be found in desert stream environs as well as those with forested canopies. They require clean gravels for spawning, preferably in the 0.25" - 2.0" range.

PRE-FIELD REVIEW:

Dr. Robert Behnke, fish geneticist, has divided the rainbow trout into three major groups. The redband is considered an inland version of the rainbow trout. The redbands of Central Oregon are included in the Columbia River Basin sub-group. Recently, genetic analysis has been completed on redbands at several locations in the Deschutes River upstream of Bend. The genetic purity seems to have been significantly altered at some locations from interbreeding with hatchery rainbow. Hatchery rainbow were routinely stocked in Tumalo Creek until 1972. The genetic status of the wild rainbows that spawn and rear in this portion of Tumalo Creek are unknown at this time. Historically, the redbands inhabited the entire Upper Deschutes River system. Habitat for redbands does exist within the project area.

Analysis of Effects

Alternative 1:
Direct Effects: There would be no direct effects to redband trout as no restoration activities would occur.

Indirect Effects: Redband habitat is expected to decline as the channel becomes less stable. Under present conditions, the channel is becoming wider, shallower and less diverse. Undercut banks for overhead cover are nearly non-existent. Fine sediment volumes within spawning areas would increase with accelerated bank erosion. Fine sediments can reduce interstitial water flow, decreasing available oxygen to developing fish embryos, resulting in lower survival. Fine sediments can also trap emerging fry in the gravel (Meehan, 1991). Primary production and invertebrate abundance can also be reduced by fine sediment, affecting available forage for fish (Meehan, 1991).

Cover would continue to decline as LWM decays or moves downstream during flood events. Some hiding cover would be replaced from the downstream movement of instream LWM from upstream areas. Most of the potential LWM recruitment from the streambanks was lost in the fire and subsequent salvage logging. Under existing conditions, pine trees approximately 20-30 feet in height and 8" diameter are occasionally being undercut into the stream. These trees are too small to provide much redband habitat or improve channel stability.

Riparian vegetation would continue to struggle to become re-established due to channel instability. Established riparian vegetation would continue to become undercut and uprooted.

Water temperatures generally increase as width/depth ratios increase, but changes may be off-set by an increase in shade as the canopy matures. Water temperatures would still remain in a range acceptable to redband trout. Past monitoring has indicated that summer water temperatures rarely exceed 13º C. Rainbow trout generally prefer temperatures < 20-21º C, but can tolerate higher temperatures for limited durations (Scott and Crossman, 1973). Preferences and tolerances vary with populations.

Fish populations are correlated with habitat conditions. The redband population within the proposed project area would be expected to decline over time as habitat decreases. Generally, fish habitat becomes reduced as the width/depth ratio increases. Other factors that would contribute to decline of the population are filling in of pools with sediment, increases of fine sediment in spawning gravels, and a reduction in hiding cover.

Macroinvertebrate habitat is expected to decline and community abundance and diversity decrease as fine sediments in the substrate increase. Macroinvertebrate populations would undergo fluctuations in abundance and diversity with differences in annual flow regimes, climate, and other variables, but would experience a downward trend over time. This would reduce available forage for redbands.

This alternative **May Impact Individuals or Habitat** for redband trout because of the trend of declining available redband habitat with unstable channel conditions within the project area, but would not result in loss of population viability or create a significant trend toward federal listing.

Alternative 2:
Direct Effects: Channel restoration would increase the abundance and diversity of redband habitats throughout the 2.8 mile reach.

Pools are an important redband habitat feature for resting, hiding, and feeding. Spawning typically occurs in the gravels of the tail-out of a pool. Pool habitat would increase from a present condition of approximately 7% to 15-20%, which approximates pre-fire conditions. The increase would primarily be from pools created at the outside of the meander mends associated with newly created log jams. An increase in redband spawning habitat would occur as pool habitat, and the associated tail-outs, are increased.

The increase in large woody material from the present condition of 19 pieces/mile to over 100 pieces/mile would increase hiding cover for redbands and maintain depth in pools. The placement of smaller pieces of wood intertwined with large pieces would add complexity and diversity to habitat. Placement of large wood structures would reduce erosion of streambanks, allowing development of newly planted riparian plant species. Instream woody material also provides habitat and forage for the aquatic invertebrate community, such as insects, crustaceans, and flatworms. These invertebrates provide forage for redbands.

Boulder structures would provide pool habitat for redbands and invertebrate habitat. J-hook boulder structures would also reduce streambank erosion to allow riparian vegetation to become re-established.

The decrease in the width/depth ratio from an average of 41 to an average of 14-19 would increase habitat available to redbands. Depths would increase, providing for more of the streambed available to be occupied by fish.

The reduction in streambank erosion and the stabilization of the channel would reduce the inputs of fine sediments (<0.25" diameter). Fine sediments have adverse effects to fish and fish habitat. Fine sediments accumulated in riverbed substrates can limit survival of developing fish embryos and limit the production of aquatic macroinvertebrates, which provide forage for fish (Bjornn and Reiser, 1991, in Meehan, 1991). Suspended sediment can be abrasive to fish gills and decrease foraging ability.

Restoration of the riparian plant community is a key component of the proposed action and would provide many benefits to redbands and redband habitat. Streamside vegetation: (1) provides shading and overhead cover for fish, (2) armors streambanks against erosion, leading to an improvement in water quality and substrate composition (less sediment), and retainment of pool depth and appropriate width/depth ratios (3) attracts various terrestrial insects that fish prey upon, and (4) provides a source of LWM as trees mature and fall into the stream.

Approximately 1500 feet of new or improved side channel habitat will be created within the project area, including the placement of large wood structures for habitat. Rearing habitat for juvenile redbands, especially the fry life stage, will be improved. The side channels provide refugia from predators and high streamflows.

The aquatic invertebrate populations would be temporarily reduced from the operation of the heavy equipment within the channel. The diversity and abundance of populations reduced from operation of heavy equipment should quickly recover after project completion (1-2 years) because of the short life cycles of most aquatic invertebrates.

The increase in turbidity and suspended sediments associated with equipment working instream will temporarily decrease foraging opportunity for redbands may cause some gill abrasion to some individuals. The equipment would take frequent breaks from operating during the work day. Past projects have shown that turbidity returns to normal levels within 15-30 minutes after the equipment ceases to operate.

Indirect Effects:
The increase in shade as the riparian community and associated forest matures would lead to cooler water temperatures in Tumalo Creek. Biological productivity in the stream, which is already partially limited by cool temperatures, would decrease to pre-fire levels. Decreased sunlight would inhibit the growth of algae and other periphyton that are an integral part of the food web. Aquatic invertebrate community structure may change with an increase in shade. Species dependent on algae may diminish, while species that collect or gather organic matter may increase.

Habitat for invertebrates and spawning gravels for redbands would be improved in the long term in the areas the heavy equipment works instream as fine sediments would be flushed out of the gravels. Invertebrate habitat and fish spawning gravels downstream of the project area may be minimally adversely affected from deposition of sediments flushed out by the equipment working instream. Due to the relatively steep gradient and stability of the channel downstream of the proposed project area, sediments are expected to be carried through the stream, with limited deposition.

Channel restoration activities would reduce the input of fine sediments by several hundred cubic yards annually. The redband population within the proposed project area is expected to increase over time with an improvement in habitat. The actual increase is infeasible to predict.

Cumulative Effects:
Past projects within the project area that have affected redband and redband habitat have included the Bridge Creek Fire and associated timber salvage, and the modified flow regime (also a present activity) to meet irrigation and drinking water demands. The proposed action would not have any adverse cumulative effects to either of these actions. This alternative action project would take action to restore redband habitat damaged in the fire and subsequent salvage operation.

Present activities include a road and trail system and associated recreational use. The proposed action would not increase any adverse effects that may be occurring to redband or redband habitat as a result of these systems.

Reasonably Foreseeable Actions include silvicultural and fuels activities such as ponderosa pine thinning and brush clearing on the valley hillslopes and valley bottom within the Bridge Creek Fire area. The proposed action would not increase any adverse effects that may occur as a result of these activities.

This alternative would have **Beneficial Impacts** to redband trout and their habitat by improving channel stability, increasing pools and instream wood, and improving riparian vegetation conditions.

Prepared by: _____ Date: _____
Tom Walker
District Fisheries Biologist

APPENDIX B

WILDLIFE

BIOLOGICAL EVALUATION (BE)

Tumalo Creek Bridge to Bridge Restoration

Biological Evaluation Short Form

Project Review Documentation
Bend-Ft. Rock Ranger District June 10, 2004

This report serves to document the review of activities and projects in order to meet the requirements of the Forest Service Manual (2672.32, .4-.43), the Endangered Species Act, and the Land and Resource Management Plan (LRMP) for the Deschutes National Forest (specifically addresses the bald eagle and northern spotted owl). This "short form" report is restricted to only those activities and projects that are relatively minor in scope and limited in duration where there are no effects to wildlife species and/or habitats or where the effects are localized and relatively insignificant. It may include required mitigation measures or optional recommendations designed to eliminate or reduce negative effects. A professional-level wildlife biologist has completed this Biological Evaluation (BE), and it has been reviewed and approved by a journey-level biologist. It will be filed with the originating request for Pre-Field Review and included in the project's files with the supporting NEPA documentation. This report **does not** meet the requirements for coordination with other resources (FSM 2634), the other LRMP requirements (e.g. MIS species), Eastside Screens, or the Northwest Forest Plan.

Project/Activity Name: Tumalo Creek Bridge to Bridge Restoration

Project Leader: Tom Walker, Fisheries Biologist

Location Description/Legal: The project occurs within T18S, R10E; Sections 8, 9, and 10, along Tumalo Creek, between the confluences of Bridge Creek, downstream to Skyliner Bridge (see the attached map). It occurs entirely within the range of the northern spotted owl and within a Riparian Reserve.

The Bridge Creek Fire of 1979 destroyed the riparian vegetation and old growth conifer forests that once occurred here. Riparian vegetation is continuing to recover and consists of bog birch, alder, willow, ponderosa pine (from reforestation efforts), and lodgepole pine, aspen, and Englemann spruce. Ground vegetation consists of sedges, introduced grasses, strawberry, horsetails, roses, mosses, etc. The stream channel itself is also recovering from the fire. Timber salvage operations after the fire removed instream wood and standing trees next to the stream bank. Active stream bank erosion ensued. Projects in 1990-1992 restored much of the large wood component in an effort to improve fish habitat. High flows in 1995-1996 and 1999 caused significant movement of the added and naturally occurring wood within the channel. In some areas, large logjams formed, exacerbating stream bank erosion and channel braiding. In one place, less than 30 feet separates Tumalo Creek from the South Fork of Tumalo Creek, and there is a potential for the two streams to join ½ mile upstream from its current junction.

