RESTORATION PLAN
and
ENVIRONMENTAL ASSESSMENT
for the
JUNE 10, 1999,
OLYMPIC PIPE LINE GASOLINE SPILL
into
WHATCOM CREEK,
BELLINGHAM, WASHINGTON

FINAL

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for the
JUNE 10, 1999,
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into
WHATCOM CREEK,
BELLINGHAM, WASHINGTON

Prepared by:

National Oceanic and Atmospheric Administration
U.S. Fish and Wildlife Service
Nooksack Tribe
Lummi Nation
State of Washington
and
City of Bellingham

August, 2002

FACT SHEET

FINAL RESTORATION PLAN and ENVIRONMENTAL ASSESSMENT for the June 10, 1999, Olympic Pipe Line Gasoline Spill Whatcom Creek, Bellingham, Washington

LEAD AGENCY FOR RP/EA:	National Oceanic and Atmospheric Administration
COOPERATING AGENCIES:	U.S. Fish and Wildlife Service Washington Department of Ecology Washington Department of Fish and Wildlife Washington Department of Natural Resources Lummi Nation Nooksack Tribe City of Bellingham
ABSTRACT:	This Restoration Plan and Environmental Assessment (RP/EA) has been prepared by the local, state, federal and tribal Natural Resource Trustees to address restoration of natural resources and resource services injured in the Olympic Pipe Line Company Gasoline Spill of June 10, 1999, into Whatcom Creek, Bellingham, Washington.
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COPIES:	Copies of the final RP/EA are available at the address listed above or available for download at www.darcnw.noaa.gov/whatcom.htm
DATE OF RELEASE:	August 2002

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.0 Introduction: Purpose of and Need for Restoration

1.1 Summary

This final Restoration Plan and Environmental Assessment (RP/EA) document has been prepared for the restoration of natural resources and natural resource services injured by the June 10, 1999, Olympic Pipe Line Company (OPLC, "the Company") gasoline spill into Whatcom Creek ("the Creek"), Bellingham, Washington, and the resulting explosion and fire ("the Incident"). The objective of this plan is to compensate the public for injuries to natural resources and natural resource services resulting from the Incident by returning the injured natural resources and natural resource services to their baseline conditions and compensating for interim losses of those resources and services. This restoration effort is compensatory only, and therefore is not designed to be a punitive action toward the Company,[1] nor is it intended to address loss of human life, loss of private property, other personal losses, or individual claims.

It is the Trustees' responsibility pursuant to the Oil Pollution Act of 1990 (OPA) (33 U.S.C. §§ 2701, *et seq.*) to determine the nature and extent of natural resource injuries, select appropriate restoration projects, and implement or oversee restoration.[2] The Trustees for this Incident include the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), the Washington Department of Ecology (WDOE), the Washington Department of Fish and Wildlife (WDFW), the Washington Department of Natural Resources (WDNR), the Lummi Nation, the Nooksack Tribe, and the City of Bellingham. This final RP/EA documents the information and analyses that support the Trustees' evaluation of:

- Injuries to natural resources and natural resource services caused by the Incident;
- Restoration alternatives and the Trustees' preferred restoration actions to compensate for the injuries and losses; and
- Rationale for the Trustees' preferred alternatives.

This document also serves, in part, as the Federal agencies' compliance with the National Environmental Policy Act (NEPA) (43 USC §§ 4321, *et seq.*).[3] In developing these restoration alternatives, the Trustees met with local entities and the Company (the Responsible Party (RP)

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[1] Civil and criminal penalties under other causes of action are being addressed separately by the appropriate state and federal agencies.

[2] The Trustees are also following the State of Washington procedures for damage assessment and restoration under the Model Toxics Control Act (MTCA) (Chapter 173-340 WAC) (http://www.ecy.wa.gov/biblio/wac173340.html).

[3] The document also supports SEPA requirements (Chapter 43.21C RCW) (http://www.ecy.wa.gov/programs/sea/sepa/e-review.html).

for the Incident) and its contractors, and sought input from agency scientists and other restoration and oil spill experts.

The primary purpose of this final RP/EA is to inform the public and guide implementation of the restoration actions ("the Preferred Alternative") outlined in Section 5. The Trustees considered written comments received during the public comment period prior to finalizing the RP/EA. As described in detail below, this Preferred Alternative includes:

- Acceptance of a 9.5-acre property above Woburn Street near the Creek to expand Whatcom Falls Park ("the Park") and compensate for losses to public and ecological services;
- Acceptance of a 4-acre property along the Creek to compensate for losses to public and ecological services and provide land for future habitat restoration projects;
- Construction of park improvements to the Woburn Street property, including restroom and public access features, to compensate the public for lost use of the Park;
- Construction of off-channel salmonid habitat at the Salmon Park project near Racine Street to compensate for impacts to fish habitats from the Incident;
- Construction of pools, wetlands, and salmonid rearing habitat near the mouth of Cemetery Creek to compensate for impacts to fish habitats from the Incident;
- Funding by the Company for long-term monitoring of the Creek and the various restoration projects; and
- Funding by the Company for maintenance of the restoration projects and parklands injured by the Incident.

Implementation of the Preferred Alternatives will be part of a settlement the Trustees are negotiating with the Company.

In addition to these long-term restoration activities, this final RP/EA summarizes and references a number of restoration activities already implemented under the emergency response and emergency restoration phase of the Incident. These emergency response and restoration activities were implemented to reduce injuries to natural resources or restore injured resources pursuant to the Oil Pollution Act damage assessment regulations (5 CFR § 990.26). These emergency restoration actions were made public and were reviewed and approved by the response and Trustee agencies and the Tribes prior to implementation. A copy of the Emergency Restoration Plan, dated June 22, 1999, was made available for public review and is included in the Administrative Record (AR) (AR #1). Other emergency restoration actions not described in the initial plan were also taken whenever the need and the opportunity presented itself to reduce natural resource injuries or to improve public use and access to resources. The emergency response and restoration activities included:

- Stabilization of soils within burned areas of the Park;
- Removal of potentially dangerous trees and branches from burned areas;
- Removal of trash and debris from the banks and channel of the Creek;
- Stream sediment remediation to release trapped hydrocarbon contamination;
- Reconfiguration of the channel bed of the Creek to improve fish habitat;
- Introduction of large woody debris to the Creek to improve fish habitat;
- Backwatering of fish-passage barriers within the Creek;
- Installation of trails and overlooks in the Park to improve public access and understanding of environmental impacts of the event;
- Reconstruction of Hanna Creek following removal of contaminated soils and gravels;
- Invasive-plant control;
- Planting of trees within burned areas of the Park;
- Funding by the Company of construction of an improved bridge over the Creek at Valencia Street;
- Daylighting the confluence of Fever Creek and Whatcom Creek to enhance fish passage; and
- Construction of a recreational trail bridge over the mouth of Fever Creek and a trail underpass at Valencia Street.

1.2 Summary of Changes from the Draft RP/EA

On March 7, 2002, a draft RP/EA (AR #142) was released for public review and comment. The Trustees received three comments (AR #143-145). Comments and responses to comments are summarized in Section 7 of this document. In general, comments were in favor of the preferred alternatives and helpful in clarifying the descriptions of the losses and proposed restoration projects. No comments suggested additional categories of injuries or losses that should have been addressed during the restoration planning phase and no comments questioned the technical sufficiency of the Trustees' assessment and quantification of damages.

In response to public comments, the Trustees made several clarifications to the RP/EA. However, no substantial modifications have been made to the preferred restoration projects proposed by the Trustees in the March 7, 2002 Draft RP/EA. Because of the modifications to the draft RP/EA are relatively minor and are descriptive or explanatory rather than substantive, the Trustees have determined that publication of an additional draft RP/EA for public review and comment is not necessary.

1.3 Olympic Pipe Line Incident and Site Overview[4]

At 3:28 p.m. on June 10, 1999, a rupture occurred in a pipeline owned by the Company (Figure 1). The Company operates a pipeline system that runs from Ferndale, Washington, to Portland, Oregon. Delivery lines carry products from the mainline to bulk terminals at Seattle, Sea-Tac International Airport, Tacoma, Olympia and Vancouver, Washington, and Linnton and Portland, Oregon. The rupture occurred at a location where the pipeline crosses the Park within the City of Bellingham, Washington, and near the City's public water treatment facility (Figures 2, 3). The Environmental Protection Agency (EPA)[5] and the Washington Department of Ecology[6] report the spill volume as approximately 236,000 gallons[7] based on the Company's calculations of product loss between the Ferndale Station and the Bayview Product Terminal (AR #3). Released product saturated the ground and geologic formations surrounding the pipeline and flowed both above ground and through subsurface pathways to nearby Hanna Creek where it proceeded downstream into the Creek, through the park. At approximately 5:00 p.m., the fuel ignited, resulting in a fire, which, at its peak, spanned from the source location down Hanna Creek to Whatcom Creek and down the Creek for a distance of approximately 1.6 miles (AR #2).

Immediate response and cleanup measures followed the Incident at the direction of a Unified Command that included the EPA, the State of Washington Department of Ecology, the City of Bellingham, Whatcom County, and the Company. An Emergency Operations Center was established in the Whatcom County Courthouse. The Unified Command also established a Joint Information Center. The Trustees' Whatcom Creek Incident Preassessment Data Report, dated April 2000, summarizes and describes the chronology of events associated with response and cleanup activities and includes copies of Environmental Protection Agency Pollution Reports, Joint Information Center Fact Sheets, and Remedial Action Plans (AR #2).

1.4 Natural Resource Trustees and Authorities

Both Federal and State of Washington laws establish liability for natural resource damages to compensate the public for the injury, destruction, and loss of such resources and/or their services resulting from oil spills.

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[4] Background materials on the Incident, including EPA Pollution Reports and Joint Information Center fact sheets, are in the Whatcom Creek Incident Preassessment Data Report (AR #2).

[5] Anthony Barber, EPA On-Scene Coordinator, Pers. Com.

[6] Linda Pilkey-Jarvis, WDOE, personal communication.

[7] The spill volume was initially reported as 277,200 gallons (AR #4).

This final RP/EA has been prepared jointly by NOAA; USFWS; the State of Washington Departments of Ecology, Fish and Wildlife, and Natural Resources; the Lummi Nation; the Nooksack Tribe; and the City of Bellingham. These entities are collectively referred to as the "Trustees."

Each of these entities acts as a Natural Resource Trustee pursuant to the Oil Pollution Act of 1990 (33 U.S.C. §§ 2701, *et seq.*), the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR § 300.600), and the Oil Pollution Act Natural Resource Damage Assessment (NRDA) regulations (15 CFR Part 990), for natural resources injured by the Incident. Executive Order 12777 designates the federal Natural Resource Trustees for oil spills, while the Governor of the State of Washington designates the state Trustees for oil spills in Washington. The City of Bellingham was appointed by the Governor as a Trustee specifically for this Incident due to the proximity of and interest in the natural resource injuries in Bellingham (AR #92). As a designated Trustee, each entity is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore natural resources and resource services injured or lost as the result of a discharge or threat of a discharge of oil. As set out in 15 CFR § 990.14 (a), the Trustees have designated NOAA as the Federal Lead Administrative Trustee and the City of Bellingham as the overall Lead Administrative Trustee (AR #6).

The assessment of injury and restoration of resources is also provided for in state law under the Washington Water Pollution Control Act, chapter 90.48 Revised Code of Washington (RCW), the Washington Oil and Hazardous Substance Spill Prevention and Response Act, Chapter 90.56 RCW, the Washington Archaeological Sites and Resources Act, chapter 27.53 RCW, and the Washington State Environmental Policy Act, chapter 43.21C RCW. These authorities are in addition to any other liability that may arise under federal law.

1.5 Overview of Natural Resource Injuries

The Creek, the Park, and the adjacent lands are important ecological and recreational resources for the City of Bellingham and surrounding area (AR #7). The Creek and riparian lands provide habitat for numerous species of plants, fish, birds, mammals, amphibians, reptiles, and invertebrates. Human uses, including wildlife viewing, hiking, fishing, biking, and other outdoor activities, also rely on the natural resources of the Whatcom Creek watershed (AR #5, 7, 8). The Lummi Nation and the Nooksack Tribe and their members depend in part on these natural resources for their livelihood. The Incident resulted in substantial adverse impacts on the watersheds of Whatcom Creek and its tributaries, including Hanna Creek, Lincoln Creek, Cemetery Creek, and Fever Creek:

- The aquatic biota of the Creek was nearly, if not completely, eliminated within the affected areas (AR #10). Affected biota included several species of juvenile salmonids, including chinook salmon (*Oncorhynchus tshawytscha*), which are listed as threatened under the

Endangered Species Act (ESA) (16 U.S.C. §§ 1531, *et seq.*, 50 CFR Part 223).

- The fire that began shortly after the pipeline rupture burned approximately 26 acres (AR #98). In addition to the direct injuries to the vegetation, the loss of vegetation resulted in increased erosion, expansion of invasive species, loss of shade and increased stream temperatures, lost recreation, and lost fish and wildlife habitat.

- The gasoline release and fire directly impacted at least 16 acres of the Park (AR #11). Losses of direct and passive use of recreational opportunities include reduction of hiking, fishing, swimming, and nature enjoyment. The majority of the Park was closed in the days and weeks after the Incident (Figures 4-9). As of early 2002, portions of the park near the confluence of Whatcom and Hanna creeks remain closed.[8]

1.6 Overview of the Oil Pollution Act of 1990 Requirements

The Oil Pollution Act allows designated Trustees to recover the cost of restoring, rehabilitating, replacing, or acquiring the equivalent of the injured natural resources ("primary restoration"), the diminution in value of those injured natural resources pending restoration ("compensatory restoration"), and reasonable assessment costs. NOAA promulgated regulations for the conduct of damage assessments for oil spills in 15 CFR Part 990 (Oil Pollution Act regulations). In conjunction with this rule-making process, NOAA also developed a series of technical guidance documents on how to structure and conduct oil spill damage assessments. The following provides a summary of the steps taken by the Trustees to develop a restoration plan to address the natural resource injuries associated with this Incident.

In compliance with the Oil Pollution Act and its regulations, the Trustees determined that legal jurisdiction to pursue restoration under the act exists for this Incident. The pipeline rupture and spill constitute an "incident" pursuant to OPA Section 1001 (14). Because the discharge was not authorized by a permit issued under federal, state, or local law and did not originate from a public vessel or from an onshore facility subject to the Trans-Alaska Pipeline Authorization Act, the Incident is not an "excluded discharge" within the meaning of OPA Section 1002 (c). Finally, natural resources under the authority of the Trustees have been injured as a result of the Incident. These factors establish jurisdiction to proceed with a NRDA under Oil Pollution Act regulations (15 CFR Part 990). The Notice of Intent to Conduct Restoration Planning (AR #137) provides a more detailed narrative on these determinations.

Natural resources are defined as "land, fish, wildlife, biota, air, water, ground water, drinking water supplies and other such resources belonging to, managed by, held in trust by, appertaining to or otherwise controlled by the United States (including the resources of the exclusive economic zone), any State or local government or Indian tribe or any foreign government" (33 U.S.C. § 2701 (20)). Injury is defined as "an observable or measurable adverse change in a

[8] C. Fogelsong, City of Bellingham, personal communication.

natural resource or impairment of a natural resource service" (15 CFR § 990.30). As described in the Oil Pollution Act regulations, a NRDA consists of three phases: preassessment, restoration planning, and restoration implementation.

Based on information collected during the preassessment phase, the Trustees make a preliminary determination as to whether natural resources and/or services have been injured and/or are likely to be injured by the release. Through coordination with response agencies (e.g., the Environmental Protection Agency), the Trustees next determine whether the oil spill response actions will eliminate the injury or the threat of injury to natural resources. If injuries are expected to continue and feasible restoration alternatives exist to address such injuries, the Trustees may proceed with the restoration planning phase. Restoration planning also may be necessary if injuries are not expected to continue or endure but are nevertheless determined to have resulted in interim losses of natural resources and/or services from the date of the incident until the date of recovery (15 CFR § 990.30).

The purpose of the restoration planning phase is to evaluate the potential injuries to natural resources and services and to use that information to determine the need for and scale of associated restoration actions. This phase provides the link between injury and restoration and has two basic components: injury assessment and restoration selection. The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thus providing a factual basis for evaluating the need for, type of, and scale of restoration actions. If the Trustees determine that the information gathered during preassessment is sufficient to provide a basis for restoration, they may proceed directly to the restoration planning phase without completing a formal damage assessment. As the injury assessment is being completed, the Trustees develop a plan for restoring the injured natural resources and services. The Trustees must identify a reasonable range of restoration alternatives, evaluate and select the preferred alternative(s), develop a draft restoration plan presenting the alternative(s) to the public, solicit public comment on the draft restoration plan, and incorporate comments into a final restoration plan (15 CFR § 990.55).

During the restoration implementation phase, the restoration plan is presented to the RP to implement or to fund the Trustees' costs for assessing damages and implementing the restoration plan. This provides the opportunity for settlement of damage claims without litigation. Should the RP decline to settle the Oil Pollution Act authorizes Trustees to bring a civil action against the RP for damages or to seek reimbursement from the Oil Spill Liability Trust Fund administered by the United States Coast Guard.

Trustees may settle claims for natural resource damages at any time during this process provided that "the settlement is adequate in the judgment of the Trustees to satisfy the goal of OPA and is fair, reasonable, and in the public interest" (15 CFR § 990.25). In other words, the Trustees must ensure that a settlement is adequate to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and services. The Trustees, acting on behalf of the public, have to

weigh the benefits of early settlement versus delayed recovery of natural resources that might result from long-term studies and protracted litigation.[9] Sums recovered in settlement of such claims, other than reimbursement of Trustees' costs, may only be expended in accordance with a restoration plan that is made available for public review and comment.

1.7 Coordination with the Responsible Party

Under Section 1002 of OPA, each party responsible for a facility from which oil is discharged is liable for natural resource damages resulting from the incident involving such discharge or threat of a discharge. The RP for this spill is the Olympic Pipe Line Company. Currently, the Company is owned by ARCO MidCon LLC (a wholly owned subsidiary of BP Pipelines North America Inc.) and Equilon. The Company is currently operated by BP Pipelines NA. At the time of the Incident, the owners were GATX, ARCO, and Equilon, with Equilon being the operator of the Company.

