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Final Environmental Impact Statement

Fish Passage and Aquatic Habitat Restoration at Hemlock Dam

Mount Adams District, Gifford Pinchot National Forest
Skamania County, Washington

S. 27, T. 4N, R. 7E, W.M.

Fish Passage and Aquatic Habitat Restoration at Hemlock Dam
Final Environmental Impact Statement
Skamania County, Washington

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Abstract

The Forest Service (USFS) proposes to remove Hemlock Dam to improve upstream and downstream fish passage at the dam site for all life stages of fish, including Threatened Lower Columbia River steelhead. The project will also improve aquatic habitat and water quality in Trout Creek. The proposed action (Alternative B) would remove and dispose of the dam structure and construct a pilot channel through the accumulated sediments behind the dam. The accumulated sediments would be permitted to erode naturally. Once the channel is stabilized, rehabilitation of streambanks would begin.

Alternatives to this action were analyzed in the environmental impact statement (EIS), including:

Alternative A: No action.

Alternative C (Preferred Alternative in the final EIS): The same as the original proposed action (Alternative B), except that the accumulated sediments behind the dam would be removed mechanically rather than by erosion and the channel would be designed and constructed, rather than permitting the stream to erode its own channel.

Alternative D: Retain the dam, improve deficiencies in fish passage components of the dam, dredge the reservoir, and modify or replace the fish ladder.

Alternative E: Retain the dam, improve deficiencies as in Alternative D, do not modify or replace the fish ladder.

Analysis of these alternatives concluded that the proposed action would adversely affect fish if a majority of the accumulated sediments were allowed to pass downstream following dam removal. Consequently, Alternative C, which would remove and dispose of the majority of accumulated sediments and construct the channel, is the environmentally preferred alternative.

The USFS originally expressed the proposed action as Alternative B. Following the consideration of public comments and the analysis of effects contained in this final EIS, Alternative C is the USFS's preferred alternative.

EXECUTIVE SUMMARY

Background

Hemlock Dam was constructed in 1935 originally to generate electricity for the U. S. Forest Service Wind River District, Wind River Nursery, and a Civilian Conservation Corps camp. It was later re-tooled to provide irrigation water for the Wind River Nursery. Since the reservoir has been in existence, it has provided recreational opportunities. The site was developed soon after the dam was constructed to include a picnic area, boat launch, and a swimming area and became known as Hemlock Lake. Recreational use of the reservoir continues to this day however, the dam no longer serves the purposes of hydroelectric power generation or water storage for irrigation.

Need for Action

Declines in the number of Lower Columbia River (LCR) summer steelhead returning to Trout Creek in the mid-1990's focused attention on fish passage and habitat conditions throughout the watershed. Listing of the LCR steelhead as Threatened under the Endangered Species Act occurred in 1998 and further heightened awareness of the need to improve conditions for these fish. Since the mid-1990's, when fewer than ten fish returned to Trout Creek, the U. S. Forest Service (USFS) and partner agencies including U.S. Fish and Wildlife Service, Bonneville Power Administration, Underwood Conservation District and others have identified and treated numerous areas within the Trout Creek watershed to improve conditions for these fish. Projects have included: instream enhancements, woody debris placement, riparian planting, road decommissioning and culvert upgrades, and incremental improvements in attraction flow to the fish ladder at Hemlock Dam. In spite of the improvements to the fish ladder, Hemlock Dam has continued to function as a bottleneck for fish and other aquatic organisms in lower Trout Creek. It also causes water temperatures to increase to lethal levels in Hemlock Lake, and contributes to poor habitat conditions in the lower reaches of Trout Creek.

Proposal

To improve upstream and downstream fish passage for all life stages of fish at the Hemlock Dam site and to improve aquatic habitat and water quality in Trout Creek, the Mount Adams District of the Gifford Pinchot National Forest proposes to remove Hemlock Dam and to dredge and construct a new channel in the area which is now occupied by the reservoir behind Hemlock Dam. The proposed action developed under the draft environmental impact statement (DEIS) would have removed the dam and allowed the river to erode sediments from the reservoir to form the new channel. The preferred alternative in the final environmental impact statement (FEIS) is different than the proposed action described in the DEIS in response to findings in the analysis of alternatives in the DEIS that the project would significantly affect fisheries if sediments were allowed to be flushed downstream.

The area affected by the proposal includes the immediate vicinity of Hemlock Dam, reservoir, and fish ladder (within S. 27, T. 4N, R. 7E, W.M.); the disposal site for the concrete dam structure in a location known as the Carson-Guler quarry; the disposal site for the excess channel sediments in a portion of the former Wind River Nursery that is still under federal ownership; the haul routes between these two disposal sites (Forest Roads 30, 43, 60 and 60-031); the channel of Trout Creek and Wind River downstream from the dam; and the confluence of Wind River with the Columbia River.

Project History

This project was initiated in 2000. The Notice of Intent (NOI) was published in the *Federal Register* on August 16, 2001. In response to this notice and local public outreach ("scoping"),

approximately 150 comments were received. Various public meetings served as a forum for stakeholders and the USFS to discuss and learn about the proposed action and associated issues. After an interruption in the project, a second scoping notice was issued on May 24, 2004 that informed the public that the project had been resumed and that previously received comments would be retained and considered along with any new comments. In both 2001 and the more recent phase of public scoping, 162 comments were received from individuals, organizations, agencies, and tribes via meetings, phone calls, letters, and emails.

Several issues were raised as a result of these comments and the concerns for the adverse effects of the proposed action. The USFS identified eight significant issues that would be used to formulate alternatives to the proposed action. The significant issues are:

Increase in water temperature

Sediment release into Trout Creek and Wind River

Barriers to fish migration

Loss of recreational opportunities at Hemlock Lake

Direct impacts to an historic structure

Direct impacts to prehistoric sites

Impacts to the local economy from expenditures by recreation visitors

Economic impacts to the USFS

These issues led the agency to develop and analyze the following alternatives to the originally proposed action:

Remove the dam, dredge 35,000 – 60,000 cubic yards of accumulated sediments from proposed channel location

Retain the dam, improve deficiencies, and modify or replace the fish ladder

Retain the dam, improve deficiencies, do not modify or replace the fish ladder

Pursuant to the National Environmental Policy Act (NEPA, at 40 CFR 1502.14) the “no action” alternative will also be evaluated.

A DEIS was issued for public comment on October 1, 2004. A total of 65 individuals, representatives of organizations, tribes, and agencies submitted comments during a formal 45-day comment period. The substantive comments received through this process have been addressed either in the text of this FEIS, or in direct responses included in Appendix A of the FEIS. Analysis in the DEIS quantified the effects of the proposed action, and through this process it was determined that the proposed action (Alternative B) would result in unacceptable short term impacts to fish, as a result of the large volume of sediments that would be eroded downstream. For that reason, Alternative C, the alternative that would remove the dam, dredge most of the accumulated sediments, and construct a designed channel through the area now occupied by the lake has become the USFS’s preferred alternative.

Analysis Findings

The results of the analysis in this FEIS are summarized in the following table.

The responsible official will consider all effects and decide whether or not to remove and dispose of Hemlock Dam and the fish ladder and if so, whether or not to remove and dispose of all of the sediments from the proposed channel. If the decision will be to retain the dam, the disposition of the fish ladder will be a part of this decision.

Comparison of Effects by Alternative					
Issue					
Measure	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D**	**Alt. E**
Water temperature and effects to fish					
Predicted peak temperatures	No change. Peak temperatures in the reservoir exceed levels that are lethal to steelhead.	Temp increases associated with Hemlock Lake are eliminated.	Same as Alt. B.	Temperature increases in Hemlock Lake are reduced following dredging. Persistence of improved temperatures is dependent on the rate the reservoir refills with sediment.	Same as Alt. D.
Predicted temperature effects to fish	Fish may be harmed or die from exposure levels and duration.	Exposure levels and duration are reduced.	Same as Alt. B.	Exposure levels reduced for same period following dredging; duration of exposure is unchanged.	Same as Alt. D.
Sediment release into Trout Creek and Wind River and effects to fish					
Predicted changes in turbidity	No change. Dam plays imperceptible role in turbidity levels downstream.	Turbidity levels extremely high during first year of channel incision and expansion.	Short term increase in turbidity during re-watering of the constructed channel and in initial high flow events.	Short term increases during construction, annual sluicing, and recreational use.	Same as Alt. D.
Predicted turbidity effects to fish	Minor effects to fish in reservoir due to recreational uses.	High steelhead mortality downstream during first year of implementation.	Minor, short term effect to fish during construction and during fall freshets.	Minor short-term effect to fish during construction, during annual sluicing, and during recreational use of the reservoir.	Same as Alt. D.
Predicted sediment deposition timing, location, and thicknesses downstream of the dam	Continued sand and silt deposition across the reservoir. No large sediment routed past dam. Continued depletion of isolated spawning gravels and cobble downstream.	Up to 1.5 feet of sand deposits in lower Trout Creek immediately following dam removal. Annual sediment load in the Wind River doubled during first year of project. Long term increase in coarse sediment downstream of dam site.	Minor project-related increase in sediment deposition downstream. Long term increase in coarse sediment deposition downstream of the dam site.	Minor project-related increase in sediment deposition downstream. No increase in coarse sediment deposition downstream.	Same as Alt. D.

Comparison of Effects by Alternative					
Issue					
Measure	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D**	**Alt. E**
Predicted effects of sediment deposition to fish and fish habitat	Continued poor habitat within reservoir due to sand and silt bottom. Continued lack of coarse sediment downstream, limiting spawning, hiding cover, food production for steelhead.	Improved substrate within the reservoir area and downstream due to reduction in sand/silt deposits and increased routing and deposition of coarse sediment, which will improve habitat.	Same as Alt. B.	Same as Alt. A.	Same as Alt. A.
Barriers to fish migration					
Upstream migration success	Continued exposure to delay in upstream migration. Numbers of returning adult steelhead influenced by passage, habitat, harvest pressures.	Migration delays resulting from the dam are eliminated. Short term decline in number of adult steelhead returning to Trout Creek. Over the long term, adult steelhead returns projected to increase by 20% to 66% as a result of dam removal.	Migration delays resulting from the dam are eliminated. Adult steelhead returns projected to increase by 20% to 66% as a result of dam removal.	Continued exposure to upstream delays. Adult steelhead returns are projected to increase slightly.	Similar to Alt. A.
Downstream migration success	Continued delay in the reservoir. Potential for mortality from fall impact over dam.	No delay or mortality associated with the dam.	Same as Alt. B.	Continued delay in the reservoir. Fall mortality is reduced by construction of downstream fish bypass.	Same as Alt. D.
Impingement potential	Continued exposure of smolts to impingement on screen or flashboards.	No exposure to impingement related to the dam.	Same as Alt. B.	Reduced exposure to impingement.	Same as Alt. D.
Predation potential	Predation opportunities are increased by ladder, trap, shallow lake.	Increased predation opportunities are eliminated.	Same as Alt. B.	Some reduction in predation opportunities due to increased lake depth.	Same as Alt. D.