In summary, since the Bridge Creek Fire, there has been substantial loss of soil, vegetation, and fish habitat in lieu of other projects attempts to prevent these losses. These resources will continue to be lost, and the wetlands and wildlife habitat they support are also threatened.

Project/Activity Description (including dates of operation):

The purpose of this project is to reverse the downward trend of channel instability and restore nearly 2.8 miles of stream.

The following is a list of activities to occur from the proposed action**:**

- Design a stream channel that would resemble reference reaches (those conditions acquired from pre-fire/salvage aerial photos and stream surveys).
- To implement the design, heavy equipment such as excavators and front-end loaders would be used to shape the new channel.

• Relocate sediments within the channel to attain the desired physical characteristics such as sinuosity, slope, width, and depth.
• Slope some unstable stream banks away from the stream.
• Excavate pools incorporating large wood and boulders.
• Install 77 logjam complex structures, 33 logjam complexes with log vanes, 5 boulder cross vanes, and 5 boulder j-hook vanes.
• Create approximately four side channels/overflow channels to provide flood flow energy dissipation, high flow refugia for fish, low flow rearing habitat, wetlands, and wildlife habitat.
•Replant over 12 acres of riparian habitat with over 30,000 riparian shrubs and trees including Engelmann spruce, western larch, mountain alder, red-osier dogwood, various willow species, Douglas spirea, black cottonwood, quaking aspen, and various sedges and native grasses.

This project is a multi-year project, likely starting during the fall of 2004.

Species List: The following wildlife/habitats have been reviewed ("x", na = not applicable) to determine if the project/activity will have any negative effects on listed, proposed, candidate or sensitive species in order to meet the requirements for a biological evaluation. **Only those species or habitats with an "X" occur within or adjacent to the project area and could potentially be affected by the project/activity.**

Threatened and Endangered Species List

Northern Spotted Owl - na	Canada Lynx LAU – na	Oregon Spotted Frog - na
NSO Critical Habitat - na	Canada Lynx KLA – na	Northern Bald Eagle - na
NSO NRF habitat – na		

Region 6 Sensitive Species List

American peregrine falcon - na	Horned grebe - na	Western sage grouse – na
Red-necked grebe – na	Bufflehead – na	Yellow rail - na
Tri-colored blackbird - na	Harlequin duck – na	California wolverine - na
Pygmy rabbit – na	Pacific fisher – na	Crater Lake tightcoil snail – X

Existing Condition

Sixteen species of wildlife (ten birds, four mammals, one amphibian, and one mollusk species) classified as threatened, endangered, candidate, sensitive, or proposed, may occur on the Bend/Ft. Rock Ranger District. The proposed project area was evaluated to determine which species might occur based on the presence of required habitats and known locations. Several field reviews have occurred with past projects on Tumalo Creek. Suitable habitat does exist for the Crater Lake tightcoil snail, a recently listed sensitive species (previously a Survey and Manage Species).

Field surveys for the Crater Lake tightcoil snail (*Pristiloma arcticum crateris*), were conducted on May 16th, June 3rd, and October 15th , 2003, within the proposed project area. This species was found within the project area on two of the visits.

Desired Condition

The desired condition for this project area is to provide a functioning, stable, stream and riparian habitat condition for the diversity of wildlife species that utilize it.

Effects/impacts determinations

Crater Lake tightcoil snail

The Crater Lake tightcoil snail can be found in suitable wet habitat on the undersides of woody debris, among wet mosses, rushes and other low vegetation at the edges of wetlands, springs, seeps and streams and in perennially damp forest floor litter, especially where it has accumulated at the bases of shrubs and against logs (Duncan et al 2003).

Suitable wet habitat would be considered as almost exclusively very stable, perennially wet riparian edges around wetlands, springs, seeps and streams and damp forest floor litter. Areas that are temporarily wet habitat, such as stream borders that may change location (up and down the stream bank) or are seasonally underwater or dry, are not suitable habitat for this species. Only areas with constant water levels that create perennially saturated habitat year-round are suitable, and may be occupied (per discussion between Mark Lehner, USFS biologist and Nancy Duncan, BLM biologist).

Approximately 1-2 acres of wetland habitat would be impacted by the implementation of this project (roughly 20 feet of this is perennially wet, with the rest being seasonally wet areas along floodplains and gravel bars). Much of the area that will be rehabilitated by utilizing heavy equipment in riparian habitat is not considered perennially saturated habitat throughout the year. The stream has down cut in so many areas, that the riparian habitat has changed to a dry condition. This project, when complete, would have physically created new habitat, plus would help to raise the water table to provide more suitable riparian habitat. It is expected that there would be a 20-40% increase in the number of acres of wetlands created, restored, and enhanced.

No Action Alternative
Direct Effects: There would be no effects to threatened, endangered, proposed, candidate, sensitive, or specially designated wildlife species.

Indirect Effects: In the long term, additional erosion of stream banks would result in the continued loss of streamside and riparian vegetation that many wildlife species use. This would be especially critical to the Crater Lake tightcoil snail, which spends its lifetime in these riparian areas. The Tumalo Creek drainage is the only known drainage, thus far, on the Bend/Ft. Rock District that this species has been found.

Action Alternative
Direct Effects: With the action alternative, it is likely that some suitable habitat and individuals of the Crater Lake tightcoil snail would physically be destroyed by the use of heavy equipment along the stream banks. This could have a negative effect on the population of Crater Lake tightcoil snails that occupy the suitable habitat in the Tumalo Creek drainage.

Indirect Effects: With the implementation of this project, utilizing heavy equipment would destroy a small amount of habitat in the short term, but, for the long term, it would help to create additional suitable habitat plus create a more stable stream system. This would positively affect this species and its population viability for the future along this stream system.

Mitigation Measures
Since this in the only stream system known, so far, to be occupied by the Crater Lake tightcoil snail on the Bend/Ft. Rock Ranger District, it is important to follow-up on the progress of this project and the newly created wetland habitat. To determine how long it may take for this species to occupy new habitat, habitat monitoring (by observation, taking photographs, etc.) should occur and results documented. When the newly created habitat is in a suitable condition for the Crater Lake tightcoil snail, bi-annual surveys should be conducted for the snail for a period of 10 years after completion of the project within each phase. This would help to determine presence of this species and how quickly the species may be able to migrate into these new habitats.

Conclusion/Recommendations
If this project proceeds, short-term effects could be direct loss of Crater Lake tightcoil individuals and loss of a

small amount of suitable habitat. Long-term effects would be the creation of habitat and a more stable system to reduce/prevent additional loss of habitat from stream bank erosion. If this project does not proceed, there would continue to be short and long-term loss of habitat and species.

To provide long-term habitat for a healthy population of Crater Lake tightcoil snails throughout this lower section of Tumalo Creek, this project must proceed as planned. Otherwise, habitat and species loss would continue to occur, possibly separating populations of the snail along this stream.

Consultation Summary

The Tumalo Creek Bridge to Bridge Restoration Project meets all applicable Project Design Criteria as described in the 2003-2006 Joint Aquatic and Terrestrial Programmatic Biological Assessment. A biological assessment (BA) and/or Level I review are not required.

_____Project Biologist _____Reviewing Biologist

_____Date _____Date

References

Duncan, Nancy et al. 2003. Survey Protocol for Survey and Manage Terrestrial Mollusk Species, from the Northwest Forest Plan. Version 3.0.

Lehner, Mark and Nancy Duncan. 2003. Discussion about the Crater Lake tightcoil snail and suitable habitat and preferred survey periods. On file at the USDA Forest Service, Deschutes National Forest, Bend/Ft. Rock Ranger District.

Documentation

Project Design Criteria Review Documentation

The PDCs for calendar year 2003-2006 were reviewed.

NEPA documentation

The following NEPA analysis procedure was used for this project/activity:

EIS_____EA__X____CE____Other_____(e.g. maintenance, specify)

The mitigation measures have ___ or have not ___ been incorporated into the NEPA document. The recommendations have ___ or have not ___ been incorporated into the NEPA document. Those measures and recommendations not adopted are as follows:

BA/Level I Review Documentation

BA completed on _____ and a Biological Opinion received on _____

Level I Review done on _____ with the following results:

Documentation/notice was provided to _____, Project Leader on ___/___/___

Project biologist's initials ____ Date _____

APPENDIX C

BOTANY

BIOLOGICAL EVALUATION (BE) (Page 49)
AND
NOXIOUS WEED ASSESSMENT (Page 54)

BIOLOGICAL EVALUATION

THREATENED, ENDANGERED, AND SENSITIVE PLANTS

TUMALO CREEK REHABILITATION PROJECT

REPARED BY: _____
Charmane Powers
District Ecologist

DATE: _____

PROJECT LOCATION: Bend/Ft. Rock Ranger District, Deschutes National Forest

* *

SUMMARY OF FINDINGS

The analysis of effects on species viability found the following:

This proposed action is expected to have beneficial impact to Newberry Gentian (*Gentiana newberryi*).

INTRODUCTION

This Biological Evaluation documents the review and review findings of Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) as Endangered or Threatened; (2) designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, FSM 10/89 R-6 Supplement 47 2670.44, and the Endangered Species Act (ESA) of 1973 (Subpart B; 402.12, Section 7 Consultation).

Proposed, Endangered, Threatened, or Sensitive (PETS) species considered in this evaluation are those listed in FSM 2670.4 R-6 Interim Directive No. 90-1, March, 1991 as suspected or documented to occur on the Deschutes National Forest. Listed plant species and their listing status are in Appendix A.

This document is organized as follows:

1.PROPOSED ACTION AND ALTERNATIVES--Description of the project and its alternatives

2.EVALUATION--Evaluation of effects on listed plant species

3.RECOMMENDATIONS--Recommendations to minimize minor effects on non-Federally listed Sensitive species viability

4.COMMUNICATION--Communication with personnel during the evaluation

5.REFERENCES--Documents referred to during the evaluation

6.APPENDICES--Appendices of sensitive species which are suspected to occur on the Bend/Ft. Rock Ranger District, and habitat descriptions of species suspected to occur within the project area

PROPOSED ACTION

The proposed action will include activities to rehabilitate channel stability on about 2.2 miles of Tumalo Creek. Damage occurred to the stream and floodplain as a result of the 1979 Bridge Creek Fire, subsequent management actions, and flooding.

Heavy equipment such as excavators and front-end loaders would be used to shape the new channel. Sediments will be relocated within channel, either as fill or as cut. Some unstable streambanks will be sloped back. Pools will be excavated. Structures incorporating large wood and boulders will be used to scour pools, provide channel and streambank stability, and provide fish cover. Adding structures will require the transport of materials to the site from off-site sources. Upon completion of in-stream work, extensive re-planting efforts would occur. Nearly 30,000 riparian shrub and tree species would be planted near the stream, covering about 12 acres. Seeding with native grass species would also occur.