The Oil Pollution Act regulations require the Trustees to invite the RP(s) to participate in the damage assessment and restoration process (15 CFR § 990.14(c)). By working together, restoration of injured resources and services may be achieved more rapidly and cost-effectively. Although the RP may contribute to the process in many ways, final authority to make determinations regarding injury and restoration rests solely with the Trustees.

Shortly after the Incident, the Trustees and the Company recognized that a cooperative process would reduce duplication of studies, increase the cost-effectiveness of the assessment process, increase sharing of information, decrease the likelihood of litigation, and, most importantly, speed the restoration process. Another benefit of the cooperation was the ability to accomplish restoration goals in coordination with the emergency response activities. In an effort to establish a single focus among all Trustees and the Company, the parties agreed to develop a Joint Restoration Committee (JRC). The JRC worked to plan and implement emergency response and restoration activities during the summer and fall after the Incident (AR #1, 6, 23).

The Company, at the request of the JRC, also prepared a draft long-term restoration plan for the Incident (AR #15). The draft plan summarized the emergency restoration actions, the results of the initial studies, and proposed potential restoration alternatives. The Trustees carefully reviewed the Company's analysis of restoration alternatives. Many of the Company's proposed alternatives have been incorporated, in whole or part, into this restoration plan.

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[9] Early settlement is discussed in several sections of 15 CFR Part 990. The preamble to the NRDA Final Rule, 61 Fed. Reg. 446 (Jan. 5, 1996) states that "Trustees may settle claims for natural resource damages under this rule at any time.... In determining the sufficiency of settlements to meet the public interest test under other statutes, reviewing courts have afforded broad deference to the judgment of federal agencies recommending such settlements. Courts have looked to whether the agencies have considered such factors as the benefits of early settlement as opposed to delayed recovery through litigation, litigation risk, certainty in the claim, and attitude of the parties toward the settlement, among other factors."

The Trustees and the Company considered longer-term assessment studies to evaluate the injuries resulting from the Incident and the need for restoration. Both parties recognized the value of additional information in planning and scaling restoration actions, but also recognized the cost and time delays (in terms of restoration implementation) that would result from longer-term studies. It was uncertain whether the additional information gained from those studies would justify the increased costs or that the results would substantially change the type and scale of the potential restoration action. The Trustees and the Company agreed that the time and money would be better spent identifying and developing restoration projects to address the injuries to natural resources. The Trustees believe it is in the public's interest to focus on the planning and implementation of restoration projects in lieu of undertaking lengthy, and potentially costly, assessment studies. When faced with uncertainties, the Trustees and the Company attempted to resolve those in favor of more extensive, rather than less extensive, restoration projects. As a result, the Trustees and the Company are confident that the restoration projects in this final RP/EA, when implemented, will compensate for the injuries to natural resources.

1.8 Public Participation

Public review of the draft RP/EA is an integral component of the restoration planning process. Through the public review process, the Trustees seek public comment on the approaches used to define and assess natural resource injuries and the projects being proposed to restore injured natural resources or replace services provided by those resources.

Opportunities for public review of restoration actions have been afforded at several points during the process. On June 22, 1999, an emergency restoration plan was presented at a public meeting and made available for public review (AR #1). The progress of the NRDA process has been reviewed at regular meetings of the State of Washington Resource Damage Assessment (RDA) committee, during which opportunities for public questions and comments were afforded. The first RDA meeting following the Incident was held in Bellingham on July 12, 1999, and was attended by the public, as well as representatives of the Trustees (AR #13).

Public review of the draft RP/EA is consistent with all federal and state laws and regulations that apply to the NRDA process, including Section 1006 of the Oil Pollution Act, its regulations (15 CFR Part 990), and the National Environmental Policy Act (42 U.S.C. §§ 4321 *et seq.*, as amended) and its implementing regulations (40 CFR Parts 1500-1508). Following a public notice in the Bellingham Herald (AR #146), Seattle Times (AR #147), and Seattle Post-Intelligencer (AR #148), the draft RP/EA (AR #142) was made available to the public for a 33-day comment period. As part of the public review process, the Trustees conducted a public meeting on March 20, 2002, at the Bellingham City Council Chambers (AR #146-148). Written comments received during the public comment period were considered by the Trustees in preparing the final RP/EA. Those comments are summarized in Section 7 of this document. The complete comments are included in the Administrative Record (AR #143-145)

1.9 Administrative Record

The Trustees have compiled an Administrative Record (AR) to support their restoration planning and to inform the public of the basis of their decisions. The AR is available for public review at the public repositories listed below. The AR index is provided in Section 10.2 of this final RP/EA.

The AR facilitates public participation in the NRDA process and will be available for use in future administrative or judicial reviews of the Trustees' actions to the extent provided by federal or state law. Additional information and documents, including the final Restoration Plan and other related restoration planning documents, will become a part of the AR and will be submitted to the public repositories upon their completion.

Arrangements must be made in advance to review the AR. The documents comprising the AR can be viewed at the following locations:

City of Bellingham Department of Public Works, 2221 Pacific Street, Bellingham, WA 98226. Contact: Clare Fogelsong Tel: (360) 676-6850 Fax: (360) 676-7799 Email: cfogelsong@cob.org

NOAA Damage Assessment Center, 7600 Sand Point Way NE, Seattle, WA 98115. Contact: Doug Helton Tel: (206) 526-4563, Fax: (206) 526-6665 Email: Doug.Helton@noaa.gov

1.10 Summary of Findings

As described in Section 1.5, the Trustees must make several threshold determinations or findings during the course of the damage assessment process. For this Incident, the Trustees have determined[10] that:

- An Oil Pollution Act incident occurred (AR #14);
- Natural resources were injured as a result of the Incident (AR #10);
- Response actions were not sufficient to compensate fully for injuries and losses of services (AR #2); and
- Feasible primary and compensatory restoration alternatives are available (AR #15).

[10] Many of the documents in the AR support these determinations. The documents listed here are not meant to be exhaustive.

1.11 Summary of the Natural Resource Damage Claim

The goal of the NRDA process, as stated in 15 CFR 990.10, is to "make the environment and public whole for injuries to natural resources and services resulting from an incident involving a discharge or substantial threat of a discharge of oil." The natural resource damages claim for this Incident seeks restoration of the following natural resources and services:

1. **Vegetation**—Riparian and terrestrial vegetation;
2. **Fisheries**—Anadromous and resident fish, stream invertebrates, and their habitats;
3. **Water Quality**—Surface and ground waters;
4. **Wildlife**—Birds, aquatic and terrestrial wildlife, and their habitats; and
5. **Human Uses**—Park and fishing closures.

Restoration actions for this Incident encompass emergency actions[11] taken during the summer and fall after the Incident as well as the longer-term restoration actions that are the focus of this document. As described in more detail in Section 5.2 below, the restoration actions seek to: 1) enhance recovery of vegetation; 2) enhance anadromous and resident fish populations through habitat improvements and protection of riparian buffers; 3) protect habitats; and 4) compensate for the lost and diminished human-use services resulting from closure and injury to the Park. The long-term restoration actions include:

- **Land Acquisition**—the transfer of ownership from the Company to the City of Bellingham of two parcels of land along the Creek, totaling approximately 13.5 acres. The acquisitions include a 9.5-acre parcel just upstream of Woburn Street and a 4-acre parcel below the confluence of Cemetery Creek and Whatcom Creek.

- **Recreational Improvements**—the construction of an access road, parking lot, and restrooms on the 9.5-acre site before transferring the property to the City to be used in perpetuity as park property.

- **Fisheries Habitat Enhancement**—the construction of two salmonid habitat restoration projects: 1) at Salmon Park near Racine Street; and 2) along the lower section of Cemetery Creek, near its confluence with Whatcom Creek.

- **Vegetation Planting**—the completion of the replanting and emergency revegetation efforts started during the emergency response phase of the Incident.

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[11] The emergency restoration actions are summarized in Appendix 9.3 to facilitate public understanding of the restoration that has already been accomplished, but are not formally part of this final RP/EA. A copy of the Emergency Restoration Plan is included in the AR (AR #1).

- **Operations, Maintenance and Monitoring**—the establishment of a dedicated fund for the continuation and further development of specific multi-year operations, maintenance, and monitoring programs. The City of Bellingham, pursuant to an agreement among the Trustees, will administer the funds for the restoration projects.

2.0 AFFECTED ENVIRONMENT

2.0 Affected Environment

2.1 Physical Environment[12]

The pipeline release and resulting fire affected the Hanna Creek and Whatcom Creek watersheds. Hanna Creek and the upper reaches of Whatcom Creek are terraced and steeply incised, with several significant waterfalls (Figure 10). Whatcom Creek starts at Lake Whatcom and flows westerly for approximately four miles through suburban and urban sections of the City of Bellingham before discharging into Bellingham Bay. As the Creek approaches the bay, the current slows and the channel and riparian habitats become progressively more modified and degraded (AR #7).

The Whatcom Creek watershed encompasses a total area of 32,251 acres, including the Lake Whatcom basin and Whatcom Creek drainage (AR #20). Land use in the Lake Whatcom watershed is a mix of urban/suburban and forestry uses, with approximately 30% of the watershed zoned for residential and commercial development (AR #20). The City of Bellingham supplies water to its residents and several additional water districts from an intake located in the northwest end of the lake. A dam and spillway at the lake outlet was built in 1937 to maintain lake levels and prevent downstream flooding along the Creek. The City of Bellingham measures daily stream flows into the Creek from the control dam at the outlet of Lake Whatcom. This measurement point is located below the diversion to the Whatcom Falls trout hatchery.[13] An average of the monthly flows during a two-year (1997-1998) period was found to range from a low of 24 cubic feet per second (cfs) in September to a high of 448 cfs in January (Figure 11). The average annual flow during this two-year period was 127 cfs (AR #15).

The drainage area downstream of Lake Whatcom is approximately 5,800 acres and is comprised of surface runoff from five associated sub-basins: Park, Hanna, Cemetery, Lincoln and Fever creeks (AR #20). Whatcom Creek forms the central habitat corridor extending from the lake to Bellingham Bay and has recently been the subject of a master planning process that aims to enhance its habitat (AR #7, 16, 17) and recreational values (AR #8, 9).

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[12] Information used in drafting this section includes Stone's Master's Thesis on the Incident (AR #5), Nahkeeta Northwest 1995 (AR #7), the City of Bellingham's Watershed Master Plan (AR #16), Shoreline Management Master Program 1988 Update (AR #18), and the 1995 City of Bellingham Master Plan (AR #19), the draft restoration plan proposed by the Company (AR #15), the Whatcom Creek Waterfront Action Program (AR #17), and Thayer's 1977 report on salmon rearing potential in Whatcom Creek (AR #21).

[13] Stream flows diverted to the fish hatchery typically range from about 3 to 4 cfs depending on their level of production. Outflow from the hatchery is returned to the Creek downstream of the lake outlet. The total volume of water returned from the fish hatchery to the Creek is measured and added to the lake outlet flow data to derive stream flows for the mainstem of the Creek (AR #15).

Land use in the Whatcom Creek watershed ranges from parkland to industrial uses. The upper portion of the watershed is a mix of residential use and parkland, while the lower portion of the watershed has been developed for commercial and residential uses. Although highly developed, the watershed contains several important habitat blocks including the 240-acre Whatcom Falls Park, Hanna and Cemetery creeks, and portions of the Sehome Arboretum. The Creek itself is recognized as a "Shoreline of the State" under the Shoreline Management Act of 1971 (Wash. Admin. Code § 172-26 and RCW § 90.58.200) (AR #18).

2.2 Stream Habitats and Fisheries

Six species of anadromous salmonids and trout utilize portions of Whatcom Creek for spawning and rearing, including fall chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*) and chum salmon (*O. keta*) as well as winter steelhead (*O. mykiss*), brook trout (*Salvelinus fontinalis*) and coastal sea-run and resident cutthroat trout (*O. clarki*) (AR #7,21). Incidental observations of juvenile sockeye salmon (*O. nerka*) have also occurred in the Creek, but these fish are believed to be strays from the kokanee (landlocked sockeye) stocking program upstream in Lake Whatcom rather than progeny from returning anadromous fish (AR #10). Resident life-history forms of rainbow and cutthroat trout also occur in the Creek. Many other fish species are known to use the Creek. The most abundant non-salmonid fishes include sculpin (*Cottus* sp.), stickleback (*Gasterosteus* sp.), and lamprey (*Lampetra* sp.) (AR #10).

Current levels of salmonid fish populations in the Creek are the result of improvements in access for migratory adults, habitat restoration, and extensive hatchery plants that were initiated in the early 1980s and continue to this day (AR #5, 15, 24). Some of the returning hatchery fish are now spawning naturally in the Creek. The most heavily utilized spawning area occurs in the low gradient section of the Creek between the Woburn Bridge and the confluence with Lincoln Creek (AR #15). Use of this area was enhanced in the mid-1990s when the Nooksack Salmon Enhancement Association installed a fish ladder near Meador Avenue (AR #24). Sea-run and resident cutthroat trout also use Cemetery Creek for spawning and juvenile rearing habitat (AR #27). Juvenile steelhead, coho, and chinook salmon also rear in Cemetery Creek (AR #10).

The pre-Incident quality of fish habitat varied significantly along Whatcom Creek (AR #7). Above Woburn Street, the stream and riparian areas were relatively pristine, with large sections of natural habitat. Large conifers provided a source of shade and woody debris. Habitat diminishes as the Creek flows toward Interstate 5 with a decline in native riparian vegetation and progressively greater channelization. From Interstate 5 to Bellingham Bay, the Whatcom Creek floodplain narrows to a thin corridor averaging 100 feet in width. Below Interstate 5, the stream course is channelized, lacking in habitat diversity and, in places, retained by riprap and gabion walls. Streamside vegetation is also limited and primarily shrub-dominated, with blackberries and occasional cottonwood, alder, and few conifer trees. Much of the stream has been invaded by reed canary grass, which, in places, chokes the stream channel. In the years preceding the Incident, however, portions of the lower riparian area were improved through revegetation and invasive-plant control efforts (AR #5, 24).

2.3 Surface Water

Whatcom Creek originates from an overflow dam in a shallow embayment near the northwest end of Lake Whatcom. The surface waters of the lake heat up during the summer resulting in seasonally high water temperatures in the Creek. Stream waters cool as they flow through the Park, but the Creek is still warm enough to be sub-optimal habitat for Pacific salmon, and therefore warrants listing on the Washington State list of impaired waterbodies submitted to EPA pursuant to § 303(d) of the Clean Water Act (33 U.S.C. §§ 1251, *et seq.*). (www.ecy.wa.gov/programs/wq/303d/1998/wrias/1998_water_segs.pdf).

2.4 Estuarine Habitats

The Creek flows through the City of Bellingham's downtown area and into Bellingham Bay. Bellingham Bay is an urban estuary and the Whatcom waterway is lined with industrial and commercial activities. Water quality conditions in the Bellingham Bay estuary are improving. Within the last ten years, secondary treatment facilities have been established for domestic wastes of the City of Bellingham and the industrial effluents of the Georgia Pacific pulp and paper mill.[14] The areas of Bellingham Bay used for log rafting are decreasing, reducing stress on intertidal and benthic habitats. Efforts have been underway for several years to coordinate the cleanup of Bellingham Bay though a project called the Bellingham Bay Demonstration Pilot Project. The final environmental impact statement (EIS) for the project was published in October 2000 (AR #28).

Bellingham Bay is an important estuary and provides habitat for fish, invertebrates, birds and marine mammals (AR #7). The bay is an important transition zone for the movement of juvenile salmonids from the Nooksack River. Bellingham Bay also has a rich variety of resident fish and benthic and intertidal invertebrates. One benthic species, Dungeness crab (*Cancer magister*), is in adequate numbers to support a commercial fishery. The bay is part of the north-south migratory flyway for western birds and is also an important wintering ground. Sightings of cetaceans (whales) in Bellingham Bay are uncommon, but killer whales (*Orcinus orca*) and gray whales (*Eschrichtius robustus*) are occasional visitors. Pinnepeds, including harbor seals (*Phoca vitulina*) and sea lions (*Zalophus californianus*), are commonly observed.

2.5 Forest and Wildlife Habitat

Forested land is limited within the urban boundary of the City of Bellingham, as residential and commercial developments have fragmented habitats. In the center of the watershed is the Park and associated undeveloped open space. To the south edge of the watershed, the upper Hanna and Cemetery Creek watersheds provide hundreds of acres of combined alder, mixed, and coniferous forests. These forests extend south over Samish Hill to Lake Padden Park and east into the contiguous block of Lookout Mountain. This connectivity is crucial in maintaining breeding populations of forest species with large home-range requirements such as pileated woodpecker (*Dryocopus pileatus*) and bobcat (*Lynx rufus*), and also allows for occasional

[14] The pulp mill closed in April 2001, but tissue manufacturing continues at Georgia Pacific.

occurrence of deer (*Odocoileus* sp.), elk (*Cervus elaphus*), black bear (*Ursus americanus*) and cougar (*Felis concolor*). Common urban mammals such as raccoons (*Procyon lotor*), cottontail rabbit (*Sylvilagus floridanus*), and opossum (*Didelphis virginiana*) range throughout the watershed. Beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and river otter (*Lutra canadensis*) use most of the Whatcom Creek corridor and Lake Whatcom shoreline (AR #7).

Although highly developed for commercial and residential purposes, the central stream corridor, upper watershed forests, and open-space areas contain enough habitat diversity to support many bird species (AR #7). The Whatcom Creek corridor is considered a flyway for bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), merlin (*Falco columbarisu*), double-crested cormorant (*Phalacrocorax auritus*), kingfisher (*Ceryle alcyon*), great blue heron (*Andea herodias*), green-backed heron (*Butorides striatus*), gulls (*Larus* sp.), and a variety of dabbling and diving birds travelling between Bellingham Bay and Lake Whatcom. The Creek also offers narrow gorges with cascading water, habitat favored by American dipper (*Cinclus mexicanus*). Dense riparian vegetation offers preferred habitat for green-backed heron, possibly rails and a multitude of passerines, including neotropical migrants and resident species. Creek-side snags (many created by beavers) are utilized by great blue herons for roosting. Raptors use snags as hunting perches and a variety of woodpeckers forage and nest in the snags. Notable aggregations of swallows (*Hirundo* sp.) and swifts (*Cypseloides* sp.) are observed during the summer feeding on insects. Common mergansers (*Mergus merganser*) and bufflehead (*Bucephala albeola*) are also observed foraging in the Creek.