Fish Passage and Aquatic Habitat Restoration at Hemlock Dam – Final Environmental Impact Statement Summary of Effects

Comparison of Effects by Alternative					
Issue					
Measure	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D**	**Alt. E**
Harassment potential	Harassment of steelhead (intentional or inadvertent) continues due to recreational uses of the reservoir.	Reduced harassment and greater opportunities for fish to avoid recreationists.	Same as Alt. B.	Slightly reduced harassment due to increased depth. Potential long term increase in harassment as recreational use increases.	Same as Alt. D.
Loss of recreation opportunities at Hemlock Lake					
Predicted changes in use (numbers of visitors and types of experiences)	3,173 local parties; 3,330 non-local parties annually.	1,586 – 2,380 local parties; 793 non-local parties annually.	Same as Alt. B.	Same as Alt. A.	Same as Alt. A.
Direct impacts to an historic structure					
Historic structures altered or destroyed and degree of alteration	No impact.	Destruction of the historic dam and fish ladder.	Same as Alt. B.	Destruction of a portion of an historic property (fish ladder); modification of an historic property (dam).	Modifications to an historic structure (dam and ladder).
Direct impacts to archaeological sites					
Percentage of archaeological site disturbed	No impact.	Impacts > or = 0.2% of Trout Creek archaeological site.	Same as Alt. B.	Impacts > or = 0.05% of archaeological Trout Creek site.	Same as Alt. D.
Impacts to the local economy from expenditures by recreation visitors					
Predicted change in expenditures by Hemlock Lake visitors	$17,600 – $61,400 annually.	Estimated at $8,400 – $34,000 annually.	Same as Alt. B.	Same as Alt. A.	Same as Alt. D.
Economic impact to the USFS					
Estimated 20-year cost (present net value)	$255,764	$1,142,497	$1,917,547	$2,691,512	$2,393,572

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Document Structure

The U. S. Forest Service (USFS) has prepared this Environmental Impact Statement (EIS) to comply with the National Environmental Policy Act (NEPA) and other relevant federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives, including the preferred alternative. The document is organized into six chapters:

Chapter 1. Purpose and Need for Action: Chapter 1 includes information on the history of the project proposal, the purpose of and need for the project, and the USFS's original proposal for achieving that purpose and need. This section also details how the USFS informed the public (including organizations, other agencies, and tribes) of the proposal and how the public responded. In addition, this chapter includes a description of the issues that were developed as a result of both internal, interdisciplinary review and public comments on the proposal.
Chapter 2. Proposed Action and Alternatives: Chapter 2 provides a detailed description of the USFS's original proposed action as well as alternative methods for achieving the stated purpose. The alternatives to the proposed action were developed based on significant issues raised by the public and agencies. This discussion also includes a brief description of alternatives that were initially considered but ultimately dropped from further analysis because they may not have been feasible, or did not meet the purpose of or need for the action.
Chapter 3. Affected Environment: Chapter 3 describes the components of the environment that would be affected by implementing the proposed action and other alternatives. This chapter is organized by resource.
Chapter 4. Environmental Consequences: Chapter 4 describes and analyzes the effects of the proposed action and each of the alternatives. This chapter is organized by resource, but focuses the analysis on the issues detailed in Chapter 1.
Chapter 5. Mitigation Measures and Monitoring: Recommended mitigation is offered to avoid or minimize the unavoidable adverse effects of an action. Chapter 5 also identifies the need for monitoring for compliance with permit terms or mitigation, and for effectiveness at achieving the desired outcomes.
Chapter 6. List of Preparers*:* This chapter provides the names of the persons who were primarily responsible for preparing the environmental impact statement or significant background papers and representatives of other agencies consulted during the development of the environmental impact statement.
Distribution of the Environmental Impact Statement: A list of the individuals, Federal agencies, federally recognized tribes, State and local governments, and organizations to whom this statement was sent.
References: The list of references cited in the environmental impact statement.
Index: The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources and the reference materials cited in this statement, may be found in the project planning record located at the Mount Adams District office, 2455 Highway 141, Trout Lake, WA 98650.

CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

1.1. Background and Existing Situation

The project area is located on national forest lands within Section 27, Township 4 North, Range 7 East, Willamette Meridian, Skamania County, Washington. Hemlock Dam is at river mile 1.8 of Trout Creek, a major tributary to the Wind River (Figure 1-1). The total length of the dam is 183 feet and the spillway length is 112 feet. The height of the dam from the streambed to the crest of the spillway is 26 feet, with the north and south abutments rising six feet above the spillway crest. It was built in 1935 to provide power for the Wind River Ranger District of the U.S. Forest Service (USFS) and the associated fish ladder was completed in 1936. The dam was later converted to provide irrigation water for the Wind River Nursery. Throughout the time that the dam has been in place, the reservoir[1] formed by the dam has been used for recreational swimming.

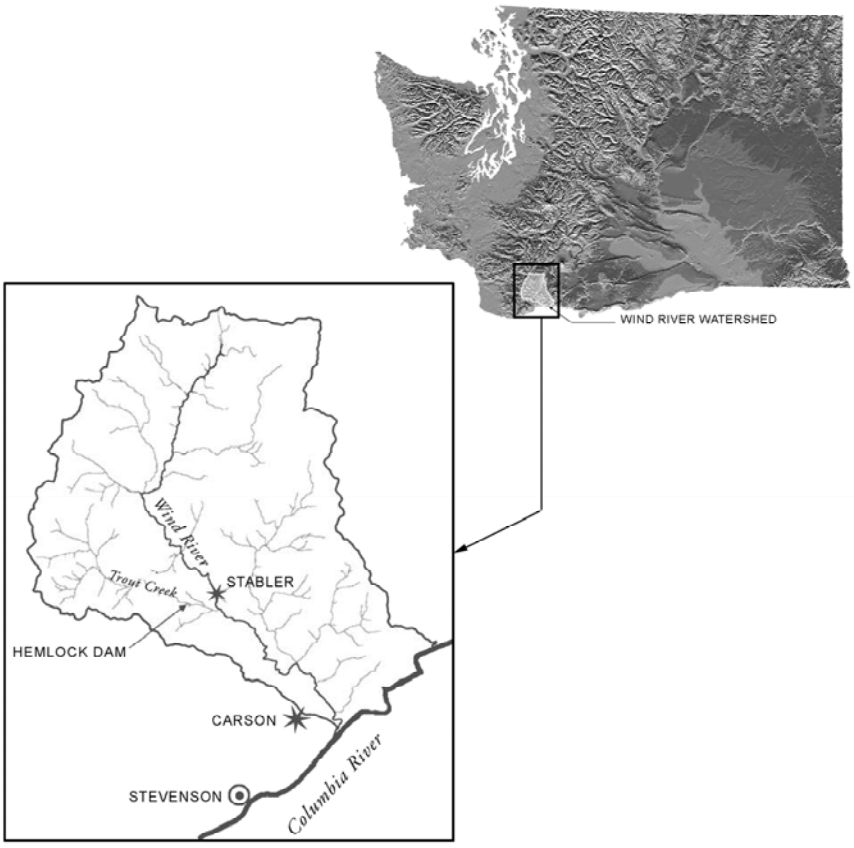

Figure 1-1. Vicinity map.

[1] The body of water impounded behind Hemlock Dam is correctly termed a reservoir, however as a result of the recreational use the reservoir has come to be known as Hemlock Lake. For the purposes of this statement these terms are equivalent.

1.1.1. Endangered Species Act Listing

In 1998, the Lower Columbia River (LCR) steelhead *(Onchorychus mykiss)* was listed as a Threatened species under the Endangered Species Act (ESA). LCR chinook salmon *(Oncorhynchus tshawytscha)* were listed as Threatened in 1999, and LCR coho salmon *(Oncorhynchus kisutch)* were listed as Threatened in 2005. Critical habitat for LCR chinook salmon and steelhead was designated in early September, 2005. Steelhead spend much of their life in the ocean and use Trout Creek and other streams in the Wind River system for spawning and for rearing their young. There are approximately 13 miles of Trout Creek and its tributaries upstream of Hemlock Dam that are accessed by LCR steelhead. Since the listing of these fish the USFS is obligated to consult with regulatory agencies on operation of the dam with respect to its effects on Threatened species. In the late 1990's, the USFS began the process to initiate consultation with the National Marine Fisheries Service (NMFS) but because the nursery had recently closed and the dam was no longer needed for irrigation, the fate of the dam was in question. As a result, the formal consultation was deferred until the USFS had made a proposal concerning the disposition of the dam. In this FEIS, the USFS evaluates options for the dam and identifies a preferred alternative for implementation.

1.1.2. Fisheries and Hemlock Dam

Since the time of dam construction Trout Creek has continued to produce steelhead due to a combination of hatchery outplanting in the upper watershed (which was discontinued in the mid-1980's) and natural migration past the dam. Although both adult and juvenile steelhead are known to pass the dam and fish ladder, there continue to be concerns about the health effects of the delay these fish experience in their attempts at finding a route past the dam via the fish ladder. In addition, large numbers of juvenile fish have been observed to annually congregate in the lake during the summer months when stream discharges are low and therefore, can be exposed to high water temperatures in the reservoir for extended periods.

The Trout Creek steelhead run saw dramatic declines in the number of returning fish in the 1990's coinciding with a regional decline in steelhead. Factors that affect fish populations include oceanic conditions, harvest, predation, natural cyclical phenomena, as well as fresh-water habitat conditions. Reaching a low of just eight returning fish in 1997, returns have since increased to peak at 75 fish in 2003. Although the source of the decline in the 1990's does not appear to be attributable to Hemlock Dam, the fact that fish returns reached such low levels indicates the tenuous nature of this run and the importance of taking any available actions to remedy known problems.

Hemlock Dam has been identified as an impediment to steelhead based on a combination of engineering and hydraulic studies and visual observations made by agency personnel. Studies completed by Orsborn (1987) and Barber and Perkins (1999) found deficiencies in the design of the fish ladder and dam equipment that would contribute to direct fish mortality and that form impediments to fish passage. USFS and U. S. Geological Survey (USGS) biologists working around the dam have documented direct fish mortality at the dam due to both impingement of fish on dam structures and fall mortality to fish going over the dam crest. Local biologists have also noted large numbers of juvenile fish just upstream of the dam during the late summer months, and have considered this an indication of some inability of the fish to find the reservoir outlet, or reticence to move downstream over the dam crest.

1.1.3. Water Quality and Aquatic Implications

During summer months Trout Creek has the highest water temperatures of any major tributary to the Wind River, frequently exceeding state water quality standards for maximum water temperature. Over the past ten years the state water quality standard for water temperature has been exceeded on an average of 50 days per year in Trout Creek just upstream of the reservoir. As these heated waters flow through the reservoir, temperatures continue to increase, at times reaching levels that are lethal to steelhead (USDA 1996). As a result of the high temperatures, Trout Creek was listed on the Washington State Department of Ecology's (WDOE) 303(d) list of impaired water bodies (WDOE 1998). In 2001, the WDOE completed a Total Maximum Daily Load (TMDL) analysis for the Wind River watershed, in which they recommended removal of Hemlock Dam as one means of improving water temperatures in Trout Creek (WDOE 2002).