The project would be implemented in three on-the-ground phases. These phases are planned to occur on an annual basis beginning in the fall of 2004. Each of these phases will rehabilitate about 1/3 of the 2.2 mile project reach, beginning with the most upstream area and proceeding downstream.

It is also proposed to collect Newberry Gentian seeds in 2004, propagate them in a greenhouse, and outplant in a suitable site or sites in the creek floodplain.

EVALUATION

This evaluation of the project area includes:

X A pre-field review
X A field survey
X An effects analysis
X Management recommendations (if a sensitive plant population exists).

PREFIELD REVIEW - METHODS AND RESULTS

Project area description: Soils in the project area are comprised of alluvium and outwash in the Tumalo Creek bottom (which includes road 4603); sandy volcanic ash over buried soil on glacial till; and sandy volcanic ash and pumice, colluvium, alluvium, and glacial till. Annual precipitation is about 25-30".

The plant communities in the project area are white fir and ponderosa pine with a sparse understory at the junction of Skyliner Road and Forest Service Road 4601, and ponderosa pine/manzanita along road 4603.

Elevations within the project area range from 4800' at the Skyliner Road/Forest Service Road 4601 junction to about 5100' at the Tumalo Falls day use area. The area is relatively flat but gradually rises as the day use area is approached.

There is a known TES plant site on Tumalo Creek, *Gentiana newberryi* (Newberry's Gentian). There were three sites originally found in 1990 but two were swept away in flood events that occurred in the mid-90's.

The potential for sensitive plant species' habitat to occur in the project area was evaluated using the preceding information. Resources used to identify potential sensitive plant habitat were aerial photo interpretation, soil resource inventory information, vegetation map information, as well as personal knowledge of the project area.

Based on the preceding information, a comparison with the habitat requirements of Bend/Ft. Rock Ranger District potential sensitive species revealed that these species might exist within the project area:

Species	Probability
Agoseris elata	Low
Artemisia ludoviciana ssp. estesii	Low
Calochortus longebarbatus var. longebarbatus	Low

Calamagrostis brewerii	Low
Carex hystericina	Low
Carex lasiocarpa	Low
Gentiana newberryi var. *newberryi*	Moderate
Lycopodium complanatum	Low
Lycopodiella inundata	Low
Ophioglossum vulgatum	Low
Rorippa columbiae	Low
Scheuchzeria palustris	Low

No habitat was found for Threatened or Endangered plant species.

FIELD RECONNAISSANCE

Since the Forest first began TES plant surveys in 1990, Tumalo Creek has received numerous surveys, some formal and most informal as we were in the area for other reasons. Surveys were conducted in 1990, 1991, and 2004 along the creek. The aforementioned Newberry Gentian (GENE) sites were discovered in the 1990 survey. No other TES plant species or site has been located in or near the project area since.

The GENE site that was not swept away downstream is small, with less than 20 plants (Pat Joslin, pers. comm., 12/10/03), is about 15 feet from the creek's edge and was being invaded by an aggressive seeded grass called intermediate wheatgrass (*Elytrigia intermedia*). A visit in June 2004 by two Forest Service botanists did not find this site. They found the area fairly dry, perhaps too dry for this species. It is not clear what has happened to the population. It is possible that continuing down-cutting by the stream has lowered the water table to the point where GENE cannot survive.

In 1998, two Forest Service botanists visited the lower bridge area and did not see any TES plant species; although it was a visit to look for Survey and Manage mosses and liverworts, had there been a TES site present it would have been found.

No Threatened, Endangered, or Sensitive plants were located during these surveys.

PROJECT EFFECTS

This section discusses what effects may occur as a result of the proposed project and what risks the effects may have on the viability of proposed, threatened, endangered, and sensitive species.

No Action Alternative

Direct and Indirect Effects: There are no known direct or indirect effects to the GENE population from not implementing the proposed action.

Cumulative Effects: There is the possibility that any GENE population that manages to get a foothold will be swept away or dried up by the creek's lateral and vertical cutting actions. It is hard to predict when this might happen; it could happen in one flood event, or it could happen over a period of years as the creek cuts away at the bank.

In 1990, when three GENE populations were found, the two populations on the south side of the creek were estimated to be 25-50' from the edge of the bank; the remaining population was estimated at 15' in late 2003, and as of a June 2004 visit, appears to be gone, too. This disheartening find illustrates the fast-changing nature of the creek and its environment.

Also, it is likely that this population was weakened by the incursion of the non-native wheatgrass at the site, making it more vulnerable to disturbances.

There are no measurable consequences by not doing the GENE propagation and outplanting, because it is unknown if this action would be successful to begin with. What would be lost by not trying it is the opportunity to add breadth to the local distribution of this species, and the lessons that can be learned from attempting propagation and outplanting of this species.

Proposed Action

Direct Effects: There are no anticipated direct effects to the GENE population with implementation of the proposed action.

Indirect Effects: Stabilization of the creek channel would likely have beneficial effects to the known GENE population by removing the threat of being eroded out of existence, although it would still have the wheatgrass competing with it for on-site resources.

Cumulative Effects: Stabilization of the creek channel would likely benefit GENE habitat by providing areas for colonization that would not be eroded or flooded. By stabilizing the water flow, it may raise the water table to a point where GENE can re-establish itself.

As with the No Action alternative, it is hard to measure results of GENE propagation and outplanting, because it has not been attempted before and success is not guaranteed; however, if the plants were successfully put into the drainage, it would be a benefit to this species, because one or more of its historical site locales would be occupied once again, in theory giving this species greater amplitude in its distribution and resiliency.

FINDINGS

The analysis of effects on species viability found the following:

This project is expected to have beneficial impact to *Gentiana newberryi*.

CONTACTS AND REFERENCES

DESCHUTES NATIONAL FOREST -- SENSITIVE PLANT CONTACTS

Forest Botanist -- Katie Grenier (388-5564)
Crescent District Plant Coordinator -- Carolyn Close (433-3234)
Bend/Ft. Rock District Plant Coordinator -- Charmane Powers (383-4730)
Sisters District Plant Coordinator -- Maret Pajutee (549-7727)

REFERENCES

PETS plants biological evaluations for Tumalo Flood (1999) and Tumalo Complex (2000) projects
Bend/Ft. Rock Ranger District Cleared Areas Atlas
Bend/Ft. Rock Ranger District Sensitive Plant Sightings Atlas
Soil Resource Inventory, Larsen 1976

Joslin, Pat, Botanist, Bend/Ft. Rock Ranger District, personal communication 12/10/03.
Milano, Gary, Region 6 Plant Sighting Report for *Gentiana newberryi,* 7/26/90
Walker, Tom, Fish Biologist, Bend/Ft. Rock Ranger District
Wasniewski, Louis, Deschutes National Forest Hydrologist

APPENDIX A

DESCHUTES NATIONAL FOREST SENSITIVE PLANT LIST

Twenty-five plants are currently on the Regional Forester's Sensitive Species List (FSM 2670.44, 4/99) for the Deschutes National Forest, as follows (BFR = Bend/Fort Rock District, CRE = Crescent District, SIS = Sisters District):

Scientific Name	Common Name	Listing Status		District	
			BFR	CRE	SIS
Agoseris elata	Tall agoseris	ONHP List 2	S	S	D
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress	Sp. Of Concern ONHP List 1	---	S	---
Arnica viscosa	Shasta arnica	ONHP List 2	D	S	S
Artemisia ludoviciana ssp. *estesii*	Estes' artemisia	Sp. Of Concern ONHP List 1	D	S	---
Aster gormanii	Gorman's aster	Sp. Of Concern ONHP List 1	S	S	S
Astragalus peckii	Peck's milk-vetch	Sp. Of Concern ONHP List 1	S	D	S
Botrychium pumicola	Pumice grape-fern	Sp. Of Concern ONHP List 1	D	D	---
Calamagrostis breweri	Brewer's reedgrass	ONHP List 2	S	S	S
Calochortus longebarbatus var. *longebarbatus*	Long-bearded mariposa lily	Sp. Of Concern ONHP List 1	S	S	S
Carex hystricina	Porcupine sedge	ONHP List 2	S	S	S
Carex livida	Pale sedge	ONHP List 2	S	S	S
Castelleja chlorotica	Green-tinged paintbrush	Sp. Of Concern ONHP List 1	D	S	S
Cicuta bulbifera	Bulb-bearing water-hemlock	ONHP List 2ex	S	S	S
Collomia mazama	Mt. Mazama collomia	Sp. Of Concern ONHP List 1	S	S	S
Gentiana newberryi var. *newberryi*	Newberry's gentian	ONHP List 2	D	S	D
Lobelia dortmanna	Water lobelia	ONHP List 2	S	S	D
Lycopodiella inundata	Bog club-moss	ONHP List 2	S	D	S
Lycopodium complanatum	Ground cedar	ONHP List 2	S	S	S
Ophioglossum pusillum	Adder's-tongue	ONHP List 2	S	S	S
Penstemon peckii	Peck's penstemon	Sp. Of Concern ONHP List 1	S	S	D
Pilularia americana	American pillwort	ONHP List 2	S	S	---
Rorippa columbiae	Columbia cress	Sp. Of Concern ONHP List 1	S	S	S
Scheuchzeria palustris var. *americana*	Scheuchzeria	ONHP List 2	D	S	S
Scirpus subterminalis	Water clubrush	ONHP List 3	S	D	S
Thelypodium howellii ssp. *howellii*	Howell's thelypody	ONHP List 2	S	S	S

* CODES:
D = Documented
S = Suspected

Species of Concern = Federal Designation; neither Endangered or Threatened

ONHP List 1 = Oregon Natural Heritage Program List: Contains species which are endangered or threatened throughout their range or which are presumed extinct.

ONHP List 2 = Oregon Natural Heritage Program List: Contains species which are threatened, endangered or possibly extirpated from Oregon, but more common or stable elsewhere.

ONHP List 3 = Oregon Natural Heritage Program List: Contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range.

ONHP List 4 = Oregon Natural Heritage Program List: Contains species of concern which are not currently threatened or endangered.

United States Department of Agriculture

Forest Service

Deschutes National Forest

Bend-Ft. Rock Ranger District
1230 NE 3rd, Suite A-262
Bend , OR 97701

Date: 28 July 2004

To: David Frantz
Re: **Noxious Weed Risk Assessment for Tumalo Creek Rehabilitation Project**
From: Charmane Powers

Summary of Finding: The Proposed Action for the Tumalo Creek Rehabilitation project has a HIGH risk of introducing and/or spreading noxious weeds into the project area. (See page 3 for a discussion of ranking and for mitigations to reduce the risk of noxious weed introduction.)

Forest Service Manual (FSM) direction requires that Noxious Weed Risk Assessments be prepared for all projects involving ground-disturbing activities. For projects that have a moderate to high risk of introducing or spreading noxious weeds, Forest Service policy requires that decision documents must identify noxious weed control measures that will be undertaken during project implementation (FSM 2081.03, 29 November 1995).