A variety of small reptiles and amphibians are also found in and along Whatcom and Hanna creeks (AR #7). Reptiles include the common garter snake (*Thamnophis sirtalis*), Northwestern garter snake (*Thamnophis ordinaoides*), rubber boa (*Charina bottae*), and Northern alligator lizard (*Elgaria coerulea*). Amphibians include the American bullfrog (*Rana catesbeiana*), Western toad (*Bufo boreas*), red-legged frog (*Rana aurora*), and a number of salamander species (*Ambystoma* sp., *Ensatina* sp., *Plethedon* sp.).

2.6 Wetland and Riparian Habitats

In 1990, approximately 335 acres of wetlands were inventoried in the Whatcom Creek watershed. Five years later, approximately 305 acres of wetland habitat were identified and the loss of wetlands is predicted to continue as further development occurs in the watershed (AR #7). Wetlands and riparian margins, particularly with associated undisturbed upland forests, provide habitat for a variety of reptilian and amphibian species. The combined loss of upland/wetland habitats and the fragmentation of remaining habitat constitute a significant loss of diversity and connectivity. The Whatcom Creek watershed wetland area is by far the greatest within the City and an important component of the remaining ecosystem (AR #7).

2.7 Threatened and Endangered Species

The Whatcom Creek watershed is known habitat for a number of species that are listed by both the Federal government (50 CFR 222-227) and the State of Washington (WAC § 232-12-297) as

endangered species or species of special concern. A complete list of Federal endangered and listed species can be found at www.nmfs.noaa.gov, and www.fws.gov. State species of concern can be found at http://www.wa.gov/wdfw/wlm/diversty/soc/concern.htm. Priority terrestrial species include the bald eagle (state threatened, federal threatened); common loon (*Gavia immer*), merlin, and pileated woodpecker (state sensitive); and Pacific Townsend's big-eared bat (*Plecotus townsendii*) (state candidate, federal species of concern). No federally or state listed plant species were found within or adjacent to the project area during the vegetation surveys conducted in connection with this Incident (AR #15).

The National Marine Fisheries Service (NMFS) has jurisdiction over Pacific salmon and has identified distinct groups or Evolutionarily Significant Units (ESUs) for each species. Chinook salmon spawning in Whatcom Creek are included in the Puget Sound Chinook Evolutionarily Significant Units listed as threatened under the Endangered Species Act (AR #12). The Creek and its adjacent riparian areas are included in the critical habitat designation for the Puget Sound Chinook Evolutionarily Significant Unit. The Puget Sound Chinook salmon is also a state candidate species of concern (AR #29).

Pacific lamprey (*Entosphenus tridentata*), a federal species of concern, also occurs in the Creek (AR #30).

2.8 Park Resources and Human Use

The Whatcom Creek watershed is an important location for fishing, recreation, leisure, education, exercise, and other uses. Large returns of chum salmon support one of the biggest recreational chum fishery in Washington State. The Creek and surrounding habitats are also used for salmon and stream education programs by local schools and colleges. The simple existence of the watershed and its resources provides passive-use benefits to residents of the City and surrounding areas. The 240-acre Park contains a system of walking, cycling, and multi-use trails (AR #31). Prior to the spill, the City of Bellingham initiated a master plan to develop the Creek as a major trail greenway through Bellingham, focusing citizen attention on the opportunity to preserve and enhance the ecology of the Creek, its riparian habitat, and the visual quality for both wildlife needs and civic and recreation opportunities (AR #8, 9).

2.9 Historic and Cultural Uses

The Whatcom Creek watershed has a cultural past dating back thousands of years. Over time, the area has provided subsistence, water, lumber, shelter, and recreation for generations of residents. The earliest inhabitants were Native Americans, including the Lummi Nation and Nooksack Tribe. The Creek and other coastal streams and rivers of the region provided salmon and other subsistence staples of the tribal diet. These natural resources also form the basis for many historic and present day rituals and ceremonies. The Creek falls within the 1855 Point Elliott Treaty Area for the Lummi Nation and Nooksack Tribe (S. Doc. 319, 58-2, volume 2:43) (AR #138).

In 1792, Captain George Vancouver, commanding the H.M.S. Discovery, was one of the first European visitors to the region. Vancouver discovered and charted a natural deepwater inlet that he named Bellingham Bay in honor of Sir William Bellingham, Controller of the British Navy. The first non-native settlers arrived in1852 and Whatcom County was officially organized as a county in 1854. Early industry focused on the natural resources of the region. Salmon processing and canning were once a major industry. The first cannery was built in 1886, and, by the turn of the century, there were twelve canneries operating within the county. The timber industry also has a long history in the region, and the forest-products industry, although declining, remains a major component of the regional economy. Today, the City of Bellingham is the county seat and the largest community in Whatcom County.

Pre-contact the Lummi Ancestors (*Xwlemi*) had all the names for Lummi lands (*Nilh Sneng'es Tengnexwqwen)* established in the Lummi language (*Xwlemi'chosen*). The place-names all relate to each other and portray specific uses or cultural significance for all Lummi lands, waterways, passageways, and usual and accustomed areas within the traditional territory. The Anglicized Whatcom Creek was actually called *Xwot'com*, which, in the *Xwlemi'chosen* structure, describes the sound made by 'rolling waters' derived from the large and small waterfalls in the stream. The *Xwlemi'chosen* dialect word for 'water' and 'drink' is *Qwo* and is represented by *Xwo* within the place-name itself. In addition, the significance of the rolling water is associated with the boiling motion at the base of the falls, where loose fallen rocks roll against the stream bedrock and make tumbling and rumbling sounds. Areas such as these have cultural significance associated with traditional cultural properties that portray the collective order and history, provide the "isolate" and relational linkages, and the association to other similar sites and areas.

The Lummi Nation temporary village area at the mouth of the Creek was used for canoe storage, fishing encampments, and drying and procuring salmon. The encampment was an isolated area between other salmon fishing and reef-net fishing areas. The encampment extended from a place in the north called *Sqwa'li'cum StoSto'lo* (referring to dog salmon (chum) and referencing the stream itself) commonly called Squalicum Creek, to the *TsiTsi'litch* area in the south, commonly called the Fairhaven district. Upstream in the *Xwot'com* creek watershed are the historic isolate areas used for hunting, gathering, and access to trails, waterways, lakes, and other historic and religious cultural sites pertaining to the salmon runs and tribal ceremony. From the falls area itself, the Tribe's ancestors used many of the known 312 native plant species for ceremony, medicine, and foods. They harvested red cedar trees, working them into cedar planks (used for building and house posts) and cedar canoes. The Tribe's ancestors also gathered the cedar bark, limbs, roots, and branches for basketry work. The *Xe'py* (Western red cedar) lined the stream banks that traditionally sustained the culturally significant salmon runs below the falls.

Environmental laws, including the National Historic Preservation Act of 1966 (12 U.S.C. §§ 470, *et seq.*), and the State Environmental Policy Act (SEPA) (chapter 43.21C RCW), require that impacts to cultural resources be considered during the public environmental review process. The National Historic Preservation Act requires that all Federal agencies consider cultural resources

as part of all licensing, permitting and funding decisions. As part of that process, each agency must consult with the Washington State Office of Archaeology and Historic Preservation (OAHP) to assure that cultural resources are identified and to obtain the formal opinion of that office on each site of significance and the impact of the proposed action upon the site.

A query of the Office of Archaeology and Historic Preservation database at http://www.ocd.wa.gov/info/lgd/oahp/register/index.tpl found a number of sites in the City of Bellingham that are listed in the National Register of Historic Places or the Washington Heritage Registry (AR #32). None of the listed sites were affected by this Incident, and the restoration actions are not near any of the listed sites. Due to Federal and state statutory protections, however, the public listings do not include information on sensitive archaeological or cultural sites. The Trustees are in consultation with the Tribal Trustees and the Office of Archaeology and Historic Preservation to ensure that such sites are undisturbed by the restoration actions (AR #139,140).

3.0 INJURY DETERMINATION AND QUANTIFICATION

3.0 Injury Determination and Quantification

Three threshold requirements identified in the Oil Pollution Act must be met before restoration planning can proceed: 1) injuries have resulted, or are likely to result, from the incident; 2) response actions have not adequately addressed, or are not expected to address, the injuries resulting from the incident; and 3) feasible primary and/or compensatory restoration actions exist to address the potential injuries (15 CFR § 990.42). Information collected by the Trustees and the Company during the preassessment phase for the Incident satisfies the three criteria listed above and confirms the need for restoration planning to address impacts from the Incident (AR #2).

This chapter describes and quantifies the natural resource injuries resulting from the Incident. The chapter begins with an overview of the types of information and data collected during the preassessment phase of the damage assessment process, followed by a description of the Trustees' strategy to identify and quantify specific injuries to natural resources.

3.1 Summary of Preassessment Activities

Within a few days of the Incident, the Trustees and the Company initiated a preliminary investigation of the impacts of the Incident on the natural resources in the area. The preliminary assessment focused on collecting perishable or ephemeral information necessary to evaluate the fate and transport of the gasoline and potential injuries to natural resources (AR #2). These activities were coordinated with and complemented information and data collected by the response agencies. The results of the preassessment evaluation are summarized in the Whatcom Creek Incident Preassessment Data Report, dated April 20, 2000 (AR #2).

The following activities, conducted by the Trustees, the Company, and/or the response agencies, were used to help evaluate the potential impacts of the Incident on natural resources. Based on the following information, the Trustees believe the Incident caused substantial resource injuries to stream biota, riparian and upland habitats, and recreational uses of the resources:

1. **Ground and Aerial Photographs and Video Records**—A comprehensive set of aerial and ground photographs and videotapes was collected to delineate the burn zone (AR #98) and to document the response, assessment, and emergency restoration efforts.

2. **Fingerprinting of Contamination**—Samples of gasoline collected from the pipeline were chemically analyzed. The results of these analyses were compared to analytical results from biota, sediment and water samples in order to confirm that the contamination of these resources came from the Incident. Samples of gasoline were also analyzed to better understand the potential toxicity, rate of degradation, fates, and persistence of the spilled material (AR #1, 2).

3. **Collection of Response Information, Toxicity Data, and Literature Search**—The Trustees collected and evaluated reports and documentation generated as part of the operational response (AR #2, 34). A search was also conducted to collect relevant historical research, management plans and other information regarding the Whatcom Creek watershed. A comprehensive literature review (AR #35-73, 79) and a risk analysis (AR #74) were conducted to assess chemical hazards and potential ecological risk to Whatcom Creek organisms from contaminated water and sediments. Finally, literature searches were collected on the fate and effects of similar spills (AR #75-77), and the effects of fire on riparian and stream habitats (AR #128-133).

4. **Documentation of Fish and Wildlife Mortalities**—Collection and recording of dead fish and injured wildlife began the day after the Incident. A formal fish kill assessment (AR #33) was conducted to assess the number of dead or moribund organisms (fish, amphibians, etc.) due to the Incident (AR #10). Survey correction factors were also considered to take into account fish and wildlife that were killed but not found (AR #33, 78, 80, 84). Surveys were conducted in the burn zone to enumerate terrestrial wildlife injuries and determine the loss of wildlife habitats (AR #85).

5. **Water Quality Studies**—Permanent water sampling stations (Figures 12, 13) were established in the Creek and in Bellingham Bay (AR #2, 15, 86). These stations were repeatedly sampled in the months following the Incident to determine whether gasoline was still present and the rate of degradation of the gasoline. One of the response actions was to agitate sediments using mechanical equipment during the day and then flush the stream nightly by increasing the flow from Lake Whatcom. Water samples were collected during nightly flushes to evaluate potential effects and success of the instream remedial restoration efforts. Water samples were also collected to determine potential input of contaminated soil and combustion products during rainfall events.

6. **Characterization of Sediments and Sediment Pore Water**—Samples of the streambed sediments and interstitial water (water among sediment particles) in the streambed gravels were collected (Figure 24) from twelve stations between the outlet of Lake Whatcom to below Interstate 5, including known salmonid spawning areas near Woburn and Racine streets (Figure 14) (AR #2, 15). Stations were sampled before and after remedial efforts to document the efficacy of the streambed remedial efforts. The samples were also analyzed to identify the location and potential severity of contaminated "hot spots" and to determine the risk to salmonid eggs and juvenile salmon that reside in the stream gravel.

7. **Stream Invertebrate Studies**—The Trustees coordinated with the Company to evaluate the effect of the Incident on invertebrates in the Creek. Periodic surveys were conducted in the Creek to determine the health, diversity, and recovery rates of the macroinvertebrate community (AR #2, 15).

8. **Stream Temperature Monitoring**—A monitoring system was developed to track changes in stream temperatures in Whatcom and Hanna creeks as a result of the fire and loss of shade canopy. Historical stream temperature data were also researched. Pre-Incident temperature data were found for several stations along the Creek, as well as for Cemetery and Lincoln creeks near their confluences with the Creek. Modeling was conducted to determine the potential temperature elevations that might occur as a result of the loss of shade (AR #2, 15).

9. **Stream Habitat Surveys**—Stream gravel was excavated and mechanically agitated to release gasoline trapped in sediments. The physical features and habitats of the Whatcom and Hanna creeks (e.g., gravel size, presence of woody debris, the number and quality of pools, riffles, glides) were assessed and mapped before and after emergency restoration. The objective of the stream habitat survey was to assess the physical habitat conditions available to salmonids before and after emergency restoration to ensure the resulting habitat conditions were at least as suitable for salmonids as prior to the stream work. A computer model, the Physical Habitat Simulation Model (PHABSIM), was used to estimate the amount of available spawning and rearing habitat available pre-and post-emergency restoration in the Creek for various life-history stages of anadromous and resident fish (AR #15, 22).

10. **Vegetation Studies**—In addition to the aerial photography of the burn zone, several surveys and studies were conducted by the City of Bellingham and WDNR to measure the size of the burn zone and to evaluate the survivability of injured trees and large woody vegetation within that zone. Surveys were conducted along the Creek and in the burn zone to assess the historic versus current vegetation status. Studies were also conducted to assess soil structure and erosion potential of the burn zone. Extensive mapping was conducted focusing on non-native vegetation. Follow-on surveys were also conducted to evaluate the efficacy of emergency revegetation and invasive-species control efforts (AR #100).

11. **Salmonid and Fish Recovery Studies**—Studies were conducted in the fall of 1999 to assess the escapement of adult salmon into the Creek and their spawning success. Snorkel and beach seine surveys were conducted in the spring and summer of 2000 to determine the abundance and condition of juvenile salmonids and resident fish in the Creek and adjacent tributaries affected by the Incident (Figure 15) (AR #87).

12. **Source Site Characterization and Remediation**—Soils at the pipeline break were contaminated and gasoline percolated into the ground water. A detailed study was conducted to determine the extent of the soil and groundwater contamination (AR #88, 89).

13. **Park and Recreational Use**—The Incident not only injured an ecologically sensitive area, but also impacted important recreational lands. Closures of the Park and other public facilities were documented (AR #11, 90) and preliminary estimates of lost visitation were developed. The Trustees prepared a timeline of the reopening of park sections (AR #2). Recreational fisheries were also affected, and the Trustees kept track of the location and

duration of fishing closures. Other related resource injuries, including passive-use losses and future losses, are identified and discussed in the Preassessment Data Report (AR #2).

14. **Preassessment Modeling of Fates and Marine Injuries**—Preliminary modeling of the potential fates of the gasoline and potential for injuries to natural resources in Bellingham Bay was performed using the SIMAP (Spill Impact Map) model developed by Applied Science Associates. SIMAP is a computer model that estimates the physical fates and biological effects of releases of oil and hazardous chemicals (AR #91).

15. **Collection of Press Releases, Fact Sheets, Newspaper Articles, and Internet Information**—The Incident generated intense local, regional, and national media attention. A number of informational Internet web sites were also developed by Whatcom County, the City of Bellingham, the *Bellingham Herald*, the Company, and others. The Trustees collected and archived media reports and Internet information on the Incident (AR #93-97).[15] This information was used to help understand community priorities and concerns about the affected areas. The Trustees also used some of the early press releases and fact sheets to understand the sequence of events of park closures and re-openings, and other restrictions on public uses. Finally, many photographs of the Incident were collected from Internet sites.

3.2 Assessment Approach

The goal of injury assessment under the Oil Pollution Act is to determine the nature and extent of injuries to natural resources and services that will provide a basis for evaluating the need for and type and scale of restoration actions. The assessment process is a two-step process: 1) injury determination and 2) injury quantification.

Injury determination begins with the identification and selection of potential injuries to be investigated. In accordance with Oil Pollution Act regulations, the Trustees considered several factors when making this determination, including, but not limited to, the following:

- The natural resources and services of concern;
- The evidence indicating exposure, pathway and injury;
- The mechanism by which injury occurred;
- The type, degree, and spatial and temporal extent of injury;
- The adverse change or impairment that constitutes injury;
- Availability of assessment procedures and their time and cost requirements;

[15] Because of the large volume of Internet and media reports on the Incident, the Trustees' archive of information is not comprehensive.

- The potential duration of the natural recovery period; and
- The scope of feasible restoration actions.

The Trustees and the Company shared a common goal of implementing restoration as quickly as possible, and therefore they did not pursue expensive, multi-year injury studies but instead focused on designing and implementing emergency restoration and long-term restoration planning which would more expediently benefit the resources. Consistent with Oil Pollution Act regulations, the Trustees used procedures such as focused site investigations, surveys, field sampling, consultation with experts, and review of relevant scientific literature to document exposure and demonstrate injuries to natural resources and services.