Although the heating of water in Trout Creek begins in the wide, open channels in the upper Trout Creek drainage well above the influence of Hemlock Dam, the reservoir formed by the dam is an important contributor to increased temperature in lower Trout Creek (USDA 2001). Moreover, the combined effect of the increased water temperature in the reservoir and the potential delay of fish moving downstream past the dam may expose those fish to the higher water temperatures for long periods as they search for the reservoir outlet. High water temperatures in the reservoir have been compounded by the continued infilling of the reservoir with sediments, which has reduced the amount of deep water where fish can find thermal refuge. In addition, water impounded behind the dam acts as a "heat sink" which alters both water temperature maximums and the diurnal temperature fluctuation in the two mile reach of stream below the dam. High water temperatures can cause direct mortality to the fish, but may also indirectly affect survival by impacting their health and vigor.

In addition to the suspected delay in fish migration, the dam forms a barrier to downstream movement of sediment and other debris. In past years, the Wind River Nursery occasionally dredged the reservoir to maintain storage capacity or used a sluice gate to periodically flush a portion of sediments from the reservoir downstream. These practices were curtailed decades ago and the reservoir has subsequently filled with sediment. The dam now entirely blocks the downstream movement of any coarse sediments and other debris. This affects aquatic habitat and channel processes both in the lake and downstream of the dam.

Because sediments are deposited and trapped upstream of the dam habitat for steelhead within the reservoir has been buried by sands and finer-grained sediments. Lower Trout Creek, and to a lesser extent the Wind River downstream of the Trout Creek confluence have been depleted of larger sediments due to their sequestration behind the dam. These larger sediments are important for providing spawning gravels, flow resistance, reducing channel erosion, providing hiding cover for fish, and retention of debris. Replenishment of sediments from upstream sources is important for building or rebuilding gravel bars and replacing channel substrate that has been scoured and transported downstream. Stored sediments and organic debris throughout the channel provide habitat for aquatic life that provides food for fish and other aquatic organisms. Since 1935, a majority of the spawning gravel and larger sediments from upper Trout Creek have been trapped behind the dam.

1.2. Purpose, Need, and Objectives

The primary purpose and need for the action is to improve upstream and downstream passage for all life stages of fish at the Hemlock Dam site and to improve water quality and habitat conditions in Trout Creek in the vicinity of Hemlock Dam.

By reestablishing Trout Creek as a free-flowing stream and providing better connectivity of the aquatic habitat in Trout Creek, both the original proposed action and the preferred alternative would enhance opportunities for viable and healthy fish populations, assist in the recovery of Lower Columbia River steelhead in the Wind River watershed, and benefit all aquatic organisms in lower Trout Creek. The proposed action (and the preferred alternative) responds to the goals and objectives outlined in the *Wind River Water Quality Restoration Plan* (USDA 2001) and the Wind River Total Maximum Daily Load (WDOE 2001), the Aquatic Conservation Strategy Objectives from the Northwest Forest Plan (1994, amended 2004), the *Gifford Pinchot National Forest Land and Resource Management Plan* (1990), as amended, and the second iteration of the *Wind River Watershed Analysis* (2002) and helps move the project area toward desired conditions, including:

- increasing resident and anadromous fish populations as a result of habitat improvements and enhanced riparian management, and
- localized improvement in water quality.

Fish passage, water quality, and habitat improvements are evaluated from analysis of the following measurements:

- fish migration
- water temperature
- sediment and turbidity

The District Ranger (Responsible Official) directed that the following objectives accompany the primary purpose:

Implement a cost effective approach to managing the Hemlock site.

Continued operation of the dam includes a number of costs that are the responsibility of the USFS. State law (RCW 77.55.060) requires regular maintenance and clearing of the fish ladder which entails daily visits to the dam to clear debris from the fish ladder, the traveling fish screen, and other places where fish passage facilities could be obstructed. In addition, older operational parts of the dam including the traveling fish screen, sluice gate, and their controls have periodic breakage from normal use or from being damaged by instream debris that is being carried downstream in Trout Creek. During summer months, dam flashboards must be managed to maintain a viable swimming lake for recreation while maintaining sufficient downstream flow through the fish ladder. A long term solution to managing the Hemlock site would be to reduce the costs associated with managing the site over the long term.

Continue to support recreational opportunities at the Hemlock site.

The Hemlock Lake recreational site has been popular since its inception in the 1930's. Currently, it is highly used by the public for swimming and water-oriented recreation, but also for picnicking, barbecuing, and other day use activities. The proposed action would eliminate lake-related activities at the Hemlock recreational site but would provide for public uses of the picnic area. Although the picnic area would be closed during the construction period it would be maintained as a recreation site for the long term. Proposals for additional recreational development at this site could be considered after the decision is made about whether to remove or retain the dam. Proposals could then be formulated into designs and analyzed by an interdisciplinary team in a separate environmental assessment.

1.3. Proposed Action

To meet the purpose of and need for action the interdisciplinary team crafted the original proposed action which was to remove Hemlock Dam. In summary, the proposed action included the following components:

Construction of a pilot channel through the reservoir sediments;

Disposal of the sediments that are excavated during construction of the pilot channel (estimated at 2,500 cubic yards) to an acceptable location;

Full removal and disposal of the dam, including abutments and other concrete structures;

Allowing the river to erode sediments from the reservoir and to form a new channel through the area now occupied by the lake (following the alignment established by the pilot channel);

Shaping and stabilization of the newly formed channel banks where necessary (1 – 2 years following implementation of the project);

Making necessary alterations at the Hemlock recreational site to accommodate the new stream channel and rehabilitate the former lakeshore;

Implementing protection and conservation measures that are intended to mitigate unavoidable adverse effects of dam removal (see **Chapter 5, Mitigation Measures**).

This action meets the purpose of enhancing opportunities for viable and healthy fish populations of Lower Columbia River steelhead within this portion of Trout Creek by removing a major obstacle to fish passage of all life-stages; improving habitat conditions and water quality by replacing a slow, warm body of water with a free-flowing stream; and permitting unrestricted stream channel processes.

Removal of the dam would also meet the secondary objectives of the project. Ongoing and long term costs associated with management of the dam would be eliminated. There would be no facility or operational parts to maintain and no liability issues associated with the dam or recreational uses around it. In addition there would be no future (deferred) costs for dam removal or repair. Though the reservoir would be drained through this action, thereby removing lake-oriented recreation, the day use area would be retained. Development opportunities could be considered in subsequent planning efforts.

A complete description of the actions associated with the dam removal is provided in Chapter 2. Chapter 4 presents the analysis of how this action compares to various alternatives in meeting project objectives, as well as the comparison of impacts to the human environment.

As stated previously in this document, the Proposed Action is no longer the alternative that is preferred by the USFS. As a result of environmental effects analysis and comments received from the public and other agencies, the USFS now prefers Alternative C, which removes the dam but constructs a channel through the reservoir instead of allowing the sediments to be flushed downstream by river erosion.

1.4. Management Direction

The National Forest Management Act explicitly directs that diversity of plant and animal species be considered in planning. Moreover, the Endangered Species Act directs the Secretary of the Interior and the Secretary of Agriculture with respect to National Forest System lands, to

establish and implement a program to conserve fish, wildlife, and plants, including those listed as Threatened or Endangered.

This action is planned under the direction of *The Land and Resource Management Plan for the Gifford Pinchot National Forest* (1990), commonly referred to as the Forest Plan. The Forest Plan was amended by the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (Northwest Forest Plan ROD). This Amendment was signed May 20, 1994 and further amended in 2004 by the *Record of Decision to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines* and the *Record of Decision…to Clarify Provisions Relating to the Aquatic Conservation Strategy*.

Attachment A to the Northwest Forest Plan ROD, *Standards and Guidelines for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl* (herein referred to as Northwest Forest Plan S&Gs), sets forth the management direction intended to facilitate implementation of the Northwest Forest Plan ROD. Collectively, the amended Northwest Forest Plan ROD and Attachment A are referred to as the Northwest Forest Plan.

Amendment 11 to the Forest Plan was published in February 1995. It is a compilation of the applicable portions of the Northwest Forest Plan and the 1990 Forest Plan and was published to serve as a convenient reference document. It is available on the internet at http://www.fs.fed.us/gpnf/.

1.4.1. Northwest Forest Plan Direction

The Northwest Forest Plan includes direction aimed at restoring and maintaining the health of watersheds and aquatic ecosystems contained within them, specifically to protect salmon and steelhead habitat on federal lands. Termed the Aquatic Conservation Strategy (ACS), this conservation strategy set forth nine objectives. The Northwest Forest Plan and Forest Plans were amended in 2004 by the *Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy* such that consistency with the ACS objectives is to be determined at the fifth-field watershed scale. For this project, the fifth-field watershed is the Wind River watershed. Collectively, activities within a watershed must meet or not prevent attainment of the nine Aquatic Conservation Strategy objectives at the watershed scale (Northwest Forest Plan S&Gs, B-11).

Components of the ACS include:

> Riparian Reserves, which are lands along streams and unstable and potentially instable areas where special standards and guidelines apply;
>
> Key Watersheds, which are a system of large refugia comprising watersheds that are crucial to anadromous and at-risk fish species and stocks and provide high-quality water;
>
> Watershed Analysis, which evaluates geomorphic and ecological processes operating in specific watersheds;
>
> Watershed Restoration, which is a comprehensive, long term program to restore watershed health and aquatic ecosystems.

Dam removal, channel restoration, sediment transport and disposal activities occur largely within Riparian Reserves. Riparian Reserves are portions of watershed where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply (Northwest Forest Plan S&Gs, B-12). The standards and guidelines for Riparian Reserves prohibit or regulate

activities that would retard or prevent attainment of the ACS objectives at the watershed scale (Northwest Forest Plan S&Gs, Amended 2004, C-31).

The Hemlock Dam planning area falls within the Wind River watershed, a Tier 1 Key Watershed emphasized as a conservation and restoration area for at-risk anadromous salmonids and resident fish. Tier 1 Key Watersheds are given the highest priority for watershed restoration (Northwest Forest Plan S&Gs, p. C-7).

The second iteration of the *Wind River Watershed Analysis* (USDA, 2001) contains watershed restoration recommendations that are specific to Hemlock Dam and to Trout Creek, including the recommendation to "modify or remove Hemlock Dam to allow unimpeded adult and juvenile migration and reduce maximum water temperatures" (USDA 2001, p. 91).

There are a number of watershed restoration activities that have been approved or implemented in the Trout Creek subwatershed and the Wind River watershed. They are considered in relation to cumulative effects to fish habitat and water quality. Restoration activities and other actions that have taken place over the past decade or are planned within Trout Creek and the Wind River watershed and that could result in cumulative impacts are identified in **Chapter 3, Affected Environment** (Table 3-20). Individual actions or types of actions are considered in the description of the resources potentially affected by this action and in the cumulative effects analysis found in **Chapter 4, Environmental Consequences**.

The Responsible Official will determine from the record and the information contained in this document whether the project is designed to contribute to maintaining or restoring the fifth-field watershed over the long term, even if the short term effects may be adverse.

1.4.2. Forest Plan Land Allocations and Direction

Gifford Pinchot National Forest lands are allocated to a system of Management Areas according to the amended Forest Plan (Amendment 11). These Management Areas carry specific management goals for activities that would occur within them. The "desired future condition" and "standards and guidelines" detailed in the Forest Plan guide how these lands will be managed. Figure 1-2 identifies the Management Areas in the vicinity of the Hemlock Dam project.