Aggressive non-native plants, or noxious weeds, can invade and displace native plant communities causing long-lasting management problems. Noxious weeds can displace native vegetation, increase fire hazards, reduce the quality of recreational experiences, poison livestock, and replace wildlife forage. By simplifying complex plant communities, weeds reduce biological diversity and threaten rare habitats. Potential and known weeds for the Deschutes National Forest are listed in Appendix A. In addition to noxious weeds, which are designated by the State, there is a group of non-native plants that are also aggressive though are not officially termed "noxious". These species are also included in this assessment.

PROJECT DESCRIPTION:

Alternative 1 – NO ACTION

Management of the area would continue under current direction.

Alternative 2 -- PROPOSED ACTION

The proposed action will include activities to rehabilitate channel stability on about 2.2 miles of Tumalo Creek. Damage occurred to the stream and floodplain as a result of the 1979 Bridge Creek Fire, subsequent management actions, and flooding.

Heavy equipment such as excavators and front-end loaders would be used to shape the new channel. Sediments will be relocated within channel, either as fill or as cut. Some unstable streambanks will be sloped back. Pools will be excavated. Structures incorporating large wood and boulders will be used to scour pools, provide channel and streambank stability, and provide fish cover. Adding structures will require the transport of materials to the site from off-site sources. Upon completion of in-stream work, extensive re-planting efforts would occur. Nearly 30,000 riparian shrub and tree species would be planted near the stream, covering about 12 acres. Seeding with native grass species would also occur.

The project would be implemented in three on-the-ground phases. These phases are planned to occur on an annual basis beginning in the fall of 2004. Each of these phases will rehabilitate about 1/3 of the 2.2 mile project reach, beginning with the most upstream area and proceeding downstream.
It is also proposed to collect Newberry Gentian seeds in 2004, propagate them in a greenhouse, and outplant in a suitable site or sites in the creek floodplain.

RISK RANKING

Factors considered in determining the level of risk for the introduction or spread of noxious weeds are:

__X__ HIGH – ***for the Proposed Action alternative***

Has to be a combination of the following three factors:

1. Known weeds in/adjacent to project area.
2. Any of vectors* #1-8 in project area.
3. Project operation in/adjacent to weed population.

__X__ MODERATE – ***for the No Action alternative***

1. Any of vectors #1-5 present in project area.

_____ LOW

1. Any of vectors #6-8 present in project area.

OR

2. Known weeds in/adjacent to project area without vector presence.

Vectors (if contained in project proposal) ranked in order of weed introduction risk:

1. Heavy equipment (implied ground disturbance)
2. Importing soil/cinders/gravel
3. OHV's
4. Grazing (long-term disturbance)
5. Pack animals (short-term disturbance)
6. Plant restoration
7. Recreationists (hikers, mountain bikers)
8. Forest Service project vehicles

DISCUSSION OF RANKING

Alternative 1 – No Action

Existing Condition: There are noxious weeds present within the Tumalo Creek floodplain between the day use area and the bridge near the OMSI Skyliner Lodge, as well as unusually high numbers of a weedy exotic species. The noxious species are spotted knapweed (*Centaurea maculosa*), Canada thistle (*Cirsium arvense*), and dalmation toadflax (*Linaria dalmatica*). The knapweed is by far the most prevalent noxious weed species present; there are scattered populations along the main road running adjacent to the creek, at both bridges, and in a few locations adjacent to the creek. The toadflax is present in one spot off the road. The Canada thistle is present in scattered locations along both sides of the creek (not adjacent to the creek, however) in wet meadow situations. There is a biocontrol agent (*Urophora carduii*) present in at least one population and has been successful in beating it back a bit.

An unusual situation exists in the project area in that perhaps the most prevalent exotic there, growing essentially all along the length of the creek within the project area, is not a noxious weed but the common dandelion (*Taraxacum officinale*). The author has not noted this species as a problem elsewhere on the Bend/Ft. Rock ranger district.

Risk Ranking Discussion, No Action Alternative:

Direct and Indirect Effects: There are no anticipated direct or indirect effects of not implementing the No Action alternative. Weed management would continue to occur in this area (herbicide use, manual pulling, biocontrol agents released as necessary).

Cumulative Effects: Alternative 1 was given a MODERATE risk ranking because, although the project would not occur, there is still the ongoing vehicle traffic on the main road through the floodplain, as well as occasional vehicles on the power line road that runs closer to the creek.

Proposed Action

Direct and Indirect Effects: This alternative was given a HIGH risk ranking because heavy machinery will be used, which even with cleaning has the potential to bring in noxious weed propagules, and also because ground will be disturbed, which may already harbor noxious weed seeds.

It is likely that the dandelion populations present will flourish with the ground disturbance that will occur with the project; it is improbable that these plants can be entirely avoided, because they are so prevalent.

The concerns over noxious weeds are offset somewhat by the fact that the main road is treated with herbicides when necessary, and the Canada thistle site has had a biocontrol agent present for several years which seems to be working. It does not appear that machinery will be working within known noxious weed sites, which is helpful.

Cumulative Effects: It is likely that the native shrub and tree plantings proposed with the project will help shade out dandelions and any other weeds that may be present. However, the ongoing use of the main road, as well as the occasional use of the power line service road, will ensure that the threat of weed introductions remains fairly high. This is independent of the proposed project.

PREVENTION STRATEGY

Prevention of noxious weeds is always the preferred strategy because it is most effective and least costly. In this case, cleaning of equipment is the form of prevention being used.

Mitigation Measures

To prevent the spread or introduction of weeds:

11. All equipment used will be clean, and free of obvious weed parts.
12. All equipment leaving the site will be washed prior to its next assignment.
13. Monitor for two years following project completion, map new weed sites, and treat weeds as necessary.

REFERENCES

USDA Forest Service, July 5, 2001, Guide to Noxious Weed Prevention Practices

APPENDIX A

DESCHUTES NATIONAL FOREST NOXIOUS WEED LIST
Updated 10/31/97

The following species are listed by the Oregon Department of Agriculture as noxious weeds. These are species designated by the Oregon State Weed Board as injurious to public health, agriculture, recreation, wildlife, or any public or private property.

Scientific Name	**Common Name**	**Presence**	**Code**
Agropyron repens	Quackgrass	Documented	AGRREP
Cardaria (=Lepidium) draba	Whitetop	Potential	CARDRA
Carduus nutans	Musk thistle	Potential	CARNUT
Carduus pycnocephalus	Italian thistle	Potential	CARPYC
Centaurea diffusa	Diffuse knapweed	Documented	CENDIF
Centaurea maculosa	Spotted knapweed	Documented	CENMAC
Centaurea pratensis	Meadow knapweed	Potential	CENPRA
Centaurea repens	Russian knapweed	Potential	CENREP
Centaurea solstitialis	Yellow starthistle	Potential	CENSOL
Centaurea virgata ssp. squarrosa	Squarrose knapweed	Potential	CENVIR
Cirsium arvense	Canada thistle	Documented	CIRARV
Cirsium vulgare	Bull thistle	Documented	CIRVUL
Conium maculatum	Poison hemlock	Potential	CONMAC
Cynoglossum officinale	Common houndstongue	Documented	CYNOFF
Cytisus scoparius	Scotch broom	Documented	CYTSCO
Euphorbia esula	Leafy spurge	Documented	EUPESU
Hypericum perforatum	St. Johnswort	Documented	HYPPER
Isatis tinctoria	Dyer's woad	Documented	ISATIN
Kochia scoparia	Kochia	Potential	KOCSCO
Linaria dalmatica	Dalmation toadflax	Documented	LINDAL
Linaria vulgaris	Butter and eggs	Documented	LINVUL
Lythrum salicaria	Purple loosestrife	Potential	LYTSAL
Onopordum acanthium	Scotch thistle	Documented	ONOACA
Salvia aethiopis	Mediterranean sage	Potential	SALAET
Senecio jacobaea	Tansy ragwort	Documented	SENJAC
Taeniatherum caput-medusae	Medusahead	Documented	TAECAP

APPENDIX D
HYDROLOGY REPORT

Specialist Report
Tumalo Creek Bridge to Bridge Restoration
Hydrology
Louis Wasniewski

Watershed Overview

Tumalo Creek is a tributary to the Deschutes River, with the mouth located near Tumalo State Park north of Bend. This project is located approximately 14 river miles upstream from the mouth and falls within the 20,744 acre Upper Tumalo Creek subwatershed (170703010502). The Upper Tumalo Creek subwatershed has been recognized as a Tier II Key Watershed in the Northwest Forest Plan (NWFP) because of high water quality. This subwatershed is relatively undisturbed from past management activities, excluding the Bridge Creek Fire, which burned in the eastern portion. Road densities are low and timber harvest activity has been light other than the salvage associated with the fire. Bridge Creek flows into Tumalo Creek at the upper end of the project area and is not undergoing restoration. The Bridge Creek drainage is the Cities of Bend's Municipal Watershed, piping drinking water 0.1 miles up from the Bridge Creek confluence with Tumalo Creek.

Although stream discharge is largely influenced by snowmelt and precipitation, groundwater discharge from springs is also a significant contributor. Tumalo Creek and its tributaries are unusual for Upper Deschutes Basin streams in that they respond immediately to rain-on-snow events with large increases in flow. Steep valley sideslopes that exceed 60° in some areas contributes to the sudden flow increases, and to a lesser degree the somewhat impermeable glaciated soils underlying a relatively thin layer of Mazama ash. Vegetation overstory outside of the fire area is dominated by stands of Engelmann spruce and various fir in the valley bottoms and lodgepole pine and ponderosa pine on the upslope areas. The fire area is now dominated by young ponderosa pine on both the valley bottom and upslope areas as a result of replanting efforts in the early 1980's.

A.Water Resources and Stream Morphology

Existing Conditions

A severe forest fire in 1979 (Bridge Creek Burn) burned approximately 4,300 acres. Following the fire and subsequent salvage logging, approximately three miles of Tumalo Creek was left virtually devoid of riparian vegetation, trees, and instream wood. Prior to its removal, the vegetation and instream large wood provided stability to this low gradient glacial moraine stream system, dominated by loose cobble and gravel material. The loss of stabilizing vegetation has resulted in severe channel erosion, instability, channel incision, and loss of fisheries habitat.

Currently this three mile section of Tumalo Creek contains 19 pieces per mile of medium and large wood debris as survey in 1996[5]. Reference conditions indicate this stream should contain around 110 to 140 pieces per miles as surveyed on Bridge Creek and Trapper Creek in 1994 and 1995, respectively. Under natural disturbance regimes, such as wildfire, wood debris counts would increase due to the dead tree

[5] Medium wood class: 12-20 inches in diameter and greater then 35 foot in length. Large wood class: greater than 20 inches in diameter and greater then 35 foot in length.

tipping into the channel and counts may increase up to around 200 to 300 pieces per mile. The increase in large woody debris during a natural disturbance is a way a stream system maintains stability while riparian vegetation gets re-established to provide the necessary roots for bank stability and feature woody debris recruitment.