3.3 Summary of Preassessment Findings

The following section briefly summarizes the key results of the preliminary studies. More detailed information can be found in Section 3.4 of this final RP/EA, in the Preassessment Data Report (AR #2), the Company's Emergency Restoration Plan (AR #1), and the Company's draft Long-Term Restoration Plan (AR #15).

Gasoline Fates—The pipeline break resulted in the release of an estimated 236,000 gallons of gasoline (AR #3). The exact fates of the gasoline are unknown but a large fraction was consumed in the fire or evaporated. Smaller amounts dispersed in the turbulent creek waters or remained on the surface in the form of sheens on Bellingham Bay. Some of the gasoline saturated the ground, geologic formations surrounding the break site and adjacent soils, and slowly seeped into Hanna Creek (AR #88, 89).

Gasoline Characteristics and Weathering—The product released from the pipeline was a typical automotive gasoline. This product is a colorless to yellow liquid with a strong petroleum odor. Chemically, gasoline consists primarily of monoaromatic hydrocarbons, also referred to as BTEX (benzene, toluene, ethylbenzene and xylene). Gasoline also has some heavier diaromatic hydrocarbons such as naphthalenes. Gasoline is lighter than water, has a high vapor pressure and a very low viscosity. As a result, it floats and spreads rapidly when spilled and readily evaporates. Following spillage, the more volatile BTEX constituents rapidly volatilize into the atmosphere and, to a lesser extent, dissolve into the water. Thus, while gasoline is considered highly toxic, most of the gasoline-range hydrocarbons have a relatively short persistence in surface waters. However, some of the slightly heavier hydrocarbons can persist and provide a source of contamination. The rate of evaporation, dissolution, and degradation are dependent on factors such as local environmental conditions, mixing, and temperature. Evaporation and burning removed most of the spilled surface gasoline, but the gasoline contamination in the groundwater and sediments provided a low-level, but long-term, source of hydrocarbons.[16]

[16] Information in this section is based on a number of sources, including AR #2, 15, 42, 43, 73.

Impacts to Surface Waters—Short-term water quality in the Creek was adversely affected during the Incident. The combination of the fire and toxic levels of hydrocarbons killed virtually all aquatic biota from the spill site to the mouth of the Creek (AR #10). Emergency activities conducted by the Company included: 1) agitation of the stream bed surface to remove volatile hydrocarbons attached to surface materials; 2) pulsed flushing flows following daily bed agitation; 3) removal of mobile pieces of debris with the potential for retaining adsorbed hydrocarbons; and 4) mechanical flushing of local areas (AR #1). Hydrocarbon levels decreased markedly following the Incident and direct long-term effects on surface water quality were not detected (AR #15).

Marine Impacts—The potential for marine impacts were evaluated using a combination of modeling and field data. Modeling was performed using the SIMAP model (AR #91). The spill was treated as a subsurface release at the point where the Creek enters Bellingham Bay. The potential effects were evaluated using a database that has average biological abundances for marine fish and invertebrates in Puget Sound. The model showed that contamination was restricted to Bellingham Bay and remained approximately four to five days after the Incident. The acute toxicity was restricted to the area near the Creek mouth. The pattern of this contamination is in agreement with the observations of the sheens and field measurements of contamination conducted jointly by the Trustees and the Company (AR #15, 86). The model predicted short-term and localized mortality of estuarine fish and invertebrates in the Whatcom Waterway.[17] Field observations[18] made immediately following the Incident indicated that direct mortalities to estuarine fish and invertebrates occurred at the Creek mouth and estuary (Figure 16). These mortalities appear to have been short-term and localized. Foot surveys conducted near the mouth of the Creek five days after the release found no sheens or odors, no distressed or freshly dead organisms, and no other indications of a persistent marine impact (AR #99).

Soil and Ground Waters—Characterization of subsurface soil and groundwater in the pipeline release area began on June 16, 1999. Over 115 subsurface explorations were completed to evaluate the lateral and vertical extent of gasoline-related soil and groundwater contamination (AR #88, 89). A free-product and ground water interceptor system (an east-west oriented horizontal drain and vertical recovery well) was installed between the point of release and the Creek to recover gasoline observed seeping into the Creek north of the pipeline rupture location. Over 6,500 cubic yards of gasoline-contaminated soil were removed and treated at a hazardous waste facility. Long-term groundwater monitoring by the Company under the supervision of WDOE will continue on a routine basis to monitor the results of the remedial action, to evaluate the migration of contaminated groundwater beneath the site, and for regulatory compliance.[19]

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[17] The Whatcom Waterway is an industrial site currently subject to cleanup under the Washington State MTCA (AR #17).

[18] Dale Davis, Washington Department of Ecology, personal communication.

[19] The requirements for the cleanup of residual gasoline-contaminated soil in the release area and contaminated groundwater and protocols for groundwater monitoring are embodied in the WDOE's MTCA Regulations (WAC 173-340).

Wildlife—The Whatcom Creek watershed is utilized by a variety of terrestrial wildlife (Figure 17). The USFWS and the WDFW conducted limited surveys of the burn zone to search for dead, moribund, or injured wildlife following the fire (AR #10, 85). The scope and extent of wildlife surveys to assess impacts to terrestrial species were deliberately limited within the burn zone to reduce additional impacts to riparian habitat by survey crews. It was also evident that it would be extremely difficult to find and enumerate the variety of animals that would likely have been present in the burn zone. Consequently, there are no complete estimates on the species and numbers of animals killed. Although observations of direct mortalities were limited, crews observed dead beavers, river otters, small mammals, birds, and reptiles in the days following the Incident (AR #10, 85). The impacts to terrestrial and riparian vegetation from the Incident resulted in a substantial and long-term loss of wildlife habitat.

Freshwater Biota (Finfish, Amphibians and Invertebrates)—Direct mortalities occurred to aquatic organisms within Whatcom and Hanna creeks. Aquatic life was most heavily impacted, with over 100,000 fish, aquatic invertebrates (e.g., crayfish), and amphibians (e.g., frogs and salamanders) collected or observed dead (AR #10). Fish losses included juvenile salmonids (coho, chinook, chum, sockeye salmon, and steelhead, rainbow and cutthroat trout), juvenile lamprey, and a variety of other species. In addition to the large fish kill, aquatic macroinvertebrates that serve as important food sources for the fishes were impacted. Aquatic flora, including algae, mosses, diatoms and aquatic vascular plants were also impacted (AR #10). Due to the time of year, adult anadromous salmonids were not present in the stream during the Incident (Figure 18).

Impacts to Stream Habitats—In addition to mortality of stream biota, the Incident and resulting response actions also disturbed the physical features of Whatcom and Hanna creeks. Although many of these features were restored by emergency restoration actions, there was a temporary loss of stream habitat. Hanna Creek was dewatered for several months following the Incident to allow for excavation of contaminated sediments and soils (Figures 19, 20). Approximately 2,000 cubic yards of gasoline-contaminated soil were excavated from the upper portion of Hanna Creek and the lower 800 feet of Hanna Creek was remediated using a combination of soil aeration and agitation followed by soil washing (AR #1). Gravels in Whatcom Creek were mechanically reworked to facilitate release of trapped hydrocarbons. Contaminated natural woody debris was removed from both creeks.

Large Woody Vegetation—Burned terrestrial vegetation totaled approximately 26 acres, including approximately 16 acres of mature riparian forest within the Park and approximately 10 acres of third- or fourth-growth floodplain forest and open lot below the Park. Loss of trees was high within the burn zone and removal of understory crown was nearly complete (AR #98). The loss of cover increased the risk of spread of invasive species into an area that historically had very little problem with invasive species (AR #1, 15, 100).

Park Resources—Recreational services were curtailed throughout a large portion of the Park during the weeks immediately following the Incident. These curtailments in services were reduced through progressive re-openings, with the exception of a continuing closure of the area within the burn zone (AR #11). As of March 2002, the closure areas in the Park are limited to the Whatcom Creek gorge from the confluence of Whatcom Creek and Hanna Creek downstream to Woburn Street to protect new vegetation, minimize the potential for erosion, and protect public safety.[20] A portion of the Park above the gorge is also closed to help restrict access to the gorge. Services lost include direct uses such as hiking, jogging, biking, horseback riding, swimming, fishing, picnicking, bird watching, nature study, education, photography, drawing, painting, nature enjoyment, and other outdoor activities. In addition to direct use losses, the Incident caused losses to passive uses of the park, i.e., those associated with the simple existence of the Park and the Creek and the natural resources they support. Finally, the Trustees believe the Incident will result in future direct and passive-use losses as a result of the continuing closures.

Fishing Closures—The Creek serves as a popular fishing resource and the Incident occurred during the summer trout fishing season. The WDFW instituted an emergency rule on June 18, 1999, closing all fisheries in the Creek and its tributaries, from Lake Whatcom down to Bellingham Bay (AR #101). These emergency closures remained in effect for 120 days. Additional harvest restrictions on salmon and other game fish were put into effect on November 19, 1999 (AR #102).

3.4 Injured Natural Resources and Resource Services

The Trustees reviewed the results of the response actions, emergency restoration projects, and preliminary assessment studies and determined that injuries to natural resources resulted from the Incident. The response and emergency restoration actions, while beneficial, did not completely compensate for the losses from the Incident. This section discusses five categories of natural resources and resource services the Trustees have determined were injured and require additional restoration measures. The injured resources and services considered by the Trustees include:

1. **Vegetation**—Riparian and terrestrial vegetation;
2. **Water Quality**—Surface and ground waters;
3. **Fisheries**—Anadromous and resident fish, stream invertebrates, and their habitats;
4. **Wildlife**—Birds, aquatic and terrestrial wildlife, and their habitats; and
5. **Human Uses**—Park and fishing closures.

These injuries and the need for restoration for each category of injury are described in more detail below. Restoration alternatives for these injuries are summarized in Section 4.5 and discussed in detail in Chapter 5.

[20] Clare Fogelsong, City of Bellingham, personal communication.

3.4.1 Riparian and Terrestrial Vegetation

The riparian zone is the interface or linkage between the upland (terrestrial) zone and the deep-water (aquatic) zone. Riparian and wetland ecosystems are important islands of diversity within extensive upland ecosystems and provide an important functional linkage between aquatic and terrestrial ecosystems (AR #103). Healthy riparian vegetation provides habitat for wildlife and invertebrates, stabilizes the shoreline and controls erosion, helps maintain water quality and stream stability, and provides shade to regulate creek water temperatures. The vegetation also provides recreational and aesthetic benefits. The Incident heavily impacted this zone and the adjacent uplands.

Three types of impacts to vegetation were anticipated: 1) direct mortality of vegetation, 2) increased potential for erosion, and 3) colonization of the burn zone by invasive plant species. Several studies were conducted by the Trustees and the Company to evaluate the vegetation injuries, and emergency restoration actions were implemented to reduce and compensate for these injuries.

Direct Mortality—The dominant and most apparent injury in the riparian zone and nearby upland zone was the loss of the trees and vegetation. The primary injury pathway resulted from the fire rather than a toxicological response from the gasoline released during the rupture (AR #2). Surveys of the area show that the fire destroyed a total of 2.5 miles of riparian vegetation along both banks of the Creek (Figures 21, 22). The WDNR collected coordinates of the burn perimeter with a differentially corrected global positioning system (GPS) receiver. The area exposed to fire was approximately 16 acres in the Park and 10 acres below Woburn Street (AR #2, 98). The response, excavation, and cleanup activities resulted in several acres of additional injury to vegetation near the break site and along upper Hanna Creek (AR #2).

Several studies were conducted by the Trustees and the Company to evaluate the pre-Incident conditions of the plant communities present within the limits of the burn zone along Whatcom and Hanna creeks. Both historic and current on-site information was collected for these purposes. These studies helped to understand baseline plant communities and the injuries from the Incident in order to scale restoration and monitoring activities. Four basic vegetation classes were evaluated: 1) evergreen-dominated mature second growth forest, 2) deciduous-dominated closed canopy forest, 3) deciduous-dominated narrow riparian forest, and 4) invasive weed-dominated stands of shrubs and low-growing vegetation.

Erosion—One of the consequences of the destroyed vegetation was the potential for increased erosion and sedimentation (AR #105, 130-132). Increased sedimentation can have adverse impacts to stream habitats and fishery resources (AR #106, 107, 130, 132). Fine sediments can smother eggs, pre-emergent salmon, and invertebrates that reside in the interstitial gravels. Burned watersheds are more prone to erosion than those that are fully vegetated for a number of reasons, including, most particularly:

- Presence of a considerable amount of ash, which is easily mobilized by rainfall and runoff;
- Absence of protective vegetative cover, which normally functions to break up the impact of raindrops, which, in turn, dislodge ash and soil particles;
- Decreased infiltration and increased runoff due to physical changes in the surface soil conditions resulting from the fire; and
- Presence of water-repellent layers within the soil profile (hydrophobicity), which decreases infiltration.

All of the burned areas drain directly into the Creek. Often, the first significant rainfall event after a fire brings a high load of ash and debris downstream. Emergency actions were taken by the Company to reduce erosion, including replanting, restrictions on vehicle and foot traffic, and application of fiber mulch with a tackifying agent (Figure 23). Most of the burn area had an intact layer of decaying organic matter that protected the soil surface. As a result, the only areas that required intensive erosion control were those areas where ground-disturbing activity took place as part of remediation. Post-spill water sampling in the Creek showed some increased sedimentation (AR #5). Fortunately, no significant rainfall events occurred during the summer and early fall after the Incident and no substantial erosion problems were observed (AR #15).

Invasive Species—Invasive plants pose a serious threat to the integrity and productivity of natural systems (AR #100). Many introduced species are better able to exploit disturbances such as fire. Invasive plants can out-compete and prevent the re-establishment of native species (AR #15, 100). Over time, non-native species increase in dominance. The result is sometimes a permanent shift in community structure with a greater abundance of introduced rather than native vegetation. Often the introduced plants have lower habitat value for native wildlife and overall habitat quality, and ecosystem functioning can be impaired. Due to the destruction from the fire and the potential for spreading of invasive species, such as Himalayan blackberry (*Rubus discolor*) and reed canary grass (*Phalaris arundinacea*), a recognized problem along historically modified portions of the Creek, the Company agreed to an extensive effort to prevent invasive plants from gaining a foothold in the burn zone (AR #1). The Company also agreed to implement control measures elsewhere along the Creek. Follow-up surveys have shown that the emergency control measures were successful (AR #100).

Need for Restoration—Recovery has already begun in the burn zone and the emergency restoration has been beneficial in reducing harm and compensating for impacts from the Incident. Ferns and other low plants have started to grow and the planted seedlings are growing. Some of the services and functions provided by the forest, including wildlife habitat, have also begun to recover. However, complete recovery back to pre-Incident conditions will be slow. The seedlings planted since the Incident will take decades to reach the size of the burned trees. Therefore, the

Trustees believe that completion of the emergency restoration actions and acquisition and protection of forested lands are appropriate restoration actions under this final RP/EA.

3.4.2 Surface and Ground Waters

The Incident affected approximately 1.6 miles of streambed in Hanna and Whatcom creeks and influenced water quality and aquatic biota in an additional 1.4 miles of Whatcom Creek downstream of the burn zone toward Bellingham Bay. The total stream length affected is estimated to be three miles.

Surface Waters—Water samples were collected at eight sites along the Creek and at twelve sites in Bellingham Bay to characterize the extent and level of gasoline hydrocarbon exposure in potentially affected areas of the Creek, as well as the decay of the concentrations over time (AR #2, 15). Water samples were taken from the Creek and bay stations beginning on the afternoon of June 11, 1999. High levels were found initially, but levels declined rapidly within the first two days following the Incident (AR #15). Stream sampling continued during the remediation process, and the presence of gasoline was detected as pockets of the spilled product were released. Water flows in the Creek were manipulated to provide low flows during working hours and higher flows at night to assist in flushing gasoline out of the system. Nighttime samples were collected near the lower end of the Creek at Dupont Street in order to evaluate whether and how much gasoline might be released into Bellingham Bay, but no appreciable levels of gasoline hydrocarbons were found (AR #15). During all aggressive remediation activities aimed at freeing product from the streambed, downstream gasoline hydrocarbon levels were at or near non-detection limits, indicating the product likely volatilized quickly after release (AR #15).

Pore Waters—Salmonid spawning habitats were exposed to gasoline and there was concern that gasoline might be trapped in the interstitial water in the streambed gravel and contaminate eggs deposited during the fall and winter spawning events. Known salmonid spawning areas were sampled by placing glass pipettes into the gravel and slowly withdrawing water (Figure 24). Samples were collected before and after instream remediation. Several spawning sites sampled in July 1999 had detectable levels of gasoline hydrocarbons and BTEX. The sites showed significant pore-water decreases in gasoline compounds after remediation but several locations still had elevated levels of gasoline compounds. These sites were re-agitated. Sampling of sites following remediation indicated that streambed agitation was successful in removing gasoline from the stream gravels (AR #15). The Company is developing a sampling plan for sampling fine sediments according to the protocols in the state's Sediment Management Standards (WAC 173-204) to demonstrate that gasoline compounds have been removed from fine sediments as well (AR #15).

Ground Waters—Although the majority of the fuel burned in the fire that followed the release, some fuel entered the soils near the Bellingham water treatment plant. Fuel also infiltrated the bed and bank sediments of Hanna Creek and the bed of Whatcom Creek. Site investigations

included collection of soil vapors, soil, groundwater, surface-water, and water-seep samples. Over 115 subsurface explorations were completed to evaluate the lateral and vertical extent of gasoline-related soil and groundwater contamination (AR #88, 89). A free-product and groundwater interceptor system (an east-west oriented horizontal drain and vertical recovery well) was installed between the release area and the Creek to recover gasoline observed seeping into the Creek north of the pipeline rupture location. Residual gasoline contaminated soil remaining in the release area will be remediated in accordance with the Washington MTCA (RCW Ch. 70.105D). Long-term groundwater monitoring will be continued by the state regulatory agencies on a routine basis to monitor the results of the remedial action.