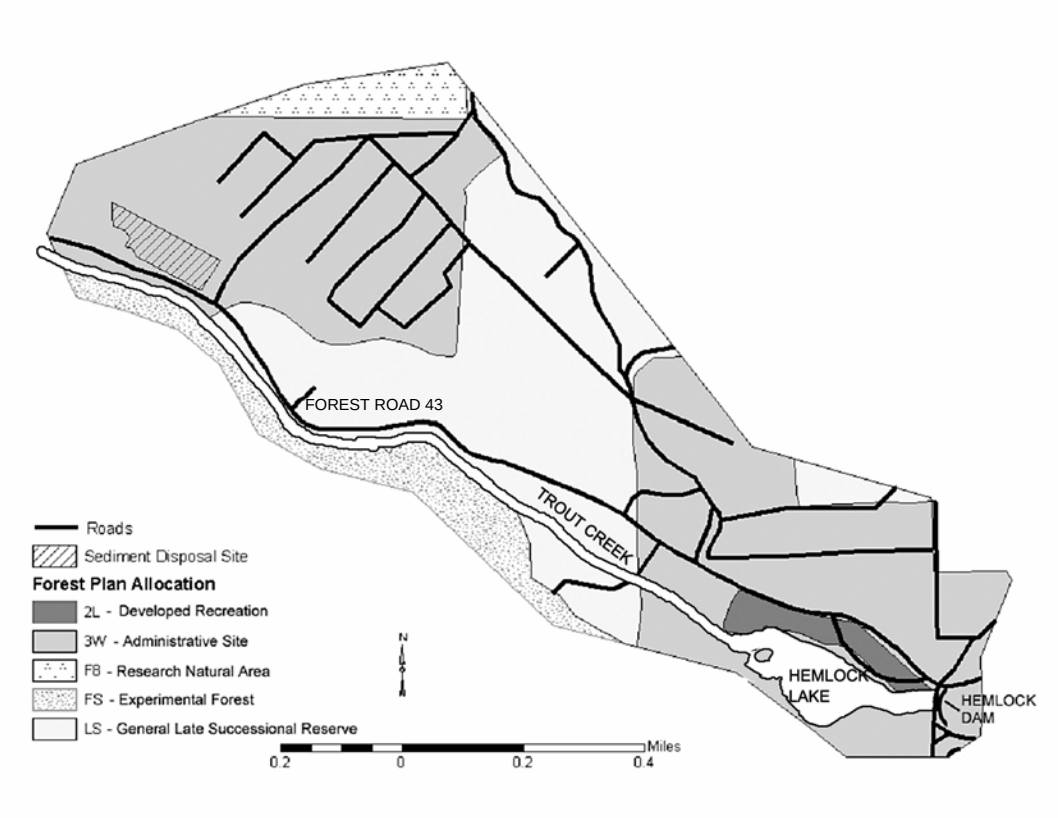

Figure 1-2. Forest Plan Management Areas in the Hemlock Dam project area.

Hemlock Dam and Hemlock Lake are within and, except for the north shore of Hemlock Lake, are included in the larger Wind River Administrative Site (3W) Management Area. The desired future condition for Administrative Sites includes the evidence of ongoing administration of the National Forest through generally permanent structures, including buildings and roads. The Recreation Opportunity Spectrum assigned to Administrative Sites is "Rural" and the Visual Quality Objective is "Modification". For Administrative Sites the Forest Plan states that "[r]ecreational facilities should be few or absent" (Amendment 11, p. 5-18). Public access may be provided when it does not conflict with the functions of the Administrative Site. The Forest Plan does not identify specific standards for managing the Hemlock Lake recreation site. Standards and guidelines appropriate to this analysis relate to recreation planning and inventory and require the inventory of cultural, biological, and other features of interest.

The north shore of Hemlock Lake is designated Developed Recreation (2L). The goal for this Management Area is to provide readily accessible, appropriately designed facilities that will provide for concentrated visitation by people seeking a convenient recreational experience. Developed recreation sites are usually close to water bodies, berry fields, and other areas of scenic or special interest. Except for winter recreation areas, they are usually located on relatively flat land with slopes of less than ten percent. Soils and vegetation must be able to absorb heavy use. Camp and picnic grounds, ski areas, recreation residences, viewpoints, boat launches, and other facilities may be accommodated (Forest Plan, p. 5-21).

The sediment disposal site is located in a portion of the former Wind River Nursery that is designated as Administrative Site (3W) by the Forest Plan. Under the proposed action, Forest

Road 43 would access the disposal site approximately 3.5 miles from the dam. This road parallels Trout Creek and passes almost equally through Administrative Site and General Late-successional Reserve (LS) (Figure 1-2).

The entire project area is overlain by the Late-Successional Reserve allocation as defined in the Northwest Forest Plan. The objective of Late-Successional Reserves is to protect and enhance conditions of late successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species including the northern spotted owl (Amendment 11, p. 5-1).

The Carson-Guler quarry (Figure 1-3), located off of Forest Road 60, has been identified as the closest practical location for disposal of the concrete dam structure (Figure 1-3). Quarries are identified as Administrative Sites in the Forest Plan.

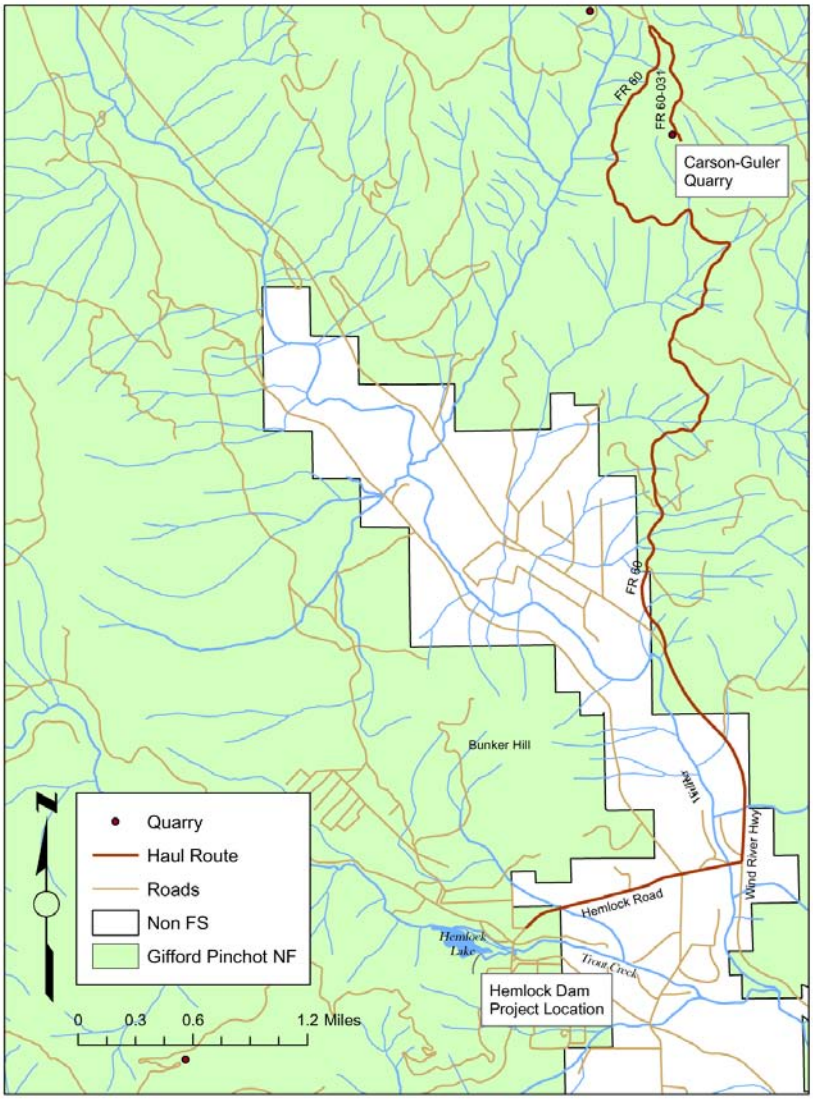

Figure 1-3. Carson-Guler Quarry located off Forest Road 60 on the 031 spur.

1.5. Scope of the Project, Analysis and Decision Framework

The scope of this project and the decision to be made are limited to the disposition of Hemlock Dam, accumulated sediments in the reservoir, and disposition of the fish ladder. The appropriate level of mitigation and monitoring will also be decided. Except for portions of the haul route for the dam materials, this project is limited to National Forest lands within the project area.

Significant issues were determined through both public and within-agency comments. The range of alternatives considered in this analysis was influenced by the significant issues, within a framework guided by the attainment of the purpose of and need for this action. The alternatives considered in this analysis represent a range of reasonable approaches to management of the dam and aquatic resources at this site that are responsive to the stated purpose and need.

If the Responsible Official selects an action alternative as a result of this analysis, implementation of the activities specifically identified will begin as soon as possible and without further documentation under the National Environmental Policy Act. The Responsible Official could also modify a selected alternative to address issues at the time of the decision. Additional information about what is and what is not within the scope of this proposed action and analysis is provided in the description of the issues and the alternatives, including "Alternatives Considered but Eliminated from Detailed Study".

The Responsible Official for this proposal is the Mount Adams District Ranger. Based on the analysis in this EIS, the Responsible Official will make the following decisions and document them in a Record of Decision:

> Whether or not to remove and dispose of Hemlock Dam and the fish ladder;
> If dam removal is selected, whether or not to remove and dispose of the accumulated sediments in the reservoir;
> If the decision will be to retain the dam, the disposition of the fish ladder will be determined.

The decision regarding which combinations of actions to implement will be determined by comparing how each factor of the project purpose and need is met by each of the alternatives and the manner in which each of the alternatives responds to the significant issues raised and public comments received during the analysis process. The alternative that the Responsible Official determines will provide for the best outcome with regard to purpose and need, while accounting for the issues and public comments, will be selected for implementation.

The Responsible Official also decides if the selected alternative is consistent with the Forest Plan and if there is a reasonable expectation that anticipated funding is adequate to complete both implementation and monitoring of the project.

1.6. Public Involvement

Formal public involvement in the Hemlock Dam proposal began with a public outreach effort called *scoping* which endeavors to garner substantive comments and concerns from the interdisciplinary team and other interested parties. These comments were used to help the USFS's interdisciplinary team better understand issues that are associated with the project. Public scoping has thus far occurred in two primary phases. The first scoping phase began with the USFS's Notice of Intent (NOI) published in the *Federal Register* on August 16, 2001. Various public meetings served as a forum for stakeholders and the USFS to discuss and learn about the

proposed action and associated issues. These meetings included: Southwest Washington Advisory Committee meeting on May 30, 2001; an open house at Rock Creek in Stevenson, Washington on May 31, 2001; a briefing for the Stabler Community Council on July 26, 2001; a Watershed Council meeting on September 19, 2001, and a Yakama Nation scoping meeting on November 20, 2001. As a result of these efforts, approximately 150 responses were received in the form of letters, emails and phone calls.

Following an interruption in the project, a second scoping notice was issued on May 24, 2004 that led to another phase of public involvement. The reissued scoping notice informed the public that previously received comments would be retained and considered along with any new comments, concerns, or suggestions. In this most recent phase of public scoping, 162 responses were received via meetings, phone calls, letters, and emails. Approximately 145 of these contacts were standardized emails originating from a website supporting the removal of this and all dams.