In some portions of the creek, channel bed elevations have eroded by up to seven feet and lateral erosion has increased the stream width from an average of 32 feet up to 45 feet with some areas reaching widths of 100 feet. The accelerated bank erosion and channel widening has been estimated to contribute 16,000 cubic yards of material, changing the hydrologic function and sediment transport of the system.

Although 20 years have passed since the salvage logging, the vast majority of the site has not been stable long enough for the recovery of significant riparian vegetation and stability in the stream channel. Each year's snowmelt runoff continues to cause excessive bank erosion and lateral channel migration. With the lack of large wood and proper channel pattern, dimension and profile the system is continuing to degrade and put at-risk the loss of neighboring stable tributaries and wetlands.

Hydrologist Dave Rosgen has classified streams based on morphology to set categories of discrete stream types so that consistent, reproducible descriptions and assessments of condition and potential can be developed. Assessments can be extrapolated to similar stream reaches across geographic ranges (Rosgen, 1996). A streams behavior can be predicted from the morphological data gathered, providing a reference for restoring streams that are not "behaving" as they should. Some of the natural factors that determine how a stream "behaves" are slope, valley width and sideslope, flow regimes, and parent geological materials.

Tumalo Creek within the project area is classified morphologically according to Rosgens system primarily as a "C-4" channel type, with some intermittent "C-3" or "B-3". "C-4" channel types have a well-developed floodplain, are slightly entrenched, relatively sinuous (generally > 1.4) with a slope of less than 2%, bedform of riffle/pool sequences, and a width/depth ratio generally > 12:1. The dominant substrate type is gravel in a "C-4" channel, and cobble in a "C-3". Aggradation/degradation processes are active. Rates of lateral migration are influenced by the presence and condition of riparian vegetation. Changes in bank stability, watershed condition, or flow regime that cause an exceedance of a channel stability threshold can significantly alter and de-stabilize channels of the "C" type stream (Rosgen, 1996).

"B-3" channel types are moderately entrenched, have a width/depth ratio > 12:1, have low channel sinuosity, and lack pools, generally being rapids with pocket water. Streambank erosion and aggradation/degradation rates are low (Rosgen, 1996).

The excessive streambank erosion is causing the stream system to become overloaded with sediment, resulting in an increase in the width/depth ratio within the "C-4" channel reaches. Small reaches within the project area are beginning to transform to a "D" channel type, departing from its given morphology. The stream potential is defined as the Proper Functioning Condition or the best channel condition (Rosgen, 1996). "D" channel types are braided, have very high width/depth ratios, excessive deposition, high streambank erosion rates, and poor fish habitat. They are considered to be unstable (Rosgen, 1996).

Intensive field surveys were conducted within the project site during 2003 to give an indication of the existing conditions. Table 1 shows the percentage breakdown of the various Rosgen stream types. The

over widened and braided "D" stream type represent 30% of the stream, 29% represent a "C" stream type, 27% represent entrenched "F" stream type, and 14% represent a steep narrow "B" stream type. Even though 29% is a "C" stream type the average width to depth ratio was 27, which is wider and shallower than the reference condition of 14-19. Existing conditions and reference conditions can be found at the end of this report.

Table 1. Existing Rosgen stream types found within the low gradient glacial moraine stream system on Tumalo Creek.

Rosgen Stream Type	Percent by length
B_3	3.5
B_4c	7.5
B_3c	2.6
C_4	29.4
D_4	30.2
F_3	13.1
F_4	13.8
Total	100.0

Aerial photograph investigation of a series of photo (1959, 1979, 1981, and 2000) was used to evaluate changes that have occurred before and after the fire. 2003 data was obtained for on the ground survey work and used to compare against aerial photo data. Table 2 shows the channel length, slope, and sinuosity values for the various years. The 1979 photo was used as comparison because the photo was taken right after the fire and before salvage logging had taken place. The photo comparison shows the rate of change before and after the fire. There was a 1.4 percent change between 1959 and 1979 compared to a 3.2 percent change from 1979 to 2000. The percent change to the channel more than doubled in the 20 years after the fire as apposed to 20 years before, which is an indication of the continuing channel instability. From 1979 to 2003 the channel changed 5 percent. The 2003 channel values are believed to be an over estimate because of the precision used to get the numbers compared to the aerial photos. However, they do indicate a continued deviation from 2000.

The photos, especially the 1979, were also used to obtain reference condition (ie radius of curvature) to be utilized in the restoration design.

Table 2. Aerial photograph measurements of channel length, slope, and sinuosity and the percent deviation from the 1979 aerial photo.

Aerial Photo	Channel			% Deviation from 1979		
	Length (ft)	Slope (ft/ft)	Sinuosity	Length	Slope	Sinuosity
2003*	15746.7	0.0136	1.28	5.4	-5.1	5.4
2000	15427.0	0.0139	1.25	3.2	-3.1	3.2
1981	14999.7	0.0143	1.22	0.4	-0.4	0.4
1979	14941.5	0.0143	1.21	0.0	0.0	0.0

1959	14738.6	0.0145	1.20	-1.4	1.4	-1.4

* 2003 data obtained from on the ground surveys.

Water quality: Tumalo Creek is a source of high quality water and not listed as a impaired waterbody under the 2002 303(d) EPA approved listing. The average summer temperatures rarely exceed 60 F. During the winter extensive icing occurs within the channel. Turbidity is usually relatively low but seasonally increases in the spring during the snow melt and at times of snow on rain or heavy thunderstorm events. Streambanks and unstable hillslopes along Tumalo Creek and a tributary stream Bridge Creek contribute sediment at these times. Bridge Creek, upstream of the project area, is a source of drinking water for the city of Bend and is among the purest for a surface water system in the United States (Prowell, 1998, personal communication). There are several private residences downstream of the project area that own water rights on Tumalo Creek for domestic use. The rights generally are 2.5 gallons/minute or less (Gorman, 2000 personal communication).

Beneficial Uses

Beneficial uses are documented after the criteria developed by the Oregon Department of Environmental Quality in (Oregon Administrative Rules; 1998 Compilation) Statewide Water Quality Management Plan; Beneficial Uses, Policies, Standards, and Treatment Criteria for Oregon. A beneficial use is a resource or activity that would be directly affected by a change in water quality or quantity. The beneficial uses of Tumalo Creek are Mun, Agr, Rec1, Rec2, Aqua, Wild, Spwn, Gwr, and Fresh. See explanations listed below:

Mun-municipal and domestic water supply, **Agr**-agriculture (livestock and irrigation), **Rec1**-non-contact recreation (hunting, aesthetic quality), **Rec2**-water contact recreation, **Aqua**-resident fish and aquatic life, **Wild**-wildlife, **Spwn**-spawning and rearing salmonid habitat, **Gwr**-groundwater recharge, **Fresh**-freshwater.

Water Quantity: The average flow for the period 1936-86 was 102 cubic feet per second (cfs). The maximum on record is 1140 cfs on 11/09/68, and the minimum is 25 cfs on 01/03/24. Streamflows typically peak at 200-300 cfs during the spring snow melt and bankfull discharge (1.5 to 2 year return interval) found within the proposed project reach is estimated at 280 to 300 cfs. Winter flows are usually around 75 cfs.

The stream is fed by many springs and also receives snow-melt waters. Tributaries are Bottle Creek, Bridge Creek, Happy Valley Creek, Middle Fork, North Fork, Rock Creek, South Fork, Spring Creek, and several unnamed springs. The proposed project area lies downstream of the City of Bend Municipal Watershed.

Diversions: The natural hydrology of Tumalo Creek has been altered both up and downstream of the proposed project area. Streamflow (up to 17 cfs during the summer) from springs on the Middle Fork of Tumalo Creek (upstream of proposed project area) are diverted to Bridge Creek to provide drinking water for Bend. Some of this water re-enters Tumalo Creek at the mouth of Bridge Creek or downstream near Shevlin Park. Streamflow within Crater Creek (from an adjoining watershed), is diverted via canal to the Middle Fork of Tumalo Creek during the summer months (up to 20 cfs).

Downstream from the proposed project area approximately 2 miles, the Columbia Southern Canal has for decades diverted a significant portion of streamflow to feed agricultural areas north of Bend, often leaving as little as 5 cfs instream. Annually, approximately 22,000 acre-feet is diverted. However, in recent years water has not been diverted because the Tumalo Irrigation District was able to utilize a recently expanded diversion downstream near Shevlin Park. This practice will likely continue into the future, but the upper diversion will remain in place if a future need arises. Downstream of Shevlin Park, the Tumalo Feed Canal diverts additional streamflow to supply Tumalo Reservoir, which functions as storage for irrigation water and furnishes various canals north of Bend. In some summers Tumalo Creek has been dry below this second diversion to the mouth at the Deschutes River. Recently an agreement was reached with the Tumalo Irrigation District to allow 2 cfs to remain in the stream. In a typical year, the canal diverts 18,000 acre-feet.

Environmental Consequences

Alternative 1 (No Action)

Direct and Indirect Effects:
Water temperatures are expected to remain above that of pre-fire levels in the short term. Water temperatures remain relatively cool in Tumalo Creek even in the summer months, generally less than 60º F. Although there is no continuous water temperature record before the fire, it is anticipated that summer water temperatures have increased and winter water temperatures have decreased with the loss of streamside cover. As the vegetation matures, shading of the stream would increase, which would decrease summer water temperatures and raise winter temperatures. However, a majority of the stream reach is unstable, the channel is widening and meander migation is lengthening the channel causing more erosion and channel changes than pre-fire conditions. The excessive erosion and assoiciated channel movement does not allow riparian vegetation to get established and mature to provide the necessary root strength and future large wood recuirement to create a stable channel. Lack of riparian vegetation development and the wider and shallower channel dimensions would cause an increase in the surface area for solar radiation which would inturn increase summer water temperatures and decrease winter water temperatures. Turbidity and movement of stream bed material called bedload is expected to remain higher than pre-fire levels as streambanks continue to erode and as the channel moves across the valley. Over a period of several decades, some eroding streambanks may eventually heal naturally, and sediment input to the stream would be reduced from these areas. Other areas may not heal naturally in the foreseeable future, and sediment inputs would continue to be above historic levels at these areas.

Without restoration activities, this project area would either remain in a functioning at risk – downward or not functioning system (e.g., if it becomes entrenched). The channel would remain in an unstable condition. The dimension, pattern, and profile would remain out of balance. The width/depth ratio would continue to increase, and the channel would continue to braid and aggrade behind channel-wide log jams.