Sedimentation—In addition to instream and groundwater contamination, the explosion and fire raised concerns over combustion-related contamination and the potential for increased erosion and sedimentation. The primary concern was that a large rainfall event might wash contaminants and unstable soils into the stream. Fortunately, no substantial rainfall events occurred during the summer after the Incident. However, several days of 0.3 and 0.35 inches of rainfall in a 24-hour period were recorded at the local weather station. Analysis of samples during those events showed no observable increases in stream water hydrocarbon levels. Suspended sediment levels were also low, indicating that no appreciable erosion was occurring in the burned gorge areas of Whatcom and Hanna creeks (AR #15).

Need for Restoration—Surface waters returned to their pre-Incident condition after the Incident indicating that the response and emergency restoration efforts were beneficial in controlling sedimentation, intercepting contaminated groundwater, and removing trapped hydrocarbons from the stream gravels. Treatment efforts are continuing in order to intercept the gasoline in the soils and groundwater near the rupture site before they flow into Hanna and Whatcom creeks.[21] While the efforts have been successful, there was an impact to water quality in the system and there is concern for continued seepage. The Trustees suite of restoration projects outlined in Section 5 will continue the emergency restoration efforts and protect and create habitat to address injuries to water quality as a result of the Incident.

3.4.3 Fish and Fish Habitats

Prior to the Incident on June 10, 1999, Whatcom Creek supported a diverse suite of fish and other organisms. The presence of multiple-year classes of naturally produced resident and anadromous salmonids and other fishes and invertebrates indicates that this stream was supporting self-sustaining populations (AR #10).

Fish Injury—Spot fires and concerns about worker safety slowed the initial assessment of fish kills (Figure 25). As soon as it was safe to enter the burn zone, scientists representing the Trustees and the Company surveyed Whatcom and Hanna creeks for dead or moribund

[21] This long-term cleanup activity is required by the WDOE MTCA, RCW Ch. 70.105D, and is not a restoration project under this final RP/EA.

organisms. Five teams of three to six people spent several days collecting and enumerating organisms in each operational stream segment as identified during the response and remediation phase of the Incident. The teams enumerated dead animals and identified all recovered animals. Results of surveys indicate that the Whatcom Creek ecosystem was severely impacted and few, if any, fish and aquatic organisms downstream of the Incident survived.

Virtually all fish and aquatic organisms within the impacted area appear to have been killed. Over 100,000 dead fish and aquatic invertebrates were observed during stream surveys, including 8,842 salmonids (AR #10). Affected biota included several species of juvenile salmonids, including chinook salmon, which are listed as threatened under the Endangered Species Act (50 CFR Part 223, 16 U.S.C. §§ 1531, *et seq.*) (AR #12). Other affected salmonid species included coho, chum, sockeye salmon, resident rainbow trout and steelhead, brook trout, and cutthroat trout.[22] Most of the dead salmonids were fry and smolts. The actual number of fish and aquatic organisms killed from this Incident is probably much higher than that observed by survey crews. Many fish were likely flushed downstream into the mouth of the creeks where they were consumed by gulls and other scavengers or carried away by tides. Other organisms went uncounted because teams could not survey all areas of the creeks due to safety closures, water depth or limited accessibility, or because the fish simply went undetected. Salmonid fry and other small fish are difficult to see and may have been hidden by debris, burned beyond recognition, or in an advanced state of decomposition (AR #33, 78, 80, 84).

Multiple brood years of resident and anadromous species, such as cutthroat and rainbow trout, were affected. The loss of spawning adult trout and the loss of all juvenile age classes from a major portion of the stream has severely reduced the reproductive potential for these species and will substantially limit the rate of natural recovery in the Creek. For anadromous salmonids, such as steelhead and sea-run cutthroat trout, and coho and chinook salmon, multiple brood years of juveniles were substantially impacted. It will take several generations for fish populations to recover to baseline levels, especially for species listed under the Endangered Species Act. Populations of benthic macroinvertebrates were eliminated in over three miles of stream. These organisms are vital as prey for fish and other species. Recovery of stream invertebrates is critical for the long-term recovery of fish populations.

Temperature Effects—The fire modified the quality of salmonid habitat by reducing shade and increasing water temperatures (AR #15). Additionally, an average volume of over 6,000 gallons per day of groundwater was removed from the watershed for treatment and then discharged through the municipal treatment plant, and therefore was not available for groundwater inflow into salmonid habitats in the stream. Salmonids are sensitive to stream temperatures, and because the Creek is largely fed by surface waters from Lake Whatcom rather than cooler groundwater, the summer water temperatures in the Creek prior to the Incident occasionally

[22] Another 15,000 fish, all rainbow trout fry, were killed at the Bellingham Technical College hatchery due to contamination and elevated water temperatures resulting from the fire (AR #10).

reached stressful levels (AR #15). Field measurements and modeling were conducted to evaluate the additional effects of the canopy loss on stream temperatures and the potential for an increased number of "stressful" days (Figure 27). The worst-case results indicate that loss of riparian vegetation as a result of the Incident increased the 1999 mean daily temperatures of the Creek at Interstate 5 by an average of less than half a degree (0.47°C) during the summer months and had even less of a thermal impact (0.39°C) during the fall months of record compared with that which was predicted to occur under pre-existing canopies (AR #15).

Since 100 percent mortality of aquatic life in the Creek was assumed as a result of the Incident, the estimated temperature increase during the summer of 1999 was not of critical importance to aquatic resources. However, temperature increases were of direct concern during the early fall, when returning adult spawners were in the Creek. Based on the modeling and temperature data, it appears that the lack of a shade canopy increased the number of thermal stress days by two additional days, or a 3.5 percent increase during the first spawning season after the Incident (AR #15). Subsequent years were also modeled to assess the stream temperature recovery as vegetation and shade recovers. Using the conservative assumption that shade would increase only five percent a year, the stream temperatures are expected to return to pre-existing levels (±0.2°C) within approximately four years (AR #15).

Physical Habitats—In addition to the acute mortality, the Incident also resulted in changes to physical features of Whatcom and Hanna creeks (Figures 26, 28). Habitat impacts extended from the spill source downstream to the estuary at the creek mouth, and encompassed all habitat used by anadromous salmonids and lamprey, as well as a large portion of the stream used by resident salmonids, other fish and invertebrate species. Emergency response actions removed contaminated large woody debris from stream channels and therefore decreased habitat complexity. The gravel cleaning and stream reconstruction efforts also disturbed stream habitats. The emergency restoration efforts mitigated the physical habitat impacts, and the physical habitats in the Creek now are comparable or enhanced compared with habitat conditions prior to the Incident (AR #1). Large woody debris was re-introduced to the Creek and cobbles and gravel were replaced and rearranged to create more pools and increased spawning habitat (Figures 26, 28, 29). Together, these actions have created a stream physiography that is more conductive to fish production (AR #15, 114, 123, 134, 136).

Need for Restoration—There was a substantial direct mortality of fish and aquatic organisms resulting from the Incident. In addition, the streambed and adjacent riparian habitats were impacted by the Incident and related remediation actions. Emergency streambed restoration projects have helped to restore the physical features of the streambed to levels that are comparable with or better than their pre-Incident condition; however, the loss of riparian habitat has raised concerns about the effects of elevated water temperatures on recovery. It will take many years for these riparian habitats to recover to full function. Therefore, the Trustees have concluded that the salmonid habitat enhancement projects are appropriate to address the fish injuries. The acquisition and revegetation projects will help to protect and restore riparian

habitats and preserve groundwater infiltration that otherwise would have been lost due to development.

3.4.4 Wildlife and Their Habitats

The Whatcom Creek watershed is home to a number of species of birds, mammals, reptiles and amphibians (AR #7). Wildlife impacts from the Incident include direct mortality, loss of habitat, loss of forage foods and prey, and disturbance caused by remedial activities. Longer-term response efforts also disturbed wildlife that reside in or use the park.

The USFWS, WDFW, and the Sardis Wildlife Center assessed acute impacts. A two-day wildlife survey was conducted starting three days after the Incident (AR #10, 85). The scope and extent of the wildlife surveys to assess impacts to terrestrial species were deliberately limited within the burn zone to reduce additional impacts to riparian habitats by survey crews. It was also evident that it would be extremely difficult to find, enumerate, and identify the variety of animals that would likely have been present in the burn zone. Consequently, there are no complete estimates on the species and numbers of animals killed. Crews conducting stream surveys also noted wildlife impacts. Many of the animals could not be identified by species because of the fire damage. Wildlife collected by survey teams after the Incident included:

- **Birds**—Pigeons, red-tailed hawk, and American dippers
- **Reptiles**—Common garter snake
- **Amphibians**—Bull frogs, red-legged frogs, and salamanders
- **Mammals**—River otter, cottontail rabbit, and unidentified small rodents

Although observations of direct mortalities were limited, it is reasonable to assume, based on the intensity of the fire, that most of the wildlife within the burn zone at the time of the explosion were killed (AR #133). Some animals may have escaped the fire by fleeing or hiding in their burrows, but many of the terrestrial or aquatic animals probably were overcome by fumes and then killed by the fire. Larger animal carcasses were found, but the fire probably completely destroyed many smaller-bodied animals (AR #133).

Need for Restoration—The impacts to terrestrial and riparian vegetation from the Incident resulted in a substantial and long-term loss of wildlife habitat. Although wildlife utilization in the watershed is recovering, it will be many years before the impacted area returns to full ecological function. Direct restoration (i.e., restocking) of the affected species is not feasible or appropriate. The suite of restoration projects outlined in Section 5 will continue the emergency restoration efforts and protect and create habitat to address injuries to wildlife as a result of the Incident. The Trustees also anticipate that amphibians and other aquatic wildlife will benefit from the salmonid habitat enhancement projects (AR #103, 123, 136).

3.4.5 Human-Use Services

The Incident directly affected one of the most important recreational resources owned by the City of Bellingham. The Park , trails and Creek form a recreational corridor from Whatcom Falls Park to Bellingham Bay and provide a variety of human-use services including hiking, jogging, biking, horseback riding, swimming, fishing, picnicking, bird watching, nature study, education, photography, drawing, painting, nature enjoyment, and other outdoor activities (AR #2, 7, 8, 19). In addition to direct use losses, the Incident caused losses to passive uses of the Park, those associated with the simple existence of the Park and the Creek and the natural resources they support. Lost, diminished, or impaired human uses of the Whatcom Creek watershed constitute injuries in accordance with the OPA regulations. The loss of human uses (Figure 30) resulted from: 1) the presence and duration of spilled gasoline in the air, water, and soils of the Park and the resulting explosion and fire; 2) the response actions conducted within the watershed that precluded visitation; 3) closure of the area to reduce erosion, allow for vegetation reestablishment, and protect public safety (AR #11); and 4) closure of the recreational fisheries in the Creek to protect recovering fish populations (AR #101, 102).

Need for Restoration—The Park areas are largely reopened, but the burned vegetation is an ongoing reminder of the loss. There has been a substantial interim loss of direct and passive uses, diminishment of the value of the Park, and future direct and passive-use losses resulting from the Incident. Therefore, the Trustees have concluded that the land acquisition and park improvements are necessary and appropriate to address the recreational and passive losses. The salmonid habitat enhancement and revegetation projects will also help address the recreational losses.

4.0 RESTORATION PLANNING

4.0 Restoration Planning

Restoration of the affected resources in the Whatcom Creek watershed requires an approach that focuses on several interconnected resources, including water quality, fish and wildlife habitat, living resources, and recreational resources. The Trustees have evaluated potential restoration options that will restore the affected natural resources to pre-Incident or baseline levels and compensate for interim losses.

In developing this final RP/EA, the Trustees have taken into consideration the restoration concepts proposed by the Company as well as proposals submitted by each of the Trustees. The Trustees have also taken into consideration the activities that were conducted or are ongoing as part of the response operations. These include emergency restoration actions already taken to address injuries to Whatcom and Hanna creeks and riparian habitats.

The Oil Pollution Act and NEPA regulations require that the Trustees state their preferred alternative(s) and explain the basis for their selection or rejection of other alternatives. These Trustee determinations may be modified based on public input and comment.

4.1 Restoration Strategy

The goal of the NRDA process is restoration of the injured natural resources and compensation for the interim lost uses of those resources. The Oil Pollution Act requires that this goal be achieved by returning injured natural resources to their pre-Incident condition, and by compensating for any interim losses of natural resources and services during the period of recovery to baseline.

Restoration actions under the Oil Pollution Act regulations are either primary or compensatory. Primary restoration is action(s) taken to return the injured natural resources and services to baseline on an accelerated time frame by directly replacing the resource or service. As one form of primary restoration, the Oil Pollution Act regulations require that Trustees consider natural recovery of the resource. Trustees may select natural recovery under three conditions: 1) if feasible; 2) if cost-effective primary restoration is not available; or 3) if injured resources will recover quickly to baseline without human intervention. Primary restoration alternatives can range from natural recovery, to actions that prevent interference with natural recovery, to more intensive actions expected to return injured natural resources and services to baseline faster or with greater certainty than natural recovery alone. For example, rather than rely on dispersion of seeds and natural succession of plant species after the fire, the Company planted conifer seedlings in the burn zone. These actions should return the forest canopy to pre-Incident condition faster than natural recovery.

Compensatory restoration includes actions taken to compensate for the interim losses of natural resources and/or services pending recovery. In the tree-planting example above, the primary restoration of planting trees will accelerate the rate of recovery, but the forest canopy will still

take decades to mature. During the time frame necessary for the forest to recover, ecological functions and human uses will be reduced. Compensatory restoration is designed to make up for the interim loss of services. The type and scale of compensatory restoration depends on the nature of the primary restoration action and the level and rate of recovery of the injured natural resources and/or services, given the primary restoration action. When identifying compensatory restoration alternatives, Trustees must first consider actions that provide services of the same type and quality and that are of comparable value as those lost. If a reasonable range of compensatory actions of the same type and quality and comparable value cannot be found, Trustees then consider other compensatory restoration actions that will provide services of at least comparable type and quality as those lost.

Compensatory restoration alternatives must be scaled to ensure that the size or quantity of the proposed project reflects the magnitude of the injuries from the spill. The Trustees selected different scaling approaches for the lost ecological and human uses, which are explained with the restoration alternatives in Section 5.

Because the Trustees are in the preliminary stages of restoration planning, several of the restoration alternatives included in Section 5 are based on conceptual designs rather than detailed engineering design work or operational plans. Therefore, details of specific projects may require additional refinements or adjustments to reflect site conditions or other factors. The Trustees assume that implementation of restoration will begin in 2002. Should actual implementation occur after this period, the Trustees may revise their calculations of losses and scale of appropriate restoration.

4.2 Evaluation Criteria

Oil Pollution Act regulations (15 CFR § 990.54) require that Trustees develop a reasonable range of primary and compensatory restoration alternatives and then identify the preferred alternatives based on the six criteria listed in the regulations:

- Cost to carry out the alternative;
- Extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses;
- Likelihood of success of each alternative;
- Extent to which each alternative will prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative;
- Extent to which each alternative benefits more than one natural resource and/or service; and
- Effect of each alternative on public health and safety.

In addition, the Trustees considered several other factors including:

- Nexus to geographic location of the injuries; and
- Compliance with applicable federal and state laws and policies.

The NEPA applies to restoration actions taken by Federal Trustees. To reduce transaction costs and avoid delays in restoration, the Oil Pollution Act regulations encourage the Trustees to conduct the NEPA process concurrently with the development of the final restoration plan.

To comply with the requirements of NEPA, the Trustees analyzed the effects of each preferred alternative on the quality of the environment. NEPA's implementing regulations (40 CFR § 1508.27) direct Federal agencies to evaluate the potential significance of proposed actions by considering both context and intensity. For the actions proposed in this final RP/EA, the appropriate context for considering potential significance of the action is local, as opposed to national or worldwide.[23]

With respect to evaluating the intensity of the impacts of the proposed action, the NEPA regulations suggest consideration of ten factors:

1. Likely impacts of the proposed project;
2. Likely effects of the project on public health and safety;
3. Unique characteristics of the geographic area in which the project is to be implemented;
4. Controversial aspects of the project or its likely effects on the human environment;
5. Degree to which possible effects of implementing the project are highly uncertain or involve unknown risks;
6. Precedential effect of the project on future actions that may significantly affect the human environment;
7. Possible significance of cumulative impacts from implementing this and other similar projects;
8. Effects of the project on National Historic Places, or likely impacts to significant cultural, scientific, or historic resources;
9. Degree to which the project may adversely affect endangered or threatened species or their critical habitat; and
10. Likely violations of environmental protection laws.

4.3 Summary of the Restoration Alternatives

The Trustees evaluated a range of primary and compensatory restoration alternatives intended to enhance the recovery of the Whatcom Creek watershed and/or to provide additional resource

[23] While the Incident generated broad national interest and concern, the restoration actions are expected to have only local benefits.

services to compensate the public for losses pending natural recovery. The Trustees developed some of the restoration concepts and the Company proposed other projects. In evaluating these preliminary alternatives, the Trustees have also taken into consideration the activities that were conducted as part of response operations and the potential for natural recovery. These actions include restoration projects already implemented by the Company to address injuries to stream sediments, enhance spawning habitats, control erosion, remove invasive vegetation, and restore riparian vegetation (AR #1, 15).

Although the Incident resulted in substantial impacts to the resources in the Whatcom Creek watershed, the Trustees believe that the prompt actions taken to respond to and remediate the Incident will allow these resources to recover over time. In some instances, natural recovery will be preferable to return resources to their pre-Incident condition. This recovery, depending on the injury category, may take years to occur, however. Therefore, many of the restoration alternatives evaluated in this document are focused on compensating for the interim losses resulting from the Incident.

As mentioned above, the Trustees focused on restoration projects that addressed the five categories of injury and loss: 1) Vegetation; 2) Water Quality; 3) Fisheries; 4) Wildlife; and 5) Human Uses. A total of thirty-six restoration alternatives (including many alternatives that were implemented as emergency projects) were considered.

These alternatives are summarized below in Tables 1, 2, and 3. The Trustees' evaluation of the alternatives is discussed in detail in Section 5.