All comments received from private individuals, non-government organizations, tribes, and government officials and agencies have been considered in the interdisciplinary team's formulation of alternatives and potential effects determination. Throughout the public scoping process, the public's interest in the proposed action has spanned a spectrum ranging from taking no action to fully removing the dam, to continuing with fact-finding and analysis. The issues supporting these various viewpoints can be broadly categorized as follows:

aesthetics
community and government economics
downstream property effects
ecosystem protection
fish health and habitat
fish trapping and monitoring
historical preservation
legal requirements
public safety
recreational opportunities
scientific justification for project
water quality
water rights

On October 1, 2004 a notice of availability of the DEIS was published in the *Federal Register* which started the formal 45-day public comment period. The DEIS was mailed to 82 individuals, organizations, and agencies. It was made available for download from the internet at the Gifford Pinchot National Forest web site. On October 14, 2004, representatives of the interdisciplinary planning team and the District Ranger hosted a public meeting. This meeting was designed to provide specific information and answer questions about the project and the significant issues raised to date and to obtain formal comments for consideration in the FEIS and the decision. As a part of the public involvement process, representatives of the interdisciplinary planning team attended and presented briefings at the Stabler Community Council meeting on May 3, 2004, Wind River Watershed Council meeting on September 15, 2004; WRIA 29 Watershed Planning Unit meeting, October 13, 2004; and the Trout Unlimited meeting on November 10, 2004.

By the close of the comment period on November 15, 2004, approximately 65 individuals, representatives of organizations, tribes, and agencies had submitted comments to the DEIS. The substantive comments are summarized and the USFS responses are found in Appendix A. These comments were used in the formulation of this final Environmental Impact Statement (FEIS). Comments received from other federal, state, and local agencies and tribes are reproduced in their entirety in Appendix A.

1.7. Issues

Through a combination of public and internal scoping, the interdisciplinary team identified a range of issues and concerns that arose in consideration of the proposed action. In order to develop alternatives to the proposed action, the team then categorized these issues as either "significant", or as "other" issues, or as issues that will not be carried forward into analysis. Significant issues[2] are defined as those concerns which are used in environmental analysis to formulate alternatives, prescribe mitigation measures, or project design criteria. "Other Issues" are issues that were raised during scoping but were not thought to drive the development of a separate alternative. These issues are analyzed and adverse effects may be addressed through mitigation. Also included are issues that were not specifically raised through scoping but for which disclosure of effects is required by law, regulation, or policy.

Issues that are not carried forward to analysis are categorized as either: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) unrelated to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in 40 CFR 1501.7. Concerns of this nature were not analyzed in this statement. A list of issues and reasons for their categorization may be found at **1.7.3 Issues Not Carried Forward To Analysis.**

1.7.1. Significant Issues

1.7.1.1. ISSUE: Water temperature and effects to fish

Trout Creek commonly exceeds state water quality standards for temperature, and Hemlock Dam is known to cause water temperatures to increase in Hemlock Lake and lower reaches of Trout Creek (USDA 2001). Water temperatures in Trout Creek and in Hemlock Lake are particularly important because of their effect on steelhead that use the Trout Creek watershed. Over the past years of monitoring water temperatures, peak summer temperatures in Hemlock Lake have been found to exceed levels that are lethal to steelhead (USDA 1996). Based on its high temperature, Trout Creek is currently identified as Category 4a on Washington State Department of Ecology's 2004 Water Quality Assessment (303(d) and 305(b) reports). Category 4a streams are waters that have pollution problems that are covered under an approved Total Maximum Daily Load (TMDL). The TMDL completed for the Wind River watershed by the Washington State Department of Ecology (2001) recommended removal of Hemlock Dam as one means of improving water temperatures in Trout Creek.

Measurement Methods:

Predicted peak temperatures

Predicted temperature effects to fish

[2] A "significant" issue does not refer to "significant impacts", as defined by the National Environmental Policy Act. Significant issues do not necessarily mean that the resulting impacts will be significant. "Other issues" may result in significant impacts. This term refers to issues that will drive the development or result in an alternative to the proposed action.

1.7.1.2. ISSUE: Sediment release into Trout Creek and Wind River and effects to fish

Removal of Hemlock Dam would cause increased sediment delivery to lower Trout Creek, the Wind River, and confluence of the Columbia River. Sediments would be released both during dam removal and during subsequent streamflow events that erode the bed and banks of the newly reformed Trout Creek as it crosses the area now occupied by Hemlock Lake. Over the long term, sediment delivery to lower Trout Creek and the Wind River would increase due to elimination of the dam and the sediment storage that now occurs in the reservoir. Larger sediments can have positive effects on channels downstream of the dam which have been depleted of sediment over the past several decades as a result of sediment being trapped at the dam. Sand-sized particles comprise a majority of the sediment in the lake and would be more rapidly transported further downstream. The sands and smaller-size material currently stored behind the dam could negatively affect fish and fish habitat in the short term, downstream of the dam in lower Trout Creek and the Wind River. Sediment released as a result of this project could also add to sediment accumulations at the mouth of the Wind River.

Measurement Methods

Predicted changes in turbidity in the reservoir and downstream of the dam

Predicted turbidity effects to fish

Predicted sediment deposition timing, location, and thicknesses downstream of the dam

Predicted effects of sediment deposition to fish

Predicted effects of sediment deposition to fish habitat

1.7.1.3. ISSUE: Barriers to fish migration

The ladder has been found to be substandard when compared to current NMFS standards, and has a sub-optimal orientation for attracting fish (Barber and Perkins 1999). Upstream-swimming adult fish must first find and then negotiate the fish ladder at the dam. The delay these fish experience and the confined space within the fish ladder can increase their exposure to predation and delay or truncate their migration, reducing the potential for successful spawning. Downstream-swimming smolts and adults are subject to harassment and predation in the reservoir, to temperatures that exceed lethal levels, and impingement or drop mortality as they approach and pass the dam.

Measurement Methods:

Upstream migration success

Downstream migration success

Potential for impingement

Potential for predation

Potential for harassment

1.7.1.4. ISSUE: Loss of recreation opportunities at Hemlock Lake

Hemlock Lake is a unique recreation feature within the local area and on the Gifford Pinchot National Forest as a whole. The lake and picnic area is also the Mt. Adams Ranger District's most developed site and one of the most highly used developed sites. On hot summer weekend days,

more than 100 visitors at one time have been counted. Visitor counts estimate use to be about 16,500 visitors annually, with the majority of visits occurring from June through August

While the lake conditions and uses have changed over time, the lake currently provides a shallow, warm water play area popular with people of all ages during the summer months, particularly families with young children In more recent times, the area has experienced an increase in use by non-local visitors who incorporate a stop at Hemlock Lake as part of their visit to the Forest.

Removing the dam would mean a direct loss of lake-based recreation opportunities for residents and visitors alike who value the area for its recreational opportunities.

Measurement Method

Predicted changes in use (numbers of visitors and types of experiences)

1.7.1.5. ISSUE: Direct impacts to an historic structure

The Hemlock Dam and its fish ladder have been determined to be eligible for listing on the National Register of Historic Places. Removal or further alteration of the dam and/or fish ladder would have an adverse effect on this historic property (36 CFR 800.5).

Measurement Methods

Historic structures altered or destroyed

Degree of alteration to historic properties

1.7.1.6. ISSUE: Direct impacts to archaeological sites

Removal of Hemlock Dam and its fish ladder and the construction of equipment access routes could result in direct impacts to the archaeological remains of the Trout Creek Site, a site that has been determined eligible for listing on the National Register of Historic Places. Additionally, future restoration of lakeshore sediments and reconditioning of the picnic area could directly and indirectly impact recorded prehistoric and historic deposits. Dredging of sediments could result in direct impacts to remains of the Wind River Lumber Company's splash dam. Under federal regulations (36 CFR 800.5), damage to the Trout Creek site as a result of heavy equipment use and access constitutes an adverse effect to the site. The State Historic Preservation Office (SHPO) has concurred with a determination of adverse effect for this proposal.

Measurement Method

Percentage of archaeological site disturbed

1.7.1.7. ISSUE: Impacts to the local economy from expenditures by recreation visitors

Public use of the Hemlock recreation site undoubtedly provides economic benefits to the local communities—particularly the Stabler Country Store, which is within two miles of the Hemlock site at a key intersection of the Wind River Highway and Hemlock Road. The proprietor of the Stabler Country Store estimated that 30% of his summertime business was related to Hemlock Lake visitors (per. com. 2004). The Wind River Market in Carson, Washington, as well as businesses in the Carson-Stevenson-Home Valley areas also likely benefit from expenditures from a portion of the estimated 16,500 annual visitors to Hemlock Lake.

Removal of the dam would result in a decrease in use of the site, which in turn may result in a net decrease in recreation-related expenditures due to local and non-local recreationists no longer visiting this portion of the Forest and making purchases associated with recreation activities.

Measurement Method

Predicted change in expenditures by Hemlock Lake visitors

1.7.1.8. ISSUE: Economic impacts to the USFS

The dam is estimated to represent an annual cost of approximately $10,000 to the USFS (source: Economics report in project record). There are currently no direct monetary returns to the USFS from operation of the dam, thus the project has a negative present net value. If the dam is retained there would be continued operations and maintenance costs, as well as repair costs as dam parts wear out. In addition, it is likely that the fish passage components of the dam would need to be upgraded to comply with requirements imposed by NMFS through the consultation process.

In the event the dam is removed there would be significant costs for dam demolition and disposal and for sediment excavation and disposal, but long term costs would be eliminated. This issue examines the relative costs of the proposed action and all of the alternatives considered in the EIS.

Measurement Method

Cost of implementing each of the alternatives (present net value)

1.7.2. Other Issues and Legally-required Disclosures

This section addresses other issues that were raised through public comment and effects that are required to be disclosed by law or agency policy. The manner in which they were addressed in **Chapter 4, Environmental Consequences** is described.

1.7.2.1. ISSUE: Impacts to fish monitoring

The USFS, in cooperation with the Washington Department of Fish and Wildlife (WDFW), installed an adult steelhead fish trap in the Hemlock Dam fish ladder in 1992 and operated the facility since that time to develop a complete census of the Trout Creek steelhead population. Datasets such as this one are important to the overall science and understanding of steelhead biology because actual counts of wild adult steelhead allow scientists a rare opportunity to study the population dynamics and estimate extinction risk of wild steelhead due to environmental variability with small measurement error (Rawding 2004). As a result of the trap and other monitoring in the Wind River system, the Governor's Salmon Recovery Office has designated the Wind River as an intensively monitored watershed *(ibid.)*. The dam and fish ladder create a constriction through which fish must pass before moving into upper Trout Creek. This construction provides an excellent opportunity to trap and count upstream migrating fish. If the dam is removed, the existing trapping capabilities at this site would be lost. Continuation of the existing dataset collected over more than a ten-year period may be compromised.

Measurement Methods

Potential for continued monitoring

1.7.2.2. ISSUE: Flooding

Downstream landowners raised the issue of potential increases in flooding if the dam were removed. Concerns revolved around the potential for higher flows without the dam in place, and the potential for sediment from Hemlock to deposit and raise stream levels near a particular residence downstream of the dam, which might then contribute to subsequent flooding at the site.