Alternative 2

Direct Effects: Tumalo Creek within the project area after project completion would have a stable dimension, pattern, and profile, and would be neither aggrading or degrading. The width/depth ratio would be restored for the proper stream type. Braided areas (D-4 channel types) would be converted to single channel "C-4" types. Sediment would be transported through the system. Entrenched F type

channel would be reshaped and reconnect to the floodplain to form either a narrower steeper "B" type channel or a lower gradient meandering "C" type channel. Wood and rock sturctures would create the necessary roughness to protect the banks from eroding while allowing flood flows to access the flood plain and dissipate stream energy. Overflow and side channels would also allow for stream energy dissipation and allow riparian vegetation to get established. Implementation of the proposed treatments would result in a trend of Tumalo Creek being a functioning at risk – upward system in the short term.

The instream phase would increase turbidity above the state standard of 10% of background while the equipment worked instream. However, limited duration activities are allowed to exceed the standard if a Section 401 or 404 permit has been granted from the Division of State Lands. A permit would be secured prior to project implementation. Increases in turbidity would be observable for approximately 1-2 miles downstream of the project area. Turbidity may be increased for downstream domestic use during periods the equipment works instream, although most water rights owners are 0.5 mile or more downstream of the downstream end of the project area. Turbidity would decrease to background levels within 30 minutes upon removal of equipment from the stream channel. The equipment would take temporary breaks (15-30 minutes) every 2-3 hours.

Indirect and Cumulative Effects: Long term turbidity and bedload movement is expected to decrease throughout the entire length of Tumalo Creek as streambanks are stabilized. Turbidity peaks with high flow events would be decreased with improved bank stability.

Streambank stabilization would lead to increased streamside vegetation. As the vegetation matures, shading of the stream would increase, which would decrease summer water temperatures and raise winter temperatures. In the long term, the stream should reach proper functioning condition.

B. Wetlands and Floodplains

Existing Conditions

Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) direct Federal agencies to avoid, to the extent possible, both short-term and long-term adverse impacts associated with the modifications of floodplains and wetlands.

Within the project area Tumalo Creek flows into a glacial outwash valley where the channel meanders across the valley bottom. This valley bottom contains roughly 100 acres of wetlands that can be divided into two main types (1) scrub_shrub type wetland and (2) emergent type wetland (Cowardin, et. al. 1979). A shrub type wetland is located throughout the valley with it being narrower at the upper end and widens out as the stream gradient decreases and the valley widens. These shrub components are mainly consisting of mountain alder (*Alnus incana*), red-osier dogwood (*Cornus stolonifera*), various willow (*Salix* spp.), and Douglas spiraea (*Spiraea douglasii*). Engelmann spruce and white fir are scattered throughout this brush component. The depth to groundwater ranges from 1 to 5 feet with the vegetation getting saturated and inundated with water annually to every couple of years. The soils consist of ash fall and alluvium over glacial till and outwash and could be classified as Typic Cryaquents. As the valley widens, stream gradient decreases, and the ground water is closer to the surface an emergent wetland vegetation occurs that consists of various sedges (*Carex spp*.) and native perennial grasses. The existing emergent vegetation has a depth to groundwater ranges from 1 to 3 feet with it getting saturated and inundated with water annually to from

spring flows and snowmelt runoff. The soils consist of ash fall and alluvium over glacial till and outwash and could be classified as Typic Cryaquolls.

Throughout the valley Ponderosa pine, lodgepole pine, and brush species are established on interspersed dry rises within the floodplain. Several springs and beaver ponds have created a diverse wetland between Tumalo Creek and road 4603. The floodplain width varies between 200 and 600 feet.

Environmental Consequences

Alternative 1 (No Action)

Direct and indirect Effects: Under the no action alternative degradation / loss of wetlands and riparian areas would continue at a higher than pre-fire rate due to loss of bank stability. Indicators of this instability and loss of wetlands can be found throughout the project area. As mentioned earlier, Tumalo Creek has widened from an estimated 32 feet to 45 feet on average. This means that this 2-mile section of stream has lost 13 feet of stream bank/riparian habitat or 3.25 acres of associated wetlands. The bank loss estimate does not take into consideration the amount of wetlands and riparian habitat being lost due to channel migration and the lowering of the water table caused by channel entrenchment. This post salvage increase rate of wetland and riparian loss through channel widening and meander migration is expected to continue.

Failing of current unstable channel spanning log jams with large amounts of deposition may result in the downcutting of the channel and the lowering of the water table approximately 2-3 feet. This could result in draining or shrinking the wetland extent and changing the wetland species composition. If the channel were to become incised, the stream would not be able to dissipate floodwaters onto the floodplain effectively. A current example of this is where a log jam had caused water to backup and use a high flow channel at the upper end of the project area. Between 2001 and 2002, all flows were routed down the high flow channel. Since this channel switch to the high flow channel the stream length decreased from 800 to 600 feet and the gradient increased causing the channel to downcut (incise) and widen from roughly 19 feet to over 35 feet. This lowering of the water and bed elevation is expected to cause the emergent vegetation component to switch to a shrub component as the water table drops.

In addition this newly created channel comes within 25 to 30 feet of the S. Fork of Tumalo approximately a half mile upstream from the current confluence. The South Fork water surface is lower than the main stem. The bank is continually being eroded and the distance between the two channels is decreasing with a risk of the S. Fork Tumalo capturing the main stem flows. If the main stem were to be routed down the S. Fork, which is lower in elevation, the 13 foot wide channel would most like widen to a width of at least 32 feet and because of instability in the main channel it would probably reach an average with of 45 feet. If the S. Fork channel were to reach a width of 32’ bank loss down the S. Fork would corresponds to a 1.7 acre lost riparian habitat and wetlands.

On another meander, there is a risk of draining beaver ponds and spring water directly into the main channel approximately 0.3 upstream from the current confluence. The new confluence would drain water that is currently maintaining roughly 15 acres of wetlands. The distance of bank separating the nearest pond and stream channel is 7.5 feet with a water elevation difference of 2.5 feet (pond is higher). A large portion of the bank was lost between 1999 and 2000 as indicated on the aerial photos. In 1999 the bank

separating the pond to the main stem was around 19 feet and in 2000 it reached it current width of 7.5 feet. This is a loss of 11.5 foot of bank. The lack of stable banks will continue eroding until it creates a new confluence for this spring water.
Alternative 2

Direct Effects: This alternative has no specific actions that adversely affect floodplains. The proposed restoration would re-establishes floodplain connectivity by eliminating entrenched stream sections. Removal of wood from log jams with large depositional areas built up behind them would lower the water table of the floodplain in areas immediately adjacent to the log jams. The stream would not become incised or downcut because of the placement of hydraulic controls. There would be short term adverse affects to floodplain vegetation and soils as a result of heavy equipment crossing the floodplain and working within the stream. Vegetation would be crushed and soils compacted along the access routes. The travel routes for the equipment are expected to total approximately 2000 feet in length, with a width of approximately 10 feet wide. The floodplain would still function in the short term in having the ability to dissipate floodwaters. Adherence to mitigation measures would minimize short term effects to soils and vegetation. Long term effects are not anticipated.

Restoring the channel to a stable sinousity and width to depth ratio would roughly impacted 1 to 2 acres of wetlands. However, the current rate of wetlands and riparian loss would be stabilized. Futhermore, the restoration would create, restore, and enhance roughly a 20 to 40 fold increase over the impacted wetland acres. This would be achieved by narrowing the channel, reduce bank erosion and channel migation through restoration log and boulder type structures, reconnecting the floodplain to the channel, and by planting over 30,000 native wetland and riparian plants.

The proposed activities are compliant with the Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands). The Oregon Department of State Lands and the US Army Corps Engineers regulations would be followed for stream restoration, wetland protection, and fill and removial under there jusidiction. Necessary fill and removial permits would be obtained from these agencies prior for the project.

Indirect and Cumulative Effects: Restoration of the stream to a stable system would allow the stream to utilize its floodplain during high flow events and maintain water table elevation in wetlands.

Reference:
Cowardin, L. M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States.

Executive Order 11988 Floodplain Management. May 24, 1977; 42 FR 26951, 3 CFR, 1977 Comp., 117

Executive Order 11990 Protection of Wetlands. May 24, 1977; 42 FR 26951, 3 CFR, 1977 Comp., 121

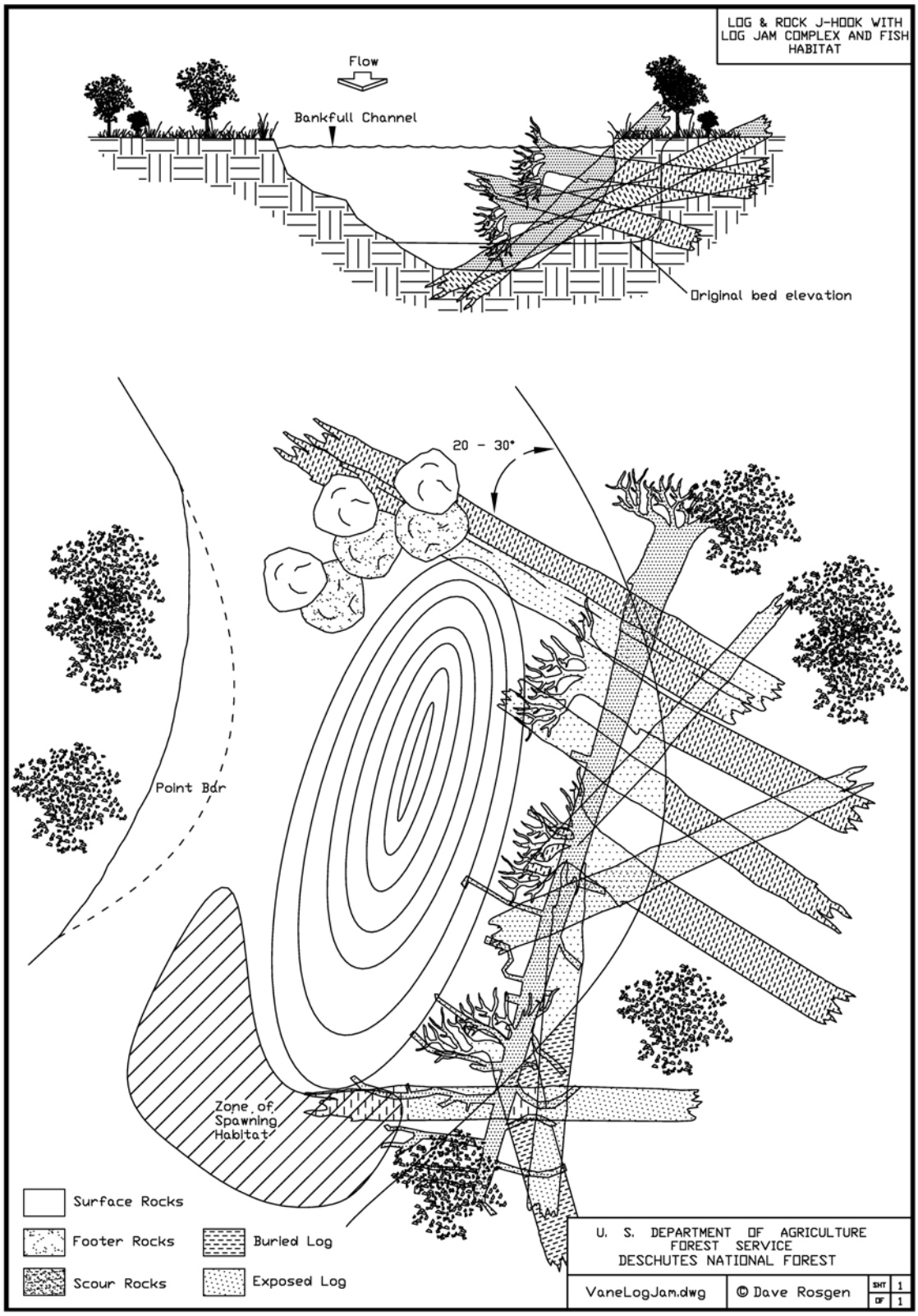


Figure 1: Typical Log jam complex with log and boulder vane

Example of a log jam complex with log and boulder vane as built on Trapper Creek a tributary to Odell Lake near Crescent, Oregon. Looking upstream at the lower end of the jam.