Table 1: Summary of the Preferred Restoration Alternatives

Preferred Alternative	Proposed Action	Project Description
No Action/Natural recovery (Section 5.1)	No Action	Allow natural recovery to occur to compensate for all and/or specific lost resources and/or services. This alternative is proposed as part of some preferred alternatives.
Land Acquisition and Park Enhancements (Section 5.2.1)	Acquire Park Land	Acquire lands to compensate for loss of human uses and loss of riparian and wildlife habitat.
	On-site Land Acquisition	Acquire riparian lands in Whatcom Creek watershed to prevent future development and promote ecological and recreational uses to compensate for losses to anadromous and resident fish, loss of riparian and wildlife habitat, and loss of human uses.
	Entrance Road, Rest-room & Parking Facility	Build access road, restroom facility and parking lot on acquired parklands to compensate for loss of human uses.
Fish Habitat Projects (Section 5.2.2)	Cemetery Creek Restoration	Develop off-channel spawning, rearing, over-wintering habitat and summer cool-water refugia to compensate for losses of anadromous and resident fish.
	Salmon Park	Develop off-channel spawning, rearing and over-wintering habitat by excavation and reconnection of historic meander to compensate for losses to anadromous and resident fish and loss of human uses.
Soil Stabilization and Revegetation Actions[24] (Section 5.2.3)	Control Vegetation	Remove invasive plants such as Himalayan blackberry that degrade habitats along Whatcom Creek to compensate for loss of riparian and wildlife habitat.
	Planting Native Vegetation	Promote native plant communities through planting and enhancement of native tree seedlings and other native species to compensate for loss of riparian and wildlife habitat and loss of human uses.
	Erosion Control	Implement erosion control measures to minimize sedimentation of Whatcom Creek to compensate loss of habitat in the Creek and loss of riparian and wildlife habitat.
	Invasive Plant Mapping and Guide to Control	Identify problem areas and develop treatment plans where invasive plants degrade portions of the Whatcom Falls Park and Whatcom Creek outside of the impacted area to compensate for loss of riparian and wildlife habitat.
Long-Term Monitoring and Maintenance (Section 5.2.4)	Management Account	Establish an account that will allow the City Parks Department to manage the impacted resources (*i.e.*, remove hazard, dead or diseased trees, manage in-stream structures, maintain plantings, etc.) in the future to compensate for loss of human uses.
	Monitoring of the Creek Recovery	Implement monitoring plan for injured resources and emergency restoration projects, including plants, in-stream structures, invertebrates, anadromous and resident fish to compensate for all lost resources and/or services.

[24] Certain actions were started under emergency restoration.

Table 2: Summary of the Non-Preferred Restoration Alternatives (Section 5.3)

Alternative	Project Description
No Action	Allow natural recovery to occur to compensate for all and/or specific lost resources and/or services.
Interpretive Center	Create an interpretive center describing the recovery of Whatcom Creek and the impact of human activities on the health of the Creek to compensate for loss of human uses.
Carcass Planting	Increase the nutrient base of Whatcom Creek by adding spawned-out salmon carcasses to compensate for losses to anadromous and resident fish.
Additional Channel Habitat Modifications	Construct in-stream modifications (in addition to those constructed during emergency restoration) to Whatcom Creek, including gravel bars, pools, additional woody debris
Additional Debris Removal	Remove garbage and debris from Whatcom Creek (in addition to actions taken during response and emergency restoration) to benefit habitat and aesthetic values
Fish Passage	Create increased upstream passage for anadromous salmonids at Middle Falls, thereby increasing available spawning habitat and potentially greater fish production to compensate for losses of anadromous and resident fish.
Sewer Line Upgrades	Upgrade the sewer line on the lower section of Whatcom Creek to make fish passage easier to compensate for losses to anadromous and resident fish.
Temperature Modifications	Reduce summer water temperatures to levels that are preferred by salmonids by adding ground water flow to creek to compensate for losses to anadromous and resident fish. This alternative also included consideration of alternative sources of cold water in Lake Whatcom and management of spilled water to reduce water temperatures to compensate for loss of water quality and losses of anadromous and resident fish.
Off-site Land Acquisition	Acquire riparian lands in nearby watersheds to prevent future development and promote ecological and recreational uses to compensate for loss of riparian and wildlife habitat, losses of anadromous and resident fish, and loss of human uses. Multiple parcels of land were evaluated.
Alternative Designs for Cemetery Creek and Salmon Park	These alternatives varied in size, location and orientation of pools and stream channels, amount of woody debris, and preservation of trees on the site locations
Stocking	Plant catchable-size sterile trout to enhance the recreational fishery in Whatcom Creek prior to what may be achieved naturally to compensate for loss of human uses.
Hatchery Upgrades	Upgrade trout production by the hatchery in Whatcom Falls Park for recreational stocking of lakes in the area by increasing access to colder water to compensate for loss of human uses.
Plant Large Trees	Promote recovery of burned lands by planting large trees to compensate for loss of riparian habitat and loss of human uses.
Gabion Removal	Remove "rock basket" gabions placed on the stream banks in the past as flood levees or for bank stabilization purposes. The benefits of this option include increased riparian vegetation structure and possibly some flood flow alteration to compensate for loss o f riparian and wildlife habitat, loss of human uses, and losses of anadromous and resident fish.
Automobile Use Reduction and Watershed Pledge Project	Encourage commuters to ride their bikes, walk or take the bus instead of driving their cars to reduce the automotive inputs to the watershed to compensate for loss of water quality. This suggestion was proposed as part of the watershed pledge project to maintain and expand the existing voluntary pollution reduction program with the watershed to compensate for loss of water quality.

Table 3: Summary of the Emergency Restoration Alternatives
Alternatives implemented in whole or part during emergency restoration

Alternative	Project Description
Channel Habitat Modifications	Creation and enhancement of instream features such as pools, gravel bars, riffles, glides and runs to compensate for losses of anadromous and resident fish.
Control Vegetation	Removal of invasive plants such as Himalayan blackberry that degrade habitats along Whatcom Creek to compensate for loss of riparian and wildlife habitat.
Debris Removal	Removal of garbage and debris from the Creek to benefit aesthetics and prevent flood-flow alteration to compensate for loss of human uses and loss of water quality.
Erosion Control	Implementation of erosion control measures to minimize sedimentation of Whatcom Creek to compensate loss of habitat in the Creek and loss of riparian and wildlife habitat.
Extend Hiking Trails	Extension of the Whatcom Creek trail system to allow greater public use to compensate for loss of human uses.
Stream and soil remediation	Agitation of gravel in Whatcom Creek to accelerate dispersion and weathering of trapped gasoline to compensate for loss of water quality and losses of anadromous and resident fish, and removal of contaminated soils
Invasive Plant Mapping and Guide to Control	Identification of problem areas and development of treatment plans where invasive plants degrade portions of the Whatcom Falls Park and Whatcom Creek outside of the impacted area to compensate for loss of riparian and wildlife habitat.
Planting Native Vegetation	Promote native plant communities through planting and enhancement of native tree seedlings and other native species to compensate for loss of riparian and wildlife habitat and loss of human uses.
Reconstruction of Hiking Trails	Repair hiking trails that were affected by the reconstruction of the Valencia Street Bridge to compensate for loss of human uses.
Reconstruction of Valencia Street Bridge and Fever Creek trail bridge	Reconstruction of the Valencia Street Bridge destroyed by the fire to provide increased opportunity for public use passage on a trail system below the bridge, on bike lanes crossing the bridge, and increased vehicular traffic support to compensate for loss of human uses.
Tree and Branch Removal	Removal of burned trees representing a public safety hazard in the park and other public use areas in order to allow public use of these areas to compensate for loss of human uses and loss of wildlife habitat. Removal was done in such a way as to preserve wildlife habitat value of standing snags.
Addition of Woody Debris	Insertion and cabling logs and stumps in stream to enhance habitat complexity and increase habitats for spawning and juvenile salmonids to compensate for losses of anadromous and resident fish.

4.4 Environmental Consequences (Indirect, Direct, Cumulative)

To restore resources and/or services lost as a result of the Incident, the Trustees examined a variety of proposed projects under the following restoration alternatives: 1) no-action and natural recovery, 2) ecological restoration, and 3) lost human-use restoration. The Trustees intend to

avoid or reduce negative impacts to existing natural resources and services to the greatest extent possible. However, in implementing or approving the implementation of restoration actions, the Trustees could undertake actions that may have short- or long-term effects upon existing habitats or non-injured species. Project-specific environmental consequences for each project are provided in Section 5.2. This section addresses the potential overall cumulative, direct, and indirect impacts and other factors to be considered in both the Oil Pollution Act and NEPA regulations.

The Trustees believe that the projects selected in this final RP/EA will not cause significant impacts to natural resources or the services they provide. Further, the Trustees do not believe the projects will affect the quality of the human environment in ways deemed significant.

Indirect Impacts—Environmental consequences will be limited to the Incident location. Indirect beneficial impacts will occur in other parts of Whatcom County, primarily due to enhancement of fish and wildlife populations.

Direct Impacts—Overall, preferred restoration actions included in this final RP/EA will enhance functionality of ecosystems. There will be, however, some short-term impacts from the projects such as:

- **Noise and Air Pollution**—Machinery and equipment used during construction and other restoration activities will generate noise. This noise may temporarily disturb wildlife and humans.
- **Threatened, Endangered, and Candidate Species**—As discussed in more detail in the following sections, there may be short-term impacts on fish and wildlife species as a result of construction activities. In accordance with state and federal permit conditions, in-water work will only take place in the absence of endangered or threatened species and during regulated time periods when no major fish runs occur. Impacts on mobile species (*e.g.*, birds, and mammals) will be minor, consisting of short-term displacement. Overall, the construction of the fish habitat projects as part of the Preferred Alternative will benefit fish and wildlife species dependent on these types of habitat.

- **Water and Sediment Quality**—Although implementation of the projects should result in no violations of water quality standards, there will be temporary increases in sedimentation and turbidity related to certain projects. Best management practices along with other avoidance and mitigation measures required by the regulatory agencies will be employed to minimize any water quality and sedimentation impacts.

- **Visual**—There will be temporary visual impacts during implementation of some of the projects. Once the Trustees complete those projects, the visual impacts will cease. Beneficial aesthetic impacts would then extend to the users of the park and trail system.

- **Public Access/Recreation**—Public access may be temporarily affected during construction activities. Because implementation time for these projects will be relatively short, the impact will be short-lived.

- **Other (*e.g.*, economic, historical, land use, transportation)**—No significant adverse effects are anticipated to soil, geologic conditions, energy consumption, wetlands, or floodplains. The restoration projects will have no adverse social or economic impacts on neighborhoods or communities. General land-use patterns will not be affected by the Preferred Alternative. The projects will not adversely affect any known archaeological sites or sites of cultural significance.

Cumulative Impacts—Since the Trustees designed the projects primarily to improve recovery of injured natural resources and/or services, the cumulative environmental consequences will be beneficial. These cumulative impacts include restoration of the injured ecosystem by increasing wildlife, fish, and invertebrate habitats and providing additional recreational lands. Certain projects may also provide educational opportunities. The Trustees anticipate that monitoring of projects funded under this final RP/EA will confirm that cumulative impacts will be beneficial rather than adverse. Any unanticipated cumulative adverse effect on an area or other area program, plan, or regulatory regime from a project identified prior to implementation of a project will result in reconsideration of the project by the Trustees.

5.0 ANALYSIS OF RESTORATION ALTERNATIVES

5.0 Analysis of Restoration Alternatives

This final RP/EA includes a suite of restoration actions, which, in combination with the emergency response and restoration activities,[25] provides appropriate types and quantities of restoration actions necessary to address the natural resource injuries resulting from the Incident. The following discussion explains the projects and outlines the Trustees' explanation of why the restoration package is necessary and sufficient compensation for the natural resource injuries that resulted from the Incident.

The following discussion is divided into three sections: 1) Evaluation of the No-Action Alternative; 2) Discussion of the Preferred Alternative; and 3) Discussion of the Non-Preferred Alternatives. For the second section, each of the preferred projects is described in terms of the primary category of injury that will be addressed, along with the expected collateral benefits. As discussed elsewhere, this Preferred Alternative was subject to public review and comment and comments received have been addressed by the Trustees in Section 7.

5.1 Evaluation of the No-Action/Natural Recovery Alternative

The NEPA requires the Trustees to consider a "no-action" alternative and the Oil Pollution Act regulations require consideration of an equivalent natural recovery option (15 CFR § 990.53). Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending environmental recovery. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources. While natural recovery would occur over varying time scales for the injured resources, the interim losses suffered would not be compensated under the no-action alternative.

The principal advantages of the no-action approach are the ease of implementation and the absence of monetary costs because natural processes rather than humans determine the trajectory of recovery. This approach, more than any other, recognizes the tremendous capacity of ecosystems to self-heal.

After evaluation of the environmental tradeoffs, the Trustees selected natural recovery for a limited number of the injuries. For example, the Trustees considered options for restoration of contaminated groundwater resources in lower Hanna Creek. The Trustees discussed options and decided the chance of success of any option other than natural recovery was low to moderate and the environmental injury would be high. The option discussed included building a road out to the ridge separating Hanna and Whatcom creeks in order to put in recovery wells. This option would

[25] Trustees must take into consideration the benefits of the response and emergency restoration actions when determining the need for, and amount of, longer-term restoration. Those efforts taken to mitigate the impacts from response or as part of the permit process are not to be credited as restoration under the NRDA process. Certain actions taken after emergency restoration, but before the release of this final RP/EA, are proposed as restoration because those actions are not being credited as mitigation actions.

have resulted in removal of the vegetation and other collateral impacts from the road construction. Because of the potential adverse effects and concerns about feasibility, the Trustees decided that natural recovery was the best alternative.[26]

The Oil Pollution Act, however, clearly establishes Trustee responsibility to seek compensation for interim losses pending recovery of the natural resources (15 CFR § 990.53 (3)(c)(1)). This responsibility cannot be addressed through a no-action alternative. While the Trustees have determined that natural recovery is appropriate as primary restoration for some of the injuries, the "no-action" alternative as the sole alternative is rejected for compensatory restoration. Losses were and continue to be suffered during the period of recovery from this Incident and technically feasible, cost-effective alternatives exist to compensate for these losses, which are discussed in the next section.

5.2 Preferred Alternatives

The Trustees will implement the following suite of restoration projects to address the ecological and human-use losses from the Incident. The list of Preferred Alternatives includes completion of certain restoration projects already implemented or underway as a part of emergency restoration, as well as additional projects for future implementation. The Trustees base this selection on the injury information summarized in Chapter 3 and the restoration evaluation criteria outlined in Section 4.2. The Preferred Alternative includes four categories of projects:

1. **Land Acquisition and Park Enhancements**—This element of the restoration plan includes the transfer from the Company to the City of Bellingham of a 9.5-acre parcel along the Creek and Woburn Street that was proposed for multiple-occupancy housing. Transferring this parcel to the City of Bellingham's ownership will protect it from being commercially developed and allow it to return to its natural state. The site will also increase public access to park trail systems and other outdoor recreation uses. An access road, parking lot, and restroom facility will be constructed on a small portion of the site. Leaving the site undeveloped, except for the improvements listed above, will enhance fish and wildlife habitat, prevent pollution that would further degrade the Creek and environment, and avoid future increases to stormwater runoff within the Whatcom Creek watershed.

   The restoration plan also involves the transfer from the Company to the City of Bellingham of a 4-acre property along Whatcom Creek, near the mouth of Cemetery Creek and adjacent to an industrial park. This property will provide a buffer area that will enhance the natural setting and recreational experiences on the pending trail system. The buffer will allow for a greater setback from the Creek for recreational trails and vegetative plantings, and provide corridors for wildlife habitat.

[26] The last sample to exceed water quality standards was taken July 6, 2000 (AR #15).

Other park enhancements include giving the Company restoration credit for construction of a recreational trail bridge over Fever Creek and trail replacement and improvements within the Park; public-use improvements as part of the Valencia Street Bridge reconstruction; and park improvements to the property above Woburn Street. (See Section 5.2.1 for more information.)

2. **Fish Habitat Projects**—Continuation of the construction of in-channel riffle-pool habitat, introduction of woody debris, backwatering of fish passage barriers; reconstruction of Hanna Creek; construction of off-channel salmon habitat at the Salmon Park project near Racine Street; and construction of pools, wetlands and salmon rearing habitat on Cemetery Creek. (See Section 5.2.2 for more information.)
3. **Soil Stabilization and Revegetation Projects**—Continuation of soil stabilization, revegetation, invasive-species control actions, and removal of hazardous trees and limbs. (See Section 5.2.3 for more information.)
4. **Long-term Monitoring and Maintenance**—Establishment of a dedicated fund to support monitoring and maintenance of the emergency and long-term restoration projects and to conduct periodic maintenance of the burned parklands (e.g., removal of hazardous snags). The City of Bellingham, pursuant to an agreement among the Trustees, would administer the fund. (See Section 5.2.4 for more information.)

As noted previously, several of the restoration activities have collateral benefits. For example, the property acquisitions and salmonid projects will benefit water quality by preventing development and the associated degradation of water quality from construction and non-point runoff from vehicles and storm drains. The land preservation and vegetation projects will also provide shade to the stream, provide sedimentation filtration, and increase stormwater retention.

5.2.1 Preferred Alternative: Land Acquisition and Park Enhancements

Project Description

The Trustees will accept the transfer from the Company to the City of Bellingham of lands for use as parklands and for park improvements (Figures 33, 34, 39, 40).[27] The primary purpose of these projects is to compensate for recreational losses resulting from the Incident. As the plantings mature and other improvements are made, the Trustees expect that the parcels will be a seamless addition to the Whatcom Falls Park and Trail System. The Trustees expect that these projects will also generate benefits for water and sediment quality, fish and other stream biota, wildlife, aesthetics, and provide opportunities for future restoration projects. Specifically, the Trustees will implement or oversee the following actions:

- Accept the transfer of a 9.5-acre property along the Creek off Woburn Street (Figure 40).

[27] Restrictive covenants will be required to ensure the properties are kept in perpetuity as restoration sites.

- Build recreational improvements. The majority of the 9.5-acre site would remain undeveloped, but an access road, an approximately 20-stall parking lot, and a restroom facility with two men's and two women's stalls, would be built near an existing access road off Woburn Street (AR #23, 110).