Measurement Methods:

Predicted changes in streamflow downstream of the dam

Predicted sediment deposition patterns and thicknesses downstream of the dam

1.7.2.3. ISSUE: Impacts to groundwater and local wells

Removal of the reservoir behind Hemlock Dam could affect recharge rates to the aquifer, influencing well water levels in the near vicinity. A 1986 report on streamflow levels in Trout Creek and nearby well water levels indicated that some reaches of Trout Creek do in fact help recharge the aquifer (Adams 1987). Elimination of the reservoir would, in effect, reduce the ground area over which water infiltration could occur, and in this way could affect the amount of water from Trout Creek that reaches the aquifer.

Measurement Methods

Comparative gain or loss of streamflow in Trout Creek above and below the reservoir

1.7.2.4. ISSUE: Sense of place: impacts to communities and individuals

Hemlock Lake represents three essential qualities associated with a sense of place as described by Ryden (1993): community history, attractive physical landscape, and emotional attachment. The local community has used the Hemlock Lake area for swimming, picnicing, and day-use recreation since the dam was constructed in 1936, and many long term residents have formed a strong emotional bond with the area. For long term residents and particularly the community of Stabler, Washington, removing the dam would result in the permanent loss of an entity that has been a centerpiece for family and community activities for decades.

Measurement Method

Assessment of emotional attachment from scoping responses

1.7.2.5. ISSUE: Beaver

The loss of a still-water habitat could affect the beaver populations that are known to be present and active in the Trout Creek area. This was identified as an issue by a local resident.

Measurement Method

Potential effect to the local beaver population

The following were not specifically raised during scoping but the effects are required to be analyzed by law or by USFS policy, as explained below.

1.7.2.6. Effects to Threatened, Endangered, and Sensitive aquatic and terrestrial species

The Endangered Species Act of 1973, as Amended, [50 CFR 402 (2000)] requires the USFS to manage for the recovery of Threatened and Endangered species and the ecosystem on which they depend. The USFS is required to consult with either National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (USFWS) if a proposed activity may affect the population or habitat of a federally listed species or a species proposed for listing. Species listed as Threatened or Endangered occupy habitats within the vicinity of the reservoir. As previously described, the purpose of this action is to improve conditions for Lower Columbia River steelhead and other federally listed fish species both upstream and downstream of Hemlock Dam. Listed terrestrial species that make use of the reservoir habitat could be affected by actions that are taken.

The USFS Regional Forester for the Pacific Northwest Region is directed by policy to identify Sensitive species for each National Forest where viability may be a concern and to review activities to determine their potential effect on Sensitive species (Forest Service Manual 2670.32).

Measurement Methods

Effects determination for federally listed species

Risk assessment for Regional Forester's Sensitive species

1.7.2.7. Management Indicator Species

Pursuant to 36 CFR 219.19, wildlife habitat shall be managed to maintain existing populations of existing native species by identifying management indicator species whose population changes are believed to indicate the effects of management activities. The Forest Plan identifies species whose population changes may indicate impacts to other species or habitats.

Measurement Method

Effect to management indicator species

1.7.2.8. Neo-Tropical Migratory Birds

Neo-tropical migratory birds are those that breed in the United States and winter in Central and South America. They include a large group of species, including many hawks, warblers, and other songbirds, with diverse habitat needs. Nationwide declines in population trends for neo-tropical migrants have developed into an international concern. Pursuant to the Migratory Bird Treaty Act, birds are listed at 50 CFR 10.13 that potentially occur or for which there is suitable habitat in the project area.

Measurement Method

Amount and quality of habitat for neo-tropical migratory birds

1.7.2.9. Loss of wetlands

Wetlands exist at several locations around the margins of the reservoir. The hydrology that creates these wetlands is provided in some cases by the reservoir, and in some cases by other nearby sources of water. If the dam is removed and Trout Creek is restored to a free-flowing

stream, some of these wetlands would be lost; others would be modified by the change in hydrology at the site; and some may persist due to water sources that are not affected by dam removal. Federal (Executive Order 11990, Protection of Wetlands and Section 404 of the Clean Water Act [22 USC § 1344]) and Washington state law (Hydraulic Procedures Act [WAC 220-110] and Shorelines Act [RCW 90.58]) require that there be no net loss of wetlands habitat as a result of actions, and thus any loss of wetlands resulting from this project would need to be mitigated following Washington State Dept of Ecology Wetland Mitigation guidelines.

Measurement Method

Amount (acres) and quality of wetlands expected to be lost or impacted

1.7.2.10. Environmental Justice

Executive Order 12898 (1994) ordered Federal agencies to identify and address the issue of environmental justice (i.e., adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations). There is a potential for disproportionate impacts to minority and low-income populations from implementing the proposed action. These impacts are primarily economic and related to the distance to comparable recreational opportunities if Hemlock Lake were no longer available as a day use area.

Measurement Methods

Indicators of disproportionate impacts (economic) to minority and low-income populations

1.7.3. Issues Not Carried Forward to Analysis

1.7.3.1. ISSUE: Potentially contaminated sediments

Internal scoping raised an issue concerning the safety of re-using sediments dredged from the reservoir. The basis for the concern was the potential for contamination of the accumulated sediments with pesticides or other chemicals used by the Wind River Nursery. Downstream water quality could be affected by disturbing the settled sediments and particularly by releasing the sediments downstream. Fish and other aquatic organisms in Trout Creek and the Wind River could be affected by toxic sediments.

Rationale for not including in this analysis

In 2001 the USFS contracted with Northwest Geotech of Wilsonville, Oregon to sample and analyze sediments in Hemlock Lake. Analysis was to include physical, biological, and chemical makeup of the sediments. A comprehensive list of chemicals applied over the history of the Wind River Nursery was supplied to the contractor to ensure that those parameters were analyzed. Samples were collected from 12 locations across the lake and at multiple depths on the sites with deeper sediment deposits. A total of nine composited samples were submitted to Columbia Analytical Services Inc., and analyzed for some 14 parameters or groups of compounds. Results indicated presence of a number of chemicals at very low levels in some of the samples. The results were submitted by the USFS to WDOE for further interpretation. A Sediment Specialist with the WDOE evaluated the findings against available guidelines for sediment quality, and concluded that the sediments did not warrant special consideration regarding in-water or uplands uses. As a result of the testing and analysis of results, the USFS has determined that the issue of potentially contaminated sediments does not warrant further analysis in this document.

1.7.3.2. ISSUE: Loss of open water habitat

Hemlock Lake provides habitat for species that require open flat water habitat such as waterfowl and certain amphibians. For example, wood duck, which is a Management Indicator Species in the Forest Plan, has been documented at the lake. It could be directly affected through disturbance and indirectly though loss of breeding and rearing habitat.

Neo-tropical migratory birds, such as tree swallows, that forage for insects over open water and those that nest in deciduous riparian vegetation could be affected by loss of pond habitat, and in the long term, loss of deciduous riparian vegetation if the area succeeds to coniferous riparian species.

An osprey pair is known to nest in the vicinity and probably forages occasionally at Hemlock Lake. Loss of the lake could reduce foraging opportunities.

These effects would be permanent impacts if the dam was removed.

Rationale for Not Including in This Analysis

The effect of loss of open water habitat for the species mentioned above is considered in the analysis of Management Indicator Species (Wood duck, osprey) and Neo-Tropical Migratory Birds.

1.8. Other Related Efforts

Since the Wind River Nursery closed in 1996, the sole purpose for the dam has been to provide a reservoir for summer recreational use. Because the dam restricts fish pathways, it has also continued to be used as a location to trap and count adult steelhead that are migrating upstream. The conveyance of the Wind River Nursery to Skamania County in 1997 included water rights for both withdrawal and storage of surface water impounded by Hemlock Dam. At the time of the conveyance, the County elected not to take ownership of the dam structure along with the other properties and water rights that it received. A more recent offer by the USFS to transfer the dam to the County (letter from Nancy Ryke to Skamania County Commissioners, 11/18/2004) has been declined by the County (letter from Al McKee, Chair, Skamania County Board of Commissioners to Mount Adams District Ranger, 1/25/2005). In July 2004, Skamania County applied to WDOE for conversion of their acquired surface rights to a subsurface water right. If Skamania County chooses to use their storage or withdrawal right at the Hemlock Lake site, the USFS would consider transferring the existing dam along with all required maintenance and improvement costs to Skamania County. The USFS would not implement an action alternative from this EIS prior to the time that the county's water rights are transferred to groundwater sources, or the year 2007, whichever comes sooner.

1.9. Permits Required

The following permits would be required for implementation of the proposed action:

Shorelines Permit (Skamania County) –

Under the State of Washington's Shoreline Management Act (RCW 90.58), Skamania County issues local shoreline permits for activities that occur along rivers, streams, and lakes.

Critical Areas Ordinance (Skamania County) –

The Washington State Growth Management Act (RCW 36.70A.030(5)), includes the definition of "critical areas" as: a) Wetlands; b) areas with a critical recharging effect on aquifers used for potable water; c) fish and wildlife habitat conservation areas; d) frequently flooded areas; and e) geologically hazardous areas. Skamania County has adopted a Critical Areas Ordinance which regulates activities in these areas.

Section 404 Permit (U.S. Army Corps of Engineers) –

Section 404 of the Clean Water Act stipulates that a permit is usually required for potentially significant impacts to wetlands. The permit is obtained from the U.S. Army Corp of Engineers to conduct any activity that might result in a discharge of dredge or fill material into water or non-isolated wetlands or excavation in water or non-isolated wetlands.

Section 401 Water Quality Certification (Washington State Department of Ecology) –

Applicants receiving a section 404 permit are required to obtain a section 401 water quality certification from the Washington State Department of Ecology (WDOE). Issuance of a certification means that WDOE anticipates that the applicant's project will comply with state water quality standards and other aquatic resource protection requirements under WDOE's authority.

Aquatic Resources Use Authorization Notification (Washington State Department of Natural Resources) –

Use of state-owned aquatic lands (including owners of adjacent lands) must get authorization from DNR.

Section 10 Permit (U.S. Army Corps of Engineers) –

Section 10 of the Rivers and Harbors Act of 1899 prohibits the obstruction or alteration of navigable waters of the United States without a permit from the Corps of Engineers. This would apply to effects to the confluence of the Wind River with the Columbia River from release of sediments under Alternative B.

General Construction Stormwater Permit (Washington State Department of Ecology) –

A permit is required for all soil disturbing activities (including grading, stump removal, demolition), where five or more acres will be disturbed, and have a discharge of stormwater to a receiving water (e.g., wetlands, creeks, rivers, etc.)

Dam Safety Permit (Washington State Department of Ecology) –

A permit may be required for activities that will affect the safety of a dam. Removal of a dam would require such a permit.

Section 7 Endangered Species Act Consultation (National Marine Fisheries Service) –

A "take" permit may be authorized for the effects to Threatened Lower Columbia River steelhead or other anadromous fish species.

Hydraulic Project Approval (Washington State Department of Fish and Wildlife) –

State law (RCW 77.55) requires that any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the bed or flow of state waters must do so under the terms of a permit (called the Hydraulic Project Approval-HPA) issued by the Washington State Department of Fish and Wildlife.