Example of a log jam complex with log and boulder vane as built on Trapper Creek a tributary to Odell Lake near Crescent, Oregon. Looking downstream at the same complex as above from the upper end of the jam.

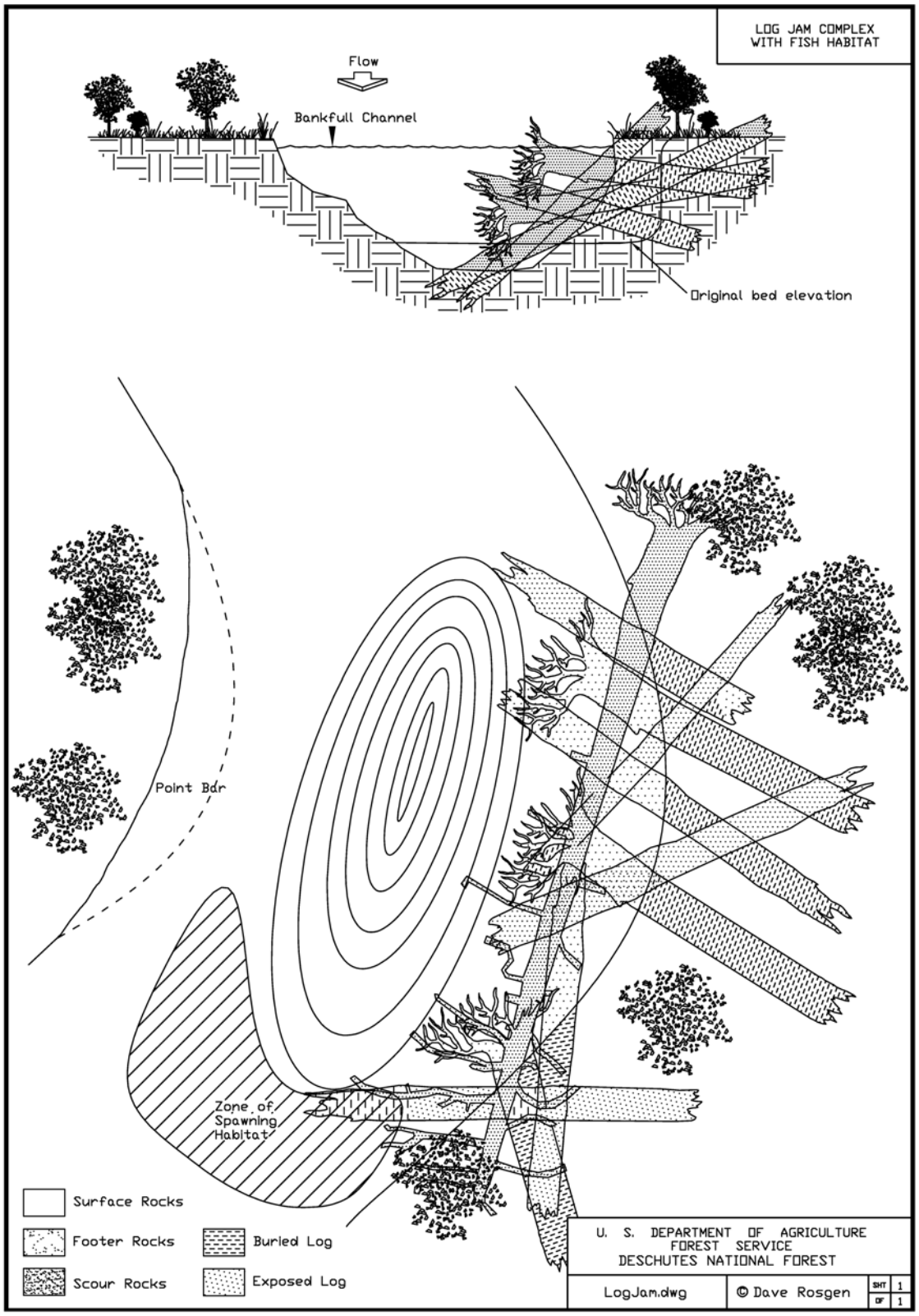


Figure 2: Log Jam Complex without log vane.

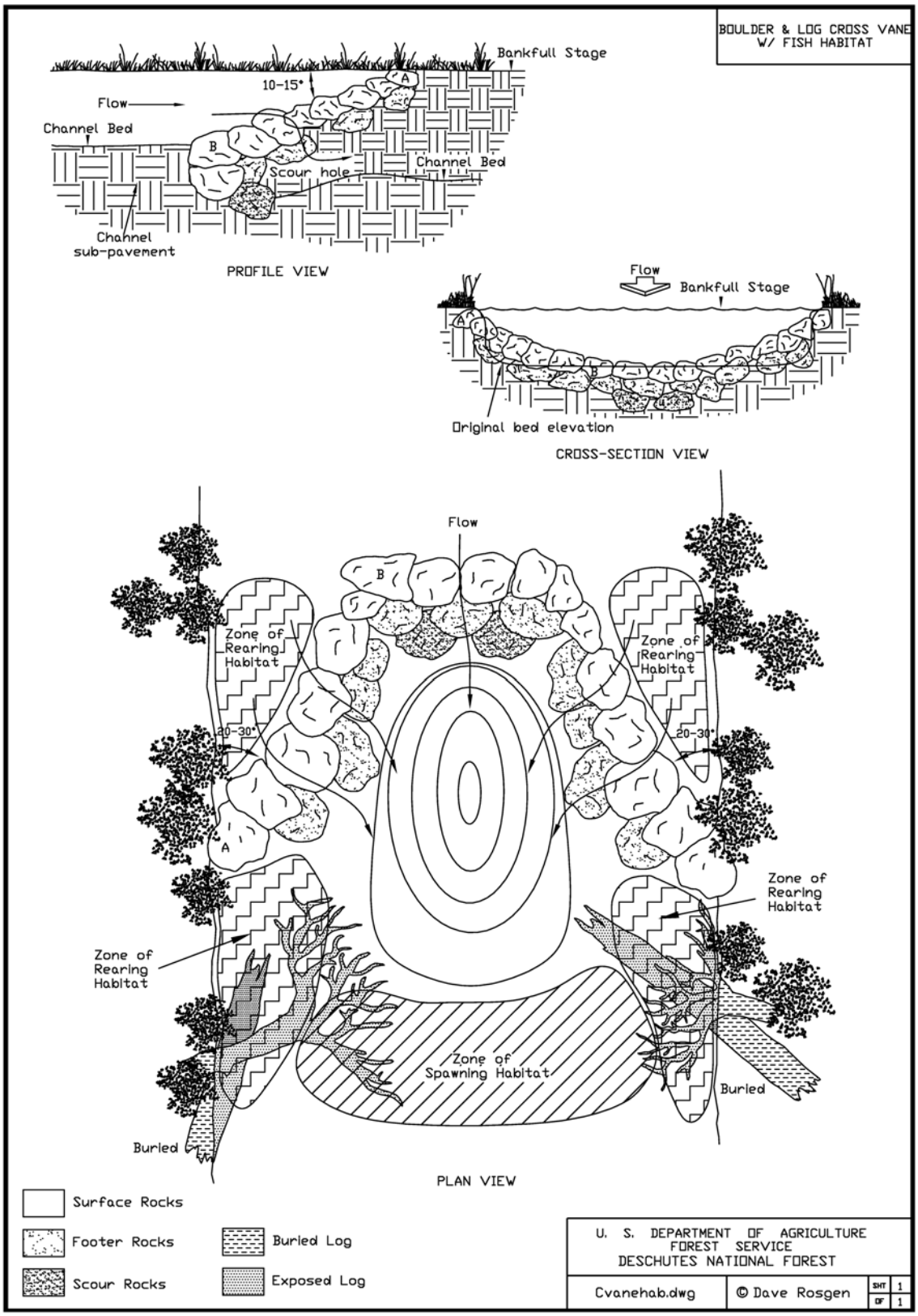


Figure 3: Boulder Cross Vane structure

Example of a Boulder Cross Vane as constructed on Trapper Creek a tributary to Odell Lake near Crescent, Oregon.