- Accept the transfer of a 4-acre property along Whatcom Creek near the confluence with Cemetery Creek (Figure 39). The primary purpose of this acquisition is to make the land available for long-term fish, wildlife, and riparian habitat restoration projects by the City of Bellingham.[28] Only minimal park improvements are planned for this parcel as part of this restoration plan, but the acquisition of the land will allow for a greater setback from the Creek for recreational trails and provide a continuous wildlife corridor and buffer the stream from development-related impacts.

- Give restoration credit to the Company for reconstruction and improvement to trails and overlooks within the Park areas (completed as part of emergency restoration but will be monitored and maintained by the long-term monitoring and maintenance plan being conducted under this final RP/EA).

- Give restoration credit to the Company for the construction of a trail bridge over Fever Creek (Figure 35) and for improvements during reconstruction of the Valencia Street Bridge (Figure 36) to provide continuity with the Whatcom Creek Trail system and provide space for bike/pedestrian lanes (completed as part of emergency restoration but will be monitored and maintained by the long-term monitoring and maintenance plan being conducted under this final RP/EA).

Scaling Approach and Justification

One of the important injuries documented by the Trustees was closure and destruction of park resources and properties. The property acquisition, combined with park improvements and recreational trails, is expected to compensate for these injuries and loss of services by increasing park visitation and trail usage opportunities without increasing congestion and user density. The Trustees prefer these projects because they directly compensate for recreational lost use of parklands and help compensate for biological injuries to the riparian and forest habitats. The Trustees considered land parcels outside the Whatcom Creek watershed but decided that on-site restoration would benefit the habitats and park users most directly affected by the Incident. The property acquisitions are adjacent to the Creek and existing public lands, and are expected to add substantially to the connectivity of wildlife habitat and greenways. In addition to increasing total park acreage, the improvement of trails, construction of overlooks, and acquisition of properties adjacent to proposed trail segments will further enhance park access and usage.

[28] The City of Bellingham has indicated a preference for land acquisition and protection, in part to provide a location for future restoration opportunities.

The Oil Pollution Act regulations specify that restoration efforts should attempt to match directly the same type and quality of services lost as a result of the Incident to those generated by the restoration effort (15 CFR § 990.53 (3)(c)(2)).[29] The Trustees believe that the acquired lands, being adjacent to the existing park, would provide the same type of services. In order to ensure that the public is not under-compensated, an equivalency must be established between the quantity of services provided by the acquired lands and an estimate of the loss of park use resulting from the Incident.

The public clearly lost access to Whatcom Falls Park, but because no fees are charged to enter the park and there are many access points to the park, there was little data on record which the Trustees could draw upon to quantify that loss. In the absence of detailed information regarding pre-Incident park use, the Trustees relied upon available data and assumptions and inferences that can be drawn from the data. The City of Bellingham Parks Department's preliminary estimate[30] is that approximately 186,000 visits occur each year in the Park, with about half of those visits (96,000) during the summer (June through September) (AR #2). The chronology of the park area closures and re-openings is complicated, but, to be conservative, the Trustees assumed that the entire park was closed for the full summer period after the Incident resulting in 96,000 lost user-days.

Relying upon a simple count of lost user-days does not address the nature and quality of the user's experience, and could lead to inaccurate assumptions about the scale and type of restoration actions that would be adequate to compensate for the losses. Other important factors, such as location and use patterns, must be taken into account in addition to the actual number of days lost to accurately account for the actual injury. To use an extreme example, offering a one-day pass for 96,000 local residents to visit a remote park on the same day would clearly generate 96,000 user-days, but would be unlikely to be viewed by the public as adequate compensation for lost use of Whatcom Park. Factors such as location, distance, accessibility, amenities, physical setting, user density and the like must be taken into account in judging the comparability of park use opportunities offered in compensation for lost user-days. Likewise, the Trustees assume that an important aspect of park use experience is the user's knowledge that the park property belongs to the public and will remain permanently available for continued open access use by the public in the future. The Trustees assume it is factors such as these, and other intangibles, that determine park user satisfaction, and that those factors should weigh as heavily

[29] OPA regulations state "To the extent practicable, when evaluating compensatory restoration actions, Trustees must consider compensatory restoration actions that provide services of the same type and quality, and of comparable value as those injured. If, in the judgment of the Trustees, compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, Trustees should identify actions that provide natural resources and services of comparable type and quality as those provided by the injured natural resources."

[30] As noted in the Preassessment Data Report, this preliminary estimate is conservative and may be a low-end estimate of direct use.

in the scaling of compensatory restoration for lost park user-days as numerical calculations of user-days lost and gained.

The entire park is approximately 240 acres with many areas that are much more difficult to access than the parcel being acquired. Although usage is not uniform throughout the park, it is reasonable to assume that the overall quality of a park visit results from both access paths and undeveloped open space. This would indicate that an acre of parkland supports 775 visits per year. The property acquisition is 13.5 acres, with similar access and open-space design as the existing parkland.

Given current and future demands for open-space recreation within easy access of the City Center, it is assumed that the additional parkland will be used in a similar manner and frequency as the pre-Incident parkland. Based on the average utilization rates of the Park, the expansion of the Park would result in an additional 10,463 visits per year without increasing congestion. The new parkland may in fact generate more use because of its easy access and stream frontage of the acquired properties, as well as the trail and visitor facilities to be constructed. At this rate, the acquired property would compensate for the estimated loss in visitation in approximately nine years and then provide benefits in perpetuity. By increasing the size and integrity (i.e., continuity) of parklands, the property acquisitions also compensate for interim losses associated with passive lost uses of the Park and Creek resources.

In addition to the primary goal of compensating the public for recreational losses, the Trustees anticipate that substantial ecological benefits will accrue from the acquisition and preservation of the acquired properties. The Creek flows through an urbanized residential and commercial area with an extensive urban road system and expanses of impervious parking lots and business complexes that limit groundwater recharge and contribute oil, gas, and other waste runoff to the stream. In some locations only a narrow protective buffer separates the stream from surrounding uses, and below the existing Park there are few undeveloped parcels. Current land-use regulations affecting new development require wider streamside buffers, but they are often not sufficient to fully protect the stream from urban runoff and other non-point pollution. Because the stream is channelized throughout much of its length and the adjacent property is privately owned, there is little opportunity for habitat development projects. Vegetated floodplain areas provide valuable habitat for many fish, bird, and mammal species and can serve as connecting corridors that enable wildlife to move safely from one habitat to another. They are productive areas and help reduce erosion, contain non-point source runoff, and recycle nutrients.

Acceptance of the transfer of the 4-acre property near Cemetery Creek will create a 150- to 200-foot-wide streamside buffer, in which commercial development is prohibited, along 1,200 feet of the Creek. This will not only preclude the expansion of the commercial business-park development proposed for the property (AR #124) but will also make it available for future habitat restoration projects by the City of Bellingham. Such projects could include revegetation with a diverse floodplain forest mixture of trees and shrubs, as well as other floodplain and off-

channel restoration projects. This acquisition also provides a more extensive buffer along the greenbelt trail system to be constructed to enhance the experience of public use.

Acceptance of the transfer of the 9.5-acre property near Woburn Street will preserve the property for restoration, as opposed to a residential development (AR #125),[31] thus providing potential for future riparian habitat restoration projects by the City of Bellingham on the floodplain adjacent to the Creek. The property acquisition actions will preserve areas important for groundwater infiltration and not increase other adverse impacts associated with site development, such as stormwater runoff to the Creek, turbidity, siltation, and non-point pollution.

The Trustees believe that a more intensive data collection and analysis effort to determine the losses and benefits would be unreasonable. The Trustees believe that the project, in conjunction with the other restoration actions and emergency restoration projects, is sufficient compensation for recreational and ecological losses to the Park resulting from the Incident.

Restoration Objectives
The Incident resulted in the injury and/or interim loss of parklands and riparian and wildlife habitats along the Creek. The objective of this restoration project is to compensate for those losses. This property acquisition will provide functions and services similar to those that were lost, resulting in compensatory restoration of those resources. Furthermore, the acquisition will ensure prevention of commercial development, which will benefit birds, fish, and other animals in the watershed.

Probability of Success
The Trustees expect to meet the restoration objectives discussed above because of the characteristics chosen for the projects. The parcels to be acquired are similar to the adjacent parklands, and, as the plantings mature and other improvements are completed, the recreational and habitat services provided should be comparable with those that were lost. Since the parcels are adjacent to the stream and the existing park, public use is expected to be high. The performance criteria and monitoring will help ensure the success of the projects and allow for adjustments if necessary.

Performance Criteria and Monitoring
The acquired lands will be surveyed prior to conveyance to City ownership. The Company will develop plans for all Park improvements included within the scope of this final RP/EA, subject to review and approval by the City of Bellingham and in accordance with all necessary permits. All construction activities will be monitored by the Trustees and permitting agencies to ensure that the work is implemented appropriately and in accordance with permits. Restrictive

[31] The Whatcom Creek property has been proposed for a multi-unit housing development. Thus, acquisition of this property represents the further benefit of making its resources available to the public and preventing these resources from being degraded through potential future development.

covenants will be required to ensure the properties are kept in perpetuity as restoration sites. Projects such as the bridge and trail construction will be documented using video and still photography.

Benefits and Environmental Impacts

Acquisition of the property is not anticipated to have any deleterious environmental or socioeconomic impacts. Potential impacts from the project are summarized here.

- **Erosion**—Certain construction activities that the Trustees are considering would cause some short-term construction-related environmental impacts. The Trustees would minimize these impacts through early coordination with the federal, state and city regulatory agencies and by direct oversight of the project to ensure implementation of construction site erosion and chemical control BMPs.

- **Endangered Species**—No adverse impacts are expected for endangered species. No endangered plants are in the project area. Endangered salmon will be protected through erosion control measures and other permit requirements, and will benefit from the shade and habitat provided by a healthy riparian zone.

- **Wildlife Impacts**—No adverse impacts are expected for wildlife. Overall, wildlife are expected to benefit from the land acquisition, but wildlife activity may be temporarily disturbed during the construction of the restroom and parking lot structures. If sensitive wildlife species are found during the project (e.g., nesting birds), the work may be modified or stopped to minimize impacts to wildlife.

- **Archaeology**—No known archaeological sites are on the lands to be acquired. Overall, any archaeological resources on the sites would benefit from the acquisition, as commercial and residential development will be precluded. There is, however, a potential that construction work may unearth a site. The Trustees are in consultation with the Tribes and the Office of Archaeology and Historic Preservation to outline steps that would be taken to ensure that any sites discovered would remain undisturbed by the proposed actions (AR #139, 140).

Evaluation

The Trustees' policy is to look first at on-site and in-kind restoration options. The activities to be conducted meet this goal by providing recreational and habitat benefits of the same types that were lost and at the location where the losses occurred. The projects are consistent with the City's long-term park improvement and trail system plans (AR #8, 9, 19). The Trustees believe that the projects will, over time and in conjunction with the vegetation and fish habitat projects, compensate for human and ecological losses resulting from the Incident.

5.2.2 Preferred Alternative: Fish Habitat Projects

Project Description

One of the major impacts documented by the Trustees was injury to anadromous and resident salmonids, fish, and other aquatic resources. Emergency instream restoration actions were undertaken in conjunction with sediment remediation and resulted in fish habitat enhancements in Whatcom and Hanna creeks.[32] Pools were increased in number, size and depth (Figure 26). The Creek channel was modified in some areas to provide more spawning habitat (pool/bar enhancement). Large woody debris was added (Figures 28, 29). These actions improved the quality of the existing instream habitat, increased the quantity of some habitats (e.g., pools), and added some channel structure. The habitat improvements associated with the sediment remediation effort will result in a potential increase in survival of the progeny of returning adults and juveniles that may have been in Whatcom Creek tributaries during the Incident.

The Trustees will oversee the implementation of two long-term habitat rehabilitation and enhancement projects, Salmon Park and Cemetery Creek, as compensatory restoration for injuries to salmonids, other fish, amphibians, aquatic invertebrates, and freshwater and riparian habitats that resulted from the Incident (AR #118). These projects are also expected to generate benefits for water quality, recreation, vegetation, and wildlife, and will substantially build upon the emergency restoration projects already completed. The Trustees considered a number of restoration alternatives for fisheries impacts and several alternative designs for the Salmon Park and Cemetery Creek projects (AR #119-122), and believe the projects will provide the most direct and beneficial compensation with the least potential for adverse impacts. While the Trustees are interested in prompt implementation of restoration actions for the Creek, there is also a recognition that many salmonid restoration efforts elsewhere have resulted in mixed and sometimes adverse effects (AR #127). Therefore, the Trustees have attempted to balance the desire for rapid restoration with appropriate caution.

More detail and draft plans can be found in Appendix 10.5. A final detailed design plan will be included in the Administrative Record. Specifically, the restoration projects include:

Salmon Park Project—This project involves creation of a backwater channel within a historic meander of the Creek to improve winter refuge habitat for juvenile salmonids (Figure 37). The project site is in the Salmon Park area just north of the Creek and east of Racine Street. The City of Bellingham already owns the project land.

Cemetery Creek Project—This project involves creation of salmonid rearing ponds and habitat enhancements in Cemetery Creek upstream of its confluence with Whatcom Creek (Figure 38).

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[32] These actions are not formally part of this final RP/EA, but are described here to explain that a significant amount of restoration work has already been conducted as emergency restoration. The amount of long-term restoration necessary depends, in part, on the success of the response and emergency restoration actions. To the extent that response and emergency restoration actions result in more rapid recovery of natural resources, the need for long-term restoration is reduced.

The project site is along the south bank of the Creek and north of Fraser Road. The City of Bellingham already owns the project land.

Scaling Approach and Justification

The primary purpose of these projects is to compensate for injuries to salmonids due to the Incident. The Salmon Park and Cemetery Creek projects will directly address two known limiting factors: 1) the limited availability of cool water refugia during the summer months, and 2) the limited availability of off-channel habitat that is normally provided when streams are allowed to meander onto the floodplain and form secondary channels. The complexity of stream channel margins can be an important factor influencing early rearing success, and ecologically healthy streams contain complex margins that include backwaters and secondary channels (AR #123, 134, 136). Juvenile fish use different habitats seasonally, and periods of high runoff and low food availability during winter force them to seek overwintering locations adjacent to, but not in, stream main stems, making floodplain channels extremely important to juvenile survival. Floodplains serve an important purpose in the health of streams (AR #123). During over-bank flows, the stream can capture the organic matter stored on the floodplain and deliver it to the main channel, enhancing trophic and food web complexity by increasing the quantity and diversity of detrital input to the stream. Hydrological connectivity also enhances water quality by trapping and retaining sediment, and recharges local groundwater, contributing to the maintenance of cooler inflow. Water temperature is related to the subsoil environment, and deep channels that interact with cool groundwater can provide important thermal refugia during summer periods of high water temperatures.

The Trustees prefer these projects because they directly compensate for fish habitat losses and help compensate for biological injuries to the riparian and forest habitats. Additionally, the construction of these restoration projects may reduce future losses to the stream due to encroaching urban activities that might otherwise occur in these areas.

The Trustees' priority in selecting these restoration options as preferred alternatives was to identify projects that provide services of comparable type, quality, and value as those provided by the lost ecological services. The Trustees believe that the increased freshwater rearing habitat provided by the Salmon Park and Cemetery Creek habitat creation and enhancement projects will provide services of the same types as those lost as a result of the Incident. These projects are in the Whatcom Creek watershed and are within the Incident zone (Figure 32). The project sites currently provide valuable but limited benefits to the same species of fish, invertebrates, and amphibians that were affected by the Incident. The enhancements will substantially increase the size and ecological value of the habitats for fish, invertebrates, and amphibians. Specifically, the improvements are expected to provide:

- Increased salmonid rearing habitat during summer months by creating thermal refuge habitat;
- Increased salmonid rearing habitat during winter months by creating backwater habitats during winter rainfall events; and

- Improved habitat complexity for all life stages of salmonids, resident fish, and amphibians.

In order to determine whether the size and benefits of the projects would be sufficient compensation, the Trustees evaluated the results of the preliminary studies, reviewed the applicable restoration ecology literature to help quantify the potential benefits of the response and emergency restoration actions, and considered the estimates of the fish kill from the Incident and the results of the post-spill fish recovery monitoring surveys (AR #87). The Trustees conducted a preliminary Habitat Equivalency Analysis (HEA) using simplifying assumptions to estimate the magnitude of restoration required to compensate for injuries resulting from the Incident.

HEA is a methodology used to determine scale of restoration projects for resources injured by oil and chemical releases (AR #81). The principal concept underlying the method is that the public can be compensated for past losses of habitat resources through habitat replacement projects providing additional resources of the same type. Natural Resource Trustees have employed HEA for groundings, spills, and hazardous waste sites. Habitats involved in these analyses include seagrasses, coral reefs, tidal wetlands, salmon streams, and estuarine soft-bottom sediments. In this Incident, the Trustees used HEA to evaluate the adequacy of the Cemetery Creek and Salmon Park projects for injuries to fish habitat.

Natural resource damage claims have three basic components: 1) the cost of restoring the injured resources to baseline, or "primary restoration," 2) compensation for the interim loss of resources from the time of injury until the resources recover to baseline "compensatory restoration," *plus* 3) the reasonable costs of performing the damage assessment. To ensure full compensation for interim losses, the Trustees determine the scale of the proposed compensatory restoration actions for which the gains provided by the actions equal the losses due to the injury. The process of scaling a project involves adjusting the size of a restoration action to ensure that the present discounted value of project gains equals the present discounted value of interim losses.

HEA is an example of the service-to-service approach to scaling. The implicit assumption of HEA is that the public is willing to accept a one-to-one trade-off between a unit of lost habitat services and a unit of restoration project services (i.e., the public equally values a unit of services at the injury site and the restoration site). HEA does not necessarily assume a one-to-one trade-off in the resources themselves, but instead in the services they provide.