Depending on the alternative selected, the above-listed permits would also drive the development of mitigation and monitoring plans, such as a Wetlands Mitigation Plan, Water Quality Monitoring Plan, Section 7 Monitoring. Refer also to **Chapter 5. Mitigation and Monitoring.**

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1. Introduction

This chapter describes the alternatives considered for the Fish Passage and Aquatic Habitat Restoration at Hemlock Dam. The alternative descriptions refer to structural features that are depicted in Figure 2-1.

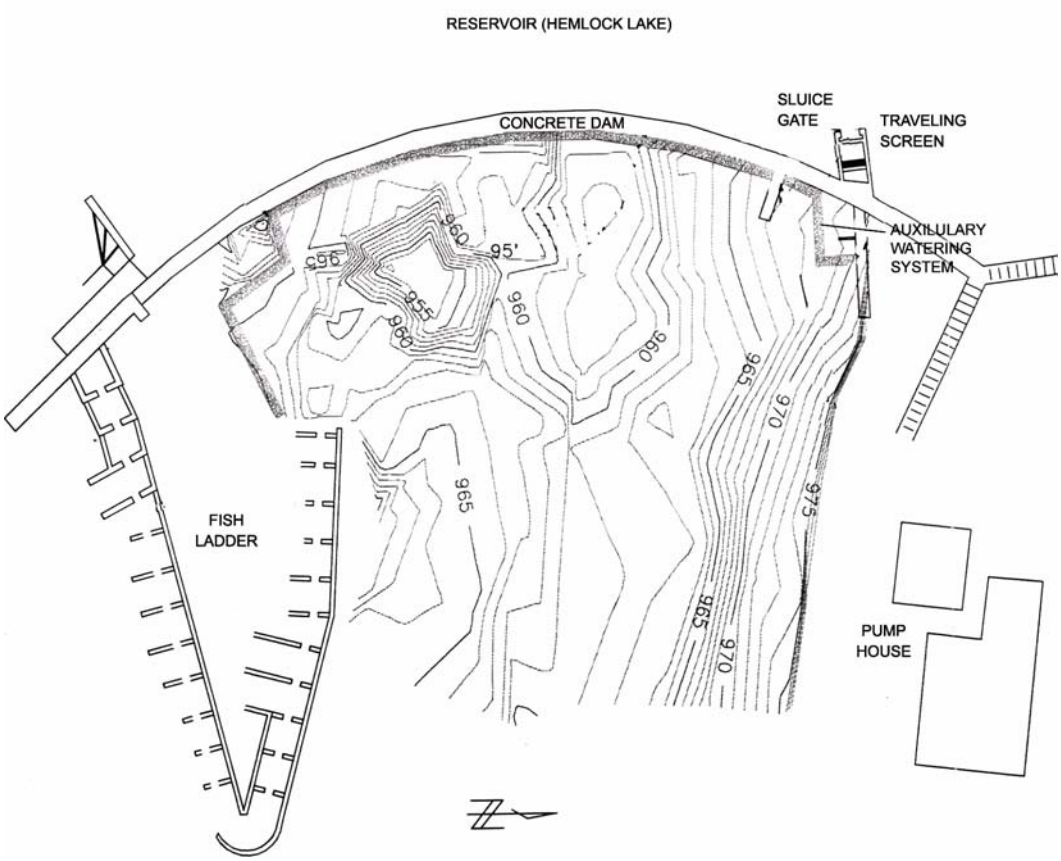

Figure 2-1. Hemlock Dam and structural features.

This section also presents the alternatives in comparative form at the end of the chapter (Table 2-1, p. II-8). The comparative format defines the differences in design features among the alternatives.

2.2. Alternatives Considered in Detail

Based on the comments received from initial scoping and issues raised by the public, the USFS developed the proposed action and four alternatives, including the "no action" alternative. All of the alternatives have the potential to satisfactorily attain the purpose, need, and objectives, as stated in Chapter 1, with the exception of Alternative A, the no action alternative. The three action alternatives to the proposed action were designed to address certain significant issues, as identified in Chapter 1. These were analyzed in the DEIS which was released for public comment on October 1, 2004.

Following the close of the public comment period for the DEIS, the interdisciplinary team reviewed the public comments and determined that no additional alternatives were necessary. Some comments referred to an alternative that was previously considered but later eliminated from further analysis. A description of this alternative with an explanation of why it was dropped is found at **2.3. Alternatives Considered but Eliminated from Detailed Study**.

The effects analysis in the DEIS revealed that the original proposed action (Alternative B), which would remove the dam and let the river erode sediments, would have resulted in greater impacts to fish than had been foreseen prior to the detailed analysis. Based on these findings and on comments received in response to the DEIS, the interdisciplinary team recommended that Alternative C (remove the dam and dredge accumulated sediments to establish a channel) be developed as the USFS's preferred alternative.

The following is a description of the actions associated with the alternatives considered by this analysis. Actions are outlined for each alternative for a quick reference and then described in more detail.

2.2.1. Description of Alternative A

No Action

Under the no action alternative, the dam and the surrounding area would not be changed from the present condition or management. The dam and fish ladder structures would be maintained to approximately the same standard as at present.

The no action alternative serves as a baseline for comparison of effects of the action alternatives. Analysis summarized in this document confirms that this alternative does not meet the purpose and need for action because it does not improve fish passage or aquatic habitat in Trout Creek.

2.2.2. Description of Alternative B

The Proposed Action – Remove the dam and let the river erode sediments in the reservoir

The proposed action responds directly to the purpose and need by removing Hemlock Dam.

Actions associated with the dam removal include:

Construct a pilot channel through the lake sediments using a tracked excavator and a loader to direct channel erosion to the designated location of the new stream;

Dispose of an estimated 2,500 cubic yards of sediments that are excavated during construction of the pilot channel to an unused portion of the former Wind River Nursery;

Fully dismantle the dam, including abutments and other concrete structures by mechanical means and dispose of the material (estimated to total 440 cubic yards of concrete and associated material) in the Carson-Guler quarry (Figure 1-3);

Allow the river to erode sediments from the lake and to form a new channel through the area now occupied by the lake (following the alignment established by the pilot channel);

Shape and stabilize the newly formed channel banks where necessary (1 – 2 years following implementation of the project);

Make necessary alterations at the Hemlock recreational site to accommodate the new stream channel and removal of the reservoir and dam;

Implement protection and conservation measures that are intended to mitigate unavoidable adverse effects of dam removal (see **Chapter 5, Mitigation Measures**).

A pilot channel would be constructed through the reservoir to direct the channel incision to the proposed channel alignment (Figure 2-2), while letting the river erode and re-form its own banks. The proposed channel alignment would follow what is thought to be the historic location of the channel as it crossed the area now occupied by the lake.

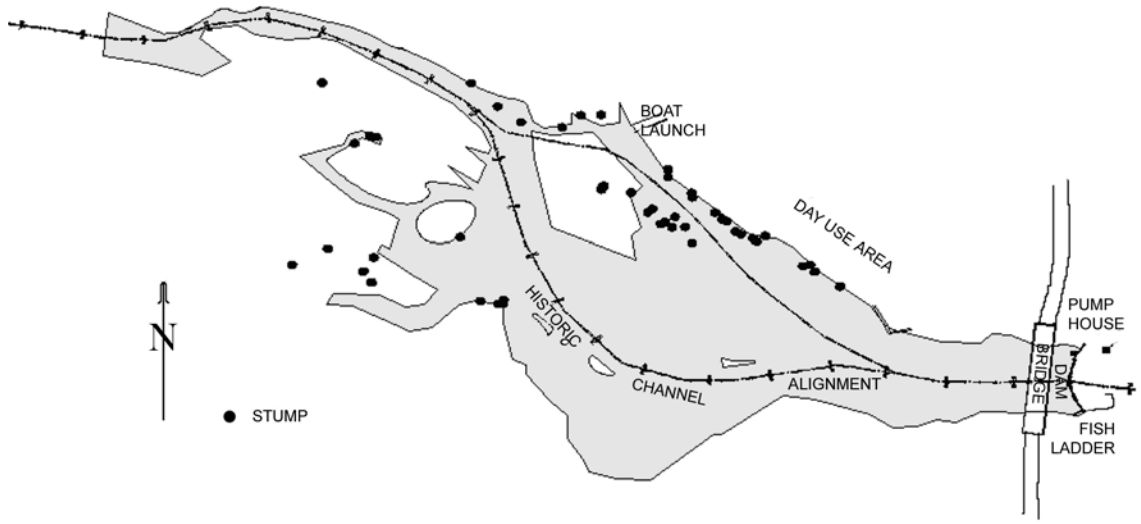

Figure 2-2. Plan view of Hemlock Dam and reservoir.

This action includes temporarily routing Trout Creek streamflows past the construction area and then removing approximately 2,500 cubic yards of sediment from the proposed channel alignment. After constructing the pilot channel and removing the dam, streamflow from Trout Creek would be introduced to the upper end of the pilot channel and the flow of Trout Creek would then dictate the process of channel formation through the lake sediments. Access for equipment for this action would be provided at the existing boat launch site (Figure 2-2).

Where appropriate, some of the material excavated from the pilot channel would be contoured into the surrounding area to improve the site. Excess dredged material would be transported to a nearby disposal site in an unused portion of the former Wind River Nursery (Figure 2-3).

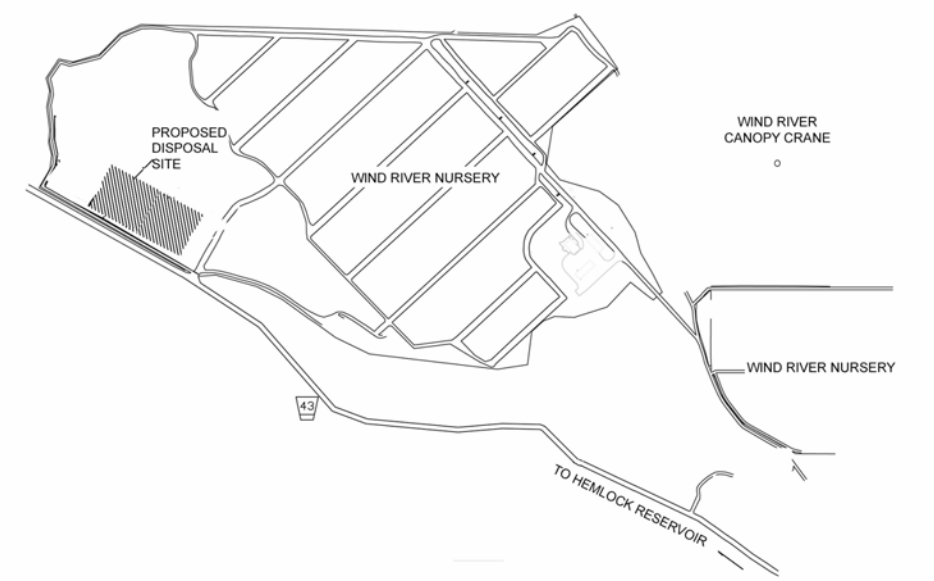

Figure 2-3. Proposed location for sediment disposal.