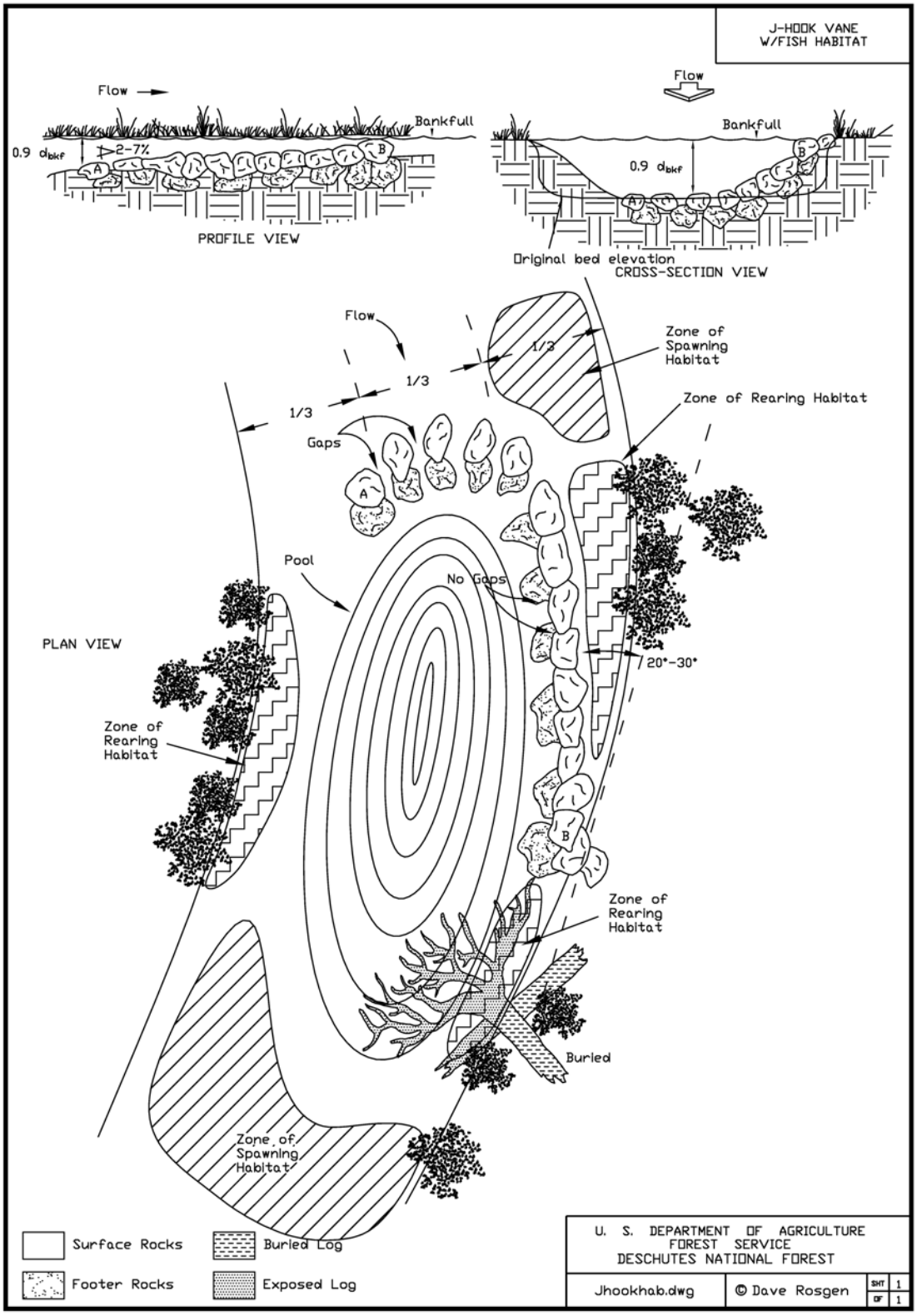


Figure 4: Boulder J-Hook Vane Structure.

Example of a Boulder J-Hook Vane with fish habitat as constructed on Trapper Creek a tributary to Odell Lake near Crescent, Oregon.

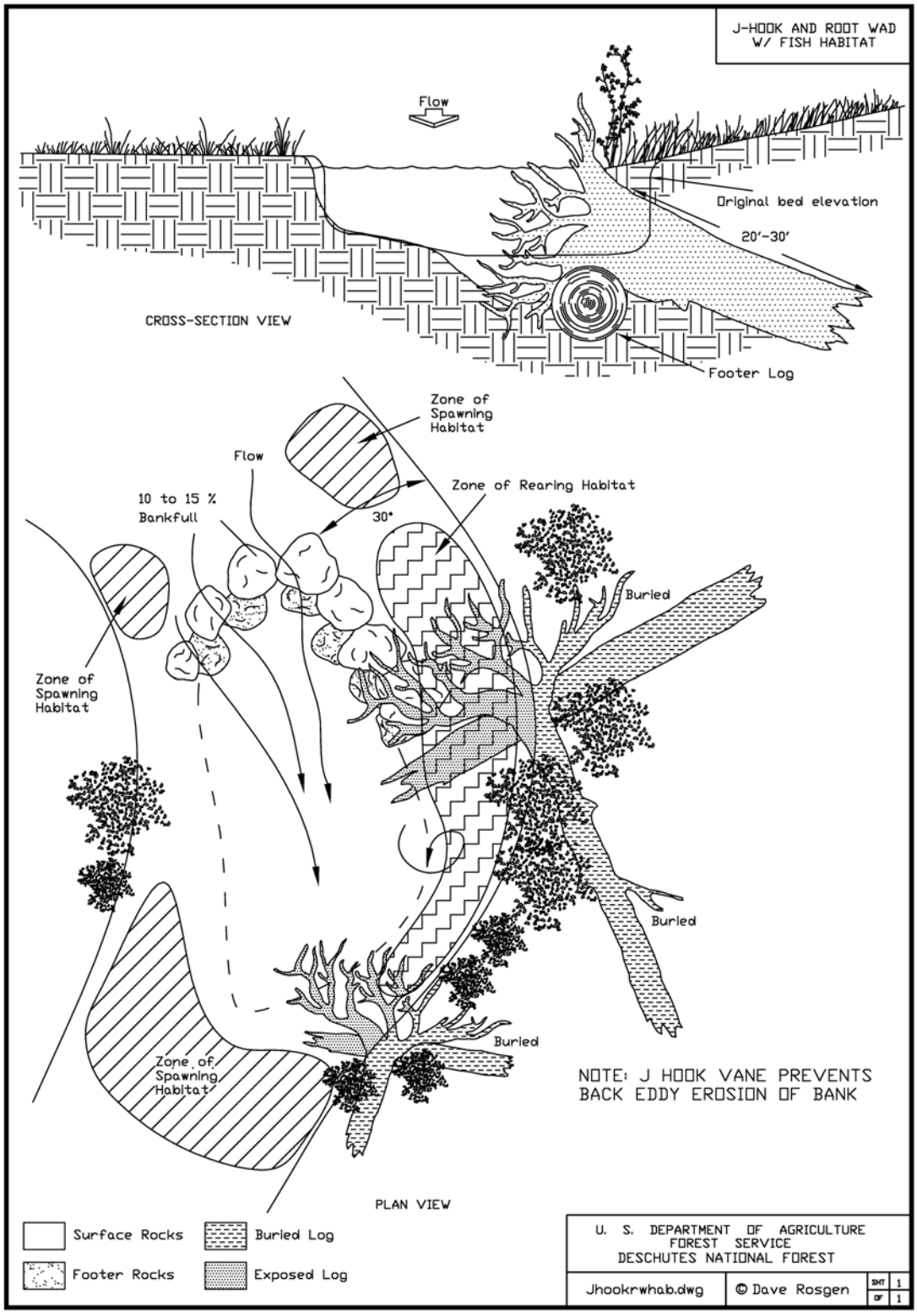


Figure 5: Boulder and Log J-Hook Vane with associated fish habitat.

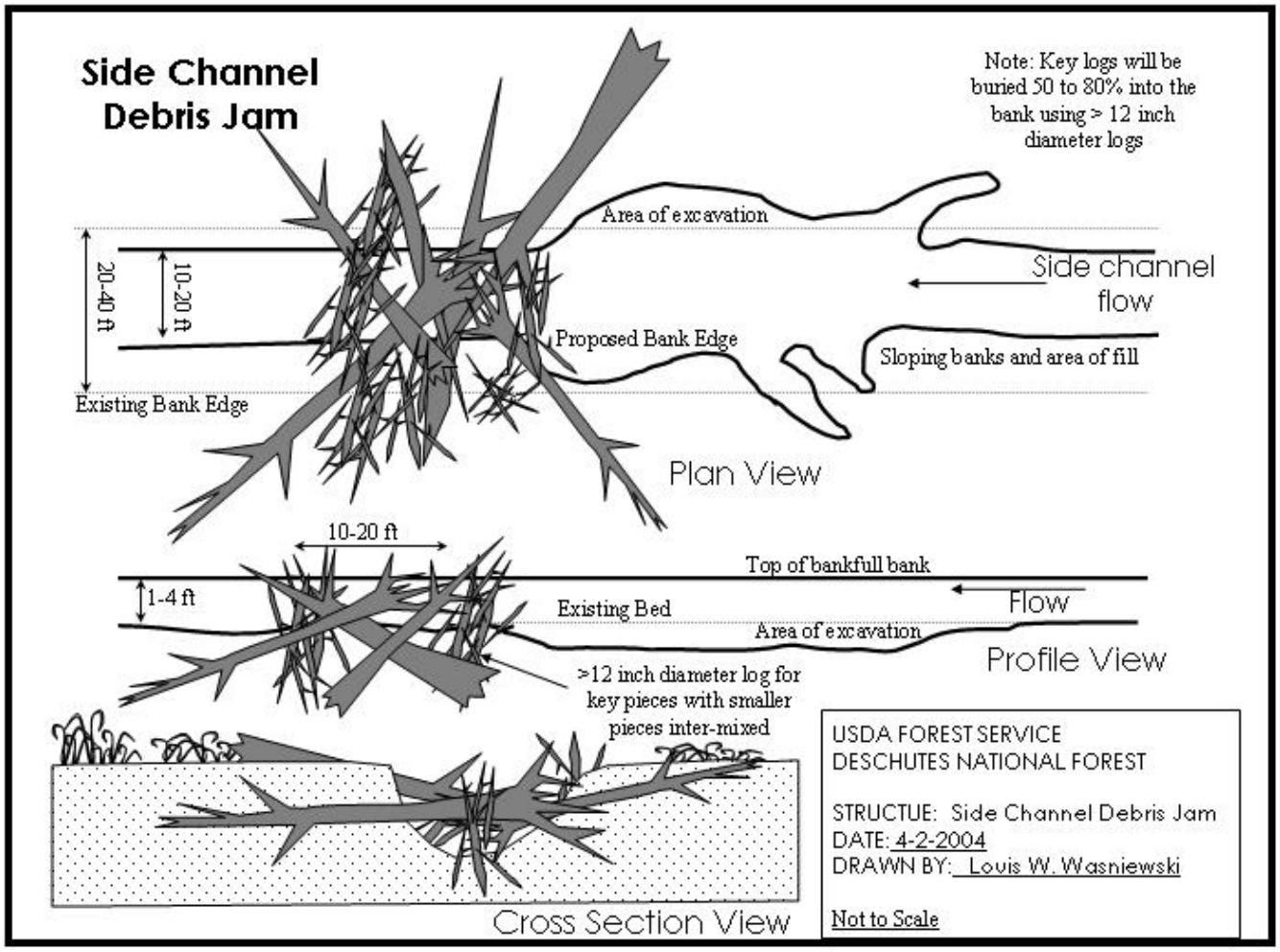


Figure 6: Typical side channel debris jam

Example of a naturally occurring side channel beaver log jam complex located on Tumalo Creek that this typical side channel debris jam drawing is trying to mimic.

BIBLIOGRAPHY