The dam would be removed by mechanical means using heavy equipment to incrementally take the dam apart. The fish ladder would remain for historical/interpretive purposes however the recently added attraction chamber would be removed. The pump house located immediately below the dam on the north bank of Trout Creek (refer to Figure 2-1) would be removed.

Equipment access to the dam for removal and disposal would be made available at the pump house site and at points immediately upstream and downstream of the bridge, at both ends of the bridge. The Carson-Guler quarry, located approximately 6 miles north of the dam site, would be the designated disposal site for concrete dam material, estimated to total approximately 440 cubic yards (refer to Figure 1-3).

For one to three years following dam removal, streambanks would be shaped, stabilized, and revegetated, when needed, for approximately 1,300 feet upstream of the dam in the area influenced by the dam. Following stabilization of the channel, recreational and interpretive facilities could be installed. The specific design of these facilities would be determined when the channel has hardened and remains stable. The actions associated with future development of the site would be covered by a separate decision.

2.2.3. Description of Alternative C

Preferred Alternative - Remove the dam and build a channel through the area now occupied by Hemlock Lake

Alternative C would remove Hemlock Dam and enough of the accumulated sediments behind it to allow construction of a stable channel and channel banks through the area now occupied by the reservoir. This alternative was primarily developed to protect fish from high turbidity associated with leaving sediments in place and from downstream deposition of sediments in lower Trout Creek, the Wind River and at the mouth of the Wind River and thus responds to the issue of sediment release.

Actions associated with this alternative include:

Dredge and remove an estimated 35,000 – 60,000 cubic yards of sediments from behind the dam, and construct a channel through the reservoir area with the intent of mimicking the historic (pre-dam) channel in this reach (Figure 2-2).

Dispose of the dredged sediments;

Fully dismantle dam, including abutments and other concrete structures by mechanical means and dispose of the material (estimated to total 440 cubic yards of concrete and associated material);

Make necessary alterations at the Hemlock recreational site to accommodate the new stream channel and removal of the reservoir and dam;

Implement protection and conservation measures that are intended to mitigate unavoidable adverse effects of dam removal (see **Chapter 5, Mitigation Measures**).

The principal difference between the preferred alternative (Alternative C) and the original proposed action (Alternative B) is the disposition of an estimated 35,000 – 60,000 cubic yards of accumulated sediments in the reservoir. Under the preferred alternative, these sediments would be dredged or physically removed from the site designated for the channel (Figure 2-2). The constructed channel would attempt to mimic the location and form of the historic channel using photos from the early 1900's, analysis of stumps, and geotechnical analysis of bedrock features surrounding and underneath the existing lake. Large wood structures formed using the boles and root ends of trees would be incorporated into the design to stabilize banks, maintain channel stability and to provide resting, hiding and rearing habitat for fish. The streambanks and disturbed areas would be revegetated.

Equipment access for sediment removal would be at the existing boat launch site. Dredged sediments would be transported to a nearby disposal site in an unused portion of the former Wind River Nursery (Figure 2-3). This amount of material would cover an area of about six acres to an average depth of three to six feet. The deposited sediments would be shaped to drain and to the extent practical, contoured to blend with the surrounding terrain and seeded for erosion and weed control.

Following stabilization of the channel, recreational and interpretive facilities could be installed. The specific design of these facilities would be determined when the channel has hardened and remains stable. The actions associated with future development of the site would be covered by a separate analysis and decision.

Dam removal and disposal would occur as described under Alternative B.

2.2.4. Description of Alternative D

Retain the dam, improve deficiencies, and replace the fish ladder

This alternative was developed in response to the issues of maintaining a recreational opportunity (reservoir) and day use facility, minimizing impacts to the local economy from the loss of the recreation site, and minimizing impacts to archaeological site while improving conditions for fish passage and improvement of water quality and sediment routing. Fish monitoring could be continued under this alternative. Sediment removal would be accomplished primarily to maximize fish habitat and water quality enhancement. Recreational benefits of the dredging are considered secondary to the benefits to fish.

Specific actions associated with this alternative include:

Retain the dam;

Replace the fish ladder with a new ladder that meets current state and Federal standards;

Modify the flashboards to eliminate impingement of fish;

Dredge approximately 25,000 cubic yards of sediment accumulated in the reservoir;

Re-establish regular use of the sluice gate to route sediments through the lake;

Implement protection and conservation measures that are intended to mitigate unavoidable adverse effects of this alternative (see Chapter 5, Mitigation Measures).

An operational plan for fish passage would be developed with NMFS and implemented. This plan would include specific measures to permit safe passage of both adult and juvenile fish, including removal or retrofit of components of the dam that are known or suspected to cause fish mortality.

A set of removable wooden flashboards is presently used to regulate the capacity of the reservoir. To reduce impingement of fish, a thick geotextile fabric would be used to block all cracks in the existing wooden flashboards.

A new fish ladder would replace the existing fish ladder. The location of the ladder to the opposite side of the dam may be recommended to permit a more unobstructed passage from the stream channel to the fish ladder.

Approximately 25,000 cubic yards of accumulated sediments would be removed by dredging from the reservoir area and transported for disposal to a nearby disposal site in an unused portion of the former Wind River Nursery as described in Alternative C.

The existing sluice gate on the dam would be used annually to route sediments through the lake, and to maintain depth within the lake. The sluice gate would be operated on average 3 – 5 times per year, during high flow events and when turbidities in Trout Creek are naturally high.

2.2.5. Description of Alternative E

Retain the dam, improve deficiencies, and repair the existing fish ladder

Alternative E was designed to address the issues associated with Alternative D, however the historic significance of the dam and fish ladder are also addressed by retaining these structures and making repairs to improve conditions for fish. Improvements to the dam components would be made to reduce fish mortality and sediment removal would be done to maximize fish habitat and water quality enhancement. Inclusion of this alternative allows the decision maker to evaluate the relative merits and costs of replacing the fish ladder with those of keeping the existing ladder in place, and repairing it.

Specific actions associated with retention of the dam and fish ladder include:

Retain the dam;

Modify the flashboards to eliminate impingement of fish;

Modify of the auxiliary water system (AWS) screen to eliminate impingement of fish and to redirect fish toward the outlet;

Install a bypass that routes fish from the screen face to below the dam;

Replace the AWS valve;

Install an AWS energy dissipater;

Dredge approximately 25,000 cubic yards of sediment accumulated in the reservoir;

Re-establish regular use of the sluice gate to route sediments through the lake;

Implement protection and conservation measures that are intended to mitigate unavoidable adverse effects of this alternative (see Chapter 5, Mitigation Measures).

Fish screens are presently used to prevent juvenile fish from passing into the AWS. The screens would be modified to meet NMFS and Washington Department of Fish and Wildlife (WDFW) criteria for juvenile fish screening. Modification include: re-installing the screen to a 60° or greater slope, installing a bypass pipe or chute to route fish from the screen to below the dam, replacing the AWS valve to make adjustments of water flow easier, installing AWS energy dissipation (i.e. baffles, diffuser panels, etc) at the diffuser to reduce velocities.

These actions would be identical to those described for Alternative D with the exception of the actions associated with replacement of the fish ladder.

2.3. Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Barber and Perkins (1999) provided a suggestion for an alternative method for achieving the purpose and need.

Notch the dam, construct a new fish ladder, and create an "off-channel" pond for recreation opportunities

The original Notice of Intent, published in the *Federal Register* on August 16, 2001 identified an alternative that would remove only a portion of the dam to create a "notch". The main channel would be routed through the notch to a newly designed fish ladder. This was originally thought to satisfy the dual needs for this action of improving both fish passage and aquatic habitat and directly address the issue of loss of recreational opportunity with full removal of the dam. This alternative would have directed the main channel of Trout Creek across the southern portion of the existing lake and to the notched dam. On the northern portion of the lake a pond would have been constructed. The pond would have had some form of inlet and outlet controls to allow the pond to be connected to the stream.

This alternative was initially considered to be infeasible due to a combination of uncertainties relating to the structural safety of a notched dam, water quality in Trout Creek and in the pond, the engineering and cost practicalities of constructing the "notch", and preserving the integrity an off-channel pond. Subsequent to the initial consideration of this "alternative", the USFS commissioned a structural analysis of the dam. The analysis found that in its present condition, Hemlock Dam is structurally sound (QUEST Structures 2003). The report did not address the issue of stability under the notched scenario. Based on the additional cost of the modeling required to evaluate stability under the notching scenario along with the projected cost of retrofitting the dam if it was to be notched and the outstanding issues related to water quality and the feasibility of retaining the off-channel pond, the alternative was dropped from further consideration.

Instead, the concept of creating an "off-channel" pond without retaining the notched dam was raised as a feasible alternative for which the structural integrity of the notched dam would not be an issue. Retention of the dam in a notched condition would do little to improve the feasibility of the off-channel pond. A number of issues would remain associated with cost, protection of the

facility during flood flows, and of maintaining sufficient flow in the channel during summer months to provide cooler water for fish while routing adequate flushing flows through the pond to retain safe water for recreationists. Specific design features of such a project would require additional analysis and site-specific information that would need to be gathered following draining of the reservoir and establishment of the channel. Without this level of information the range of environmental and economic tradeoffs and effects associated with this option could not be clearly determined.

Because the feasibility of the off-channel pond concept is not contingent upon the disposition of the dam, the line officer determined that the analysis of the off-channel pond could be considered under a separate and subsequent analysis and decision. Were Alternative B or C to be selected (removing the dam), further consideration of the off-channel pond could occur along with consideration of all other amenities at the Hemlock site, including trails, interpretive signing, and water related facilities.

2.4. Comparison of Alternatives

The following table summarizes the actions for each alternative. Information in Table 2-1 is focused on the proposed activities and not on the affect of those actions on the environment.

Table 2-1. Summary of alternatives.

Feature	Alt A No Action	Alt B Remove Dam (Proposed Action)	Alt C Remove Dam w/ Sediment Dredging (Preferred Alternative)	Alt D Retain Dam, Replace Ladder	Alt E Reatain Dam, Retain Ladder
Dam	Retain	Remove dam including abutments and dispose of in Carson Guler Quarry	Remove dam including abutments and dispose of in Carson Guler Quarry	Retain	Retain
Sediment	Retain	Allow the river to erode (Dredge minor amounts)	Dredge and haul to PC Nursery Fields	Dredge and haul to PC Nursery Fields	Dredge and haul to PC Nursery Fields
Flashboards[3]	Retain	Remove	Remove	Repair with geotextile	Repair with geotextile
Fish Ladder	Retain	Retain for historic significance and interpretation	Retain for historic significance and interpretation	Replace ladder	Leave and patch concrete cracks

[3] A set of boards that are manually installed to raise the water level for recreation activities during the summer months.

Feature	Alt A No Action	Alt B Remove Dam (Proposed Action)	Alt C Remove Dam w/ Sediment Dredging (Preferred Alternative)	Alt D Retain Dam, Replace Ladder	Alt E Reatain Dam, Retain Ladder
Auxiluary Water System[4]	Retain	Remove	Remove	Remove	Upgrade per NMFS
Recreation	Retain	Retain picnic area and provide river access from the day-use area	Retain picnic area and provide river access from the day-use area	Retain current recreation site as is	Retain current recreation site as is

[4] A pipeline to convey attraction flow from the existing screen at the top of the dam to the inlet to the fish ladder at the base of the dam.