HEA takes into consideration the amount and quality of habitat lost or restored and the time frame of the losses and gains to determine the scale of restoration action needed to compensate for the losses. In this case, the Trustees assume that the proposed restoration project will generate habitat services of the same type and quality and of comparable value per acre as were lost due to the injury. Consequently, the HEA need only address the size of project (in acres) and the years the project will produce the expected benefits in order to determine the adequacy of compensation.

Injury Assumptions—Gasoline and the resulting fire killed much of the aquatic biota in lower Whatcom Creek. As a first-order assumption, the Trustees estimated that 3 miles of stream habitat were completely destroyed. The average width of the Creek is 15 feet. The total aquatic injury was therefore 237,600 square feet, or 5.45 acres of lost stream habitat. The Trustees estimated that the stream provided no resource services for one year, and that recovery of the aquatic habitat will take 5 years. The recovery of the stream was assumed to be linear (i.e., that the stream will recover at a constant rate per year until full recovery is reached).

Projects Benefit Assumptions—The Trustees have identified a feasible restoration action for compensation: creation of off-channel salmon habitat at a nearby site. The project is expected to restore the same type and quality of resources and services per acre as did Whatcom Creek before the Incident. The Trustees assumed that the project would be built in the present year (2002), and that it would take 20 years to reach full maturity.[33] The rate of recovery was assumed linear. Because of the proximity and similarity of injured and created habitats, the Trustees assumed that after 20 years, the created habitat would provide the same amount of environmental services per acre as the injured stream habitat. (In other words, the mature created habitat would provide 100% of the services per acre provided by the pre-spill stream habitat.) Based on the preliminary conceptual drawings of the project, the project is estimated to provide approximately 0.9 acres of aquatic habitat.[34,35] The Trustees believe that the habitat creation project will last (i.e., will provide the expected environmental services) between 50 and 100 years.[36]

Discounting—The injured habitats will slowly recover, and the created projects will also take time to reach full function. Because losses and gains are occurring in different years, the Trustees discount the losses and gains so that units reflect what they are worth in the present year, 2002. Past losses are compounded and future losses and gains are discounted at a fixed rate to make units from different time periods comparable.[37] Discounting also effectively provides a premium for restoration actions taken sooner rather than later.

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[33] The projects will provide ecological services sooner, but full functionality, including regrowth of vegetation and fish utilization, will take time.

[34] Jason Smith, Inter-Fluve, Inc., personal communication.

[35] The project site is considerably larger because of enhancement of upland areas. The 0.9 acres refers to the size of the pools and stream channels alone.

[36] The project site will be protected in perpetuity, but the aquatic functions provided will change naturally over time as the ponds and stream undergo natural succession.

[37] The discount rate incorporates the standard economic assumptions that people place a greater value on having resources available in the present than on having their availability delayed until the future. (This process is analogous to financial calculations in which, if a dollar is put into the bank today at 3% interest, there will be $1.03 in one year.) The annual discount rate used in an HEA calculation represents the public's preference towards having a restoration project in the present year, rather than waiting until next year. The economics literature supports a discount rate of approximately 3%.

Taking into consideration the services provided by the affected habitat, the size of the injured and restored habitat, and the time frame of the losses from injuries and gains from restoration, the HEA calculates results in terms of *discounted service acre-years (DSAYs)*. DSAYs thus serve as the common currency for determining the adequacy of compensatory restoration.

Calculation of the Habitat Equivalency—The underlying HEA calculation is to solve the following problem: Will the proposed aquatic habitat project (0.9 acres) provide the same number of DSAYs as those lost? To answer this question the HEA requires two calculations: the calculation of losses from the injuries, and the calculation of gains from the restoration.

The HEA calculation of losses of the approximate 5.45 acres of stream habitat for 5 years, with compounding, equates to 16.69 DSAYs. Table 4 lists the factors employed in this calculation. The assumed linear recovery of the injured area over a five-year period is reflected in the "% Services Lost" column by the loss decreasing from 100% (1.0) to 0% over five years. When the percent services lost are multiplied by the affected area, the result yields the number of service-acres lost per year. Multiplying this result by the discount factor applicable to the year of loss generates a present value, or discounted service-acres lost figure. Adding the discounted losses for all years in which the effects of the injury are experienced yields a total of discounted service acre-years (DSAYs) lost.

Table 4. Calculation of Discounted Service Acre-Years Lost					
A	B	C	D	E	F
Year	% Services Lost (% / 100)	Acres Affected	Service-acres Lost Per Year (B x C)	Discount Factor (@ 3% per annum)	Present Value of Loss (D x E)
1999	1.0	5.45	5.45	1.06	5.78
2000	0.8	5.45	4.36	1.03	4.49
2001	0.6	5.45	3.27	1.00	3.27
2002	0.4	5.45	2.18	0.97	2.12
2003	0.2	5.45	1.09	0.94	1.03
2004	0	5.45	0	0.92	0
				Sum	16.69

The habitat-creation project needs to produce a similar gain in DSAYs to create an equivalency. The discounted calculation of gains in the HEA showed that the 0.90-acre project will generate 15.78 DSAYs if the project functions for 50 years, and up to 20.74 DSAYs if it functions for 100 years. The project will generate the approximate equivalent of the losses (16.84 DSAYs) after 56 years, well within the project's expected lifespan. The HEA calculations that generated these results is shown in Table 6 included as Appendix 10.4.

The calculations of injuries and benefits are preliminary and based on simplified assumptions. The size of the affected area and recovery rates are approximations, and the size of the restoration projects may be modified through permitting requirements. Based on the first-order assumptions in this analysis, however, the preliminary HEA suggests that the proposed projects will be reasonable compensation for the aquatic impacts in Whatcom Creek. Further studies and analytical approaches to evaluate the losses from the Incident and the likely benefits from the restoration projects were considered, but it was determined that further studies would not provide results in a timely and cost-effective manner. More-comprehensive studies would also delay implementation of the restoration projects. Additionally, because of year-to-year natural variability and the complicated life history of salmon and other injured species in the Whatcom Creek watershed, it was uncertain whether the outcome of studies conducted in any one year would provide information that would support a more accurate scaling calculation.

Restoration Objectives

The goals for restoration in Salmon Park and Cemetery Creek are to create new aquatic habitats and enhance and restore existing salmonid habitat to a level greater than that which existed prior the Incident. Due to the fact that stream temperature has been identified as one of the more important environmental factors affecting salmonid habitat in the Creek, the restoration has focused primarily on providing cool-water refuge and rearing habitat during the summer months.

The Salmon Park site has been identified by the City of Bellingham as a location in which winter rearing habitat and high-flow refuge could be created through reconnection and construction of backwater rearing channels. This will enhance juvenile salmonids' opportunities to escape and survive flood events in the Whatcom Creek watershed. A secondary goal will be to restore the ability of this section of the Creek to meander naturally. In the long term, these conditions will benefit spawning and rearing habitat by creating a larger floodplain area with greater riparian complexity than that which currently exists. The backwater channel will be created by breaching the berm adjacent to the Creek and allowing water to flow back up the channel. At the upstream end of the backwater channel, the berm elevation will be reduced so that flood flows will overtop the berm and eventually erode through it. Thus, creation of the backwater rearing channel in Salmon Park will promote long-term enhancements to spawning and rearing habitat through the progression of natural channel processes.

One of the factors that limits fish production in Cemetery Creek is the availability of rearing habitat, especially due to the warm stream temperatures that occur each summer (AR #15). Therefore, the Trustees have concluded that one of the best ways to increase fish production in the Creek is to increase the amount of cool-water rearing habitat. Temperature studies of the watershed show that Cemetery Creek has cool water available for fish refuge, running from 2° to as much as 5°C colder than Whatcom Creek (AR #15). Therefore, the primary objective of the Cemetery Creek Project is to increase the availability of cool-water summer rearing habitat. A secondary objective is to improve access to these cool-water habitats during all stream flow levels and improve the quality and complexity of the existing habitats. The Cemetery Creek project involves grading incised portions of the stream channel in Cemetery Creek, placing large woody debris to stabilize head cuts, and excavating several deep off-channel pools. This will result in the creation of cool-water rearing habitat and the restoration of 1,200 feet of stream channel, improving rearing habitat and making it more accessible to anadromous fish.

The restoration projects have also been designed to address other limiting factors in Cemetery Creek. These include reduced availability of high-flow refuge and overwintering habitat for juvenile salmon, and the loss of natural habitat-forming processes.[38] Specific project objectives have been identified to achieve the overall goal as follows:

- Provide for increased thermal refuge and summer rearing habitat for salmonids by increasing available living space in Cemetery Creek;
- Provide for increased high-flow refuge and winter rearing habitat by creating backwatered off-channel habitats during frequent floods;
- Improve habitat complexity for all life stages of salmonids in the lower portion of Cemetery Creek (limited to the area within park boundaries and City easements);

[38] The dam at the outlet of Lake Whatcom that regulates flows, lack of natural riparian floodplain, and limited natural sources of large woody debris, especially large and rot-resistant cedar trees, combine to preclude the habitat-forming processes that would otherwise naturally occur.

- Create instream conditions favorable to the production of fish prey (benthic macroinvertebrates) in Cemetery Creek;
- Remove man-made gravel berms where appropriate to restore geomorphic processes within the confines of Salmon Park;
- Provide enhanced habitat conditions while minimizing impacts to surrounding vegetation and ground surfaces;
- Provide/improve access to available fish habitat by addressing known impediments to fish passage in Cemetery Creek; and
- Provide environmental conditions favorable to the creation and establishment of additional wetland habitats adjacent to the Creek, and the establishment of conifers including Western red cedar.

To achieve these goals and objectives, work will take place within Cemetery Creek and the Salmon Park portion of Whatcom Creek. The project includes a reconstructed channel alignment in place of the current ditched segment of Cemetery Creek and the creation of three on-line cool-water rearing ponds. Ponds will vary between 1 and 6 feet deep. Large woody material will be utilized to create complex channel, pond, and floodplain habitat.

In Salmon Park, a backwater channel will be constructed within a historic meander of the Creek to improve winter high-flow refuge habitat for juvenile salmonids. This channel will be free draining (0.0025 slope) and the extent of inundations will expand and retract as the floodwater stage changes in the creek. The free-draining nature of the channel will prevent fish stranding as flows diminish. Large woody material will be a major cover component for juvenile salmon using this area.

To restore natural river processes within the Salmon Park segment of the Creek, the gravel pushup berms adjacent to the Creek will be removed and the banks modified. Currently, these human-constructed berms are a landscape feature that prevents frequent over-bank flows into the existing historic meander feature. Lowering the berm will facilitate natural channel processes such as planform adjustment and gravel recruitment.

A wetland swale will be constructed where an old Cemetery Creek channel enters Whatcom Creek approximately 600 feet upstream of the existing confluence. The swale will function in a manner similar to the Salmon Park backwater habitat by providing high-flow rearing and refuge habitat during average winter flows. The wetland swale area will be excavated and planted to establish emergent wetland and scrub shrub plant communities. The swale will be free draining to prevent any fish entrapment.

An important component of enhancement work on Cemetery Creek, Cemetery Creek ponds, Salmon Park, and the wetland swale consists of an aggressive re-vegetation plan with a diverse assemblage of native plant species and a variety of plant material types. The installed native

plants will initiate the development of productive and diverse riparian plant communities that will help achieve project goals related to salmonid habitat complexity, salmonid thermal refuge, erosion control, and aesthetics. Throughout Salmon Park and Cemetery Creek, cedar plantings will accelerate the establishment of a valuable cedar component that is missing now but occurred historically.

Probability of Success

These projects have a high probability of success. The land is already under public ownership. The projects are expected to be successful because the project sites were once part of the Whatcom Creek and Cemetery Creek watershed, and, although degraded, the project sites already provide some limited fisheries habitats. The projects will address known limiting factors and provide habitat features and functions needed by juvenile salmonids.

The objectives for the rehabilitation have been specifically chosen to address environmental parameters known to limit habitat of salmonid fishes generally and are currently identified as limiting factors in the Creek. For instance, the annual fish habitat in the Creek may be limited by existing thermal regimes in the creek that are a consequence of the seasonally warm surface waters from Lake Whatcom. Maximizing the availability of seasonal thermal refugia for salmonids during periods of elevated stream temperatures would serve to reduce natural mortality or other sub-lethal effects adversely affecting salmonid life stages. Furthermore, the specific location of the rehabilitation has been chosen to maximize the potential for success. For instance, the WDFW indicates that the Cemetery Creek confluence and Whatcom Creek near Salmon Park are important spawning areas. Enhancement of fish habitat in these areas is preferred, since there is known salmonid use and restoration potential that serves to achieve the overall goal of increased quality salmonid habitat. Once the projects are complete, fish utilization of the sites is expected to be high.

Performance Criteria and Monitoring

The project areas will be surveyed prior to construction, and detailed construction plans will be prepared. All construction activities will be monitored to ensure that the work is implemented appropriately and in accordance with permits. Fish surveys will be conducted following completion of the projects to monitor recovery and need for any mid-course corrections.

Benefits and Environmental Impacts

There are short- and long-term benefits from the restoration work to be conducted within Salmon Park and Cemetery Creek. In the short term, physical habitat improvements will provide cold-water rearing habitat in Cemetery Creek and high-flow refuge within Salmon Park and Cemetery Creek for juvenile and resident salmonids to improve survival of floods. In the long term, the restoration of natural stream channel processes within Salmon Park will improve habitat complexity for both fish and wildlife. Intensive re-vegetation efforts will accelerate the development of a climax cedar wetland forest within Cemetery Creek and portions of Salmon Park.

The Salmon Park and Cemetery Creek projects are not anticipated to have any significant and deleterious environmental or socioeconomic impacts. Overall, the projects are expected to directly benefit fish, and provide collateral benefits to invertebrates, birds, terrestrial wildlife, water quality, vegetation, and recreation. Potential impacts from the project are summarized here.

- **Erosion and Sedimentation**—The Trustees expect short-term impacts to water quality (sedimentation) as a result of construction-related activities. These impacts will be minimized through careful design and appropriate construction practices, including seasonal construction windows and sediment control structures. These potential impacts will be addressed through the permit conditions for the project.

- **Endangered Species**—No significant adverse impacts are expected for endangered species. There are no endangered plants in the project area. The permit conditions and construction plans for the project will address protection measures for endangered salmon, including seasonal construction windows, rescue and relocation of juvenile fish prior dewatering areas, screening on pumps to prevent fish entrapment, erosion control measures, and spill containment for heavy equipment.

- **Wildlife Impacts**—No significant adverse impacts are expected for wildlife. Overall, wildlife are expected to benefit from the projects but wildlife activity may be temporarily disturbed during the construction phase of the project. If sensitive wildlife species are found during the project (e.g., nesting birds), the work may be modified or stopped to minimize impacts to wildlife.

- **Archaeology**—No known archaeological sites are on the lands selected for the project. There is, however, the potential that construction work may unearth a site. The Trustees are in consultation with the Tribes and the Office of Archaeology and Historic Preservation to outline steps that would be taken to ensure that any sites discovered would remain undisturbed by the proposed actions (AR #139, 140).

- **Wetlands**—The projects have the potential to impact wetlands near the confluence of Cemetery and Whatcom creeks. These impacts include the potential temporary loss of vegetation, sedimentation, erosion, changes in hydrology, and changes in wetland functions. While overall wetland functioning and services are expected to improve as a result of the projects, some existing wetland areas will be affected. To reduce the potential for wetland impacts, the Trustees considered several alternative designs for the Salmon Park and Cemetery Creek projects (AR #119-122). A wetland delineation was also conducted for the proposed enhancement areas (AR #126). Based on the delineation and preliminary discussions with state and local regulatory officials, the project was further revised to minimize wetland impacts. The permit conditions and construction plans for the project will

also mandate techniques to minimize collateral impacts during the construction phase of the project, including salvage and re-use of native vegetation, minimization of vehicle and heavy equipment impacts, and reseeding of disturbed areas.

Evaluation
The projects have a high probability of success and the Trustees believe the additional habitat will, as they develop, compensate for the impacts to fisheries resulting from the Incident. The activities will also provide multiple benefits for the natural resources along Whatcom and Cemetery creeks. The created habitats will take some time to reach full maturity, but should begin to provide habitat functions shortly after they are constructed.

5.2.3 Preferred Alternative: Soil Stabilization and Revegetation Actions

Project Description
During the emergency response phase of the Incident, the Company, the EPA, and the Trustees worked together to develop and implement a series of emergency restoration actions. The revegetation projects will be completed, specifically the planting efforts near the break site and maintenance of the vegetation (Figure 32). The revegetation plan is intended to restore the area's terrestrial and riparian vegetation to pre-Incident or better condition. The plan involves:

- Completion of the planting of native tree seedling stock to quickly produce a closed canopy (Figure 31) and to remove or control weedy invasive species using a combination of chemical and mechanical methods (completed except for area around the water treatment facility);

- Give restoration credit to the Company for development of a watershed-wide invasive-plants hot-spot map and control strategy (AR #100) and implementation of this strategy in areas directly and indirectly impacted by the Incident (plan completed as part of emergency restoration; maintenance is ongoing);

- Give restoration credit to the Company for removal of hazardous trees and limbs injured by the Incident, for the purposes of protecting public safety and improving public access to the impacted areas (largely completed as part of emergency restoration; maintenance is ongoing); and

- Give restoration credit to the Company for stabilization of burned soils to prevent erosion and provide a stable and fertile soil for planting of replacement trees (completed, except for area around the water treatment facility).

Scaling Approach and Justification
Approximately 17% of the burned area, located on the floodplain terrace of the Creek downstream of Whatcom Falls Canyon, is dominated by invasive species, such as Himalayan

blackberry, and has no tree canopy cover (AR #15, 100). These invasive-weed-dominated stands of shrubs and low-growing vegetation will be replaced with native vegetation and converted to mixed evergreen and deciduous forest canopy, increasing the quality of riparian habitat on this segment of the Creek to above pre-Incident conditions.

The Trustees have selected this project as a preferred alternative because it directly restores resources and services affected by the Incident. The overall scale of the project (in terms of number of trees planted) is based on the size of the burn area and the intensity of the replanting efforts. The Trustees determined that approximately 26 acres of vegetation was injured as a result of the Incident, and all of the burn areas have been targeted for replanting of native species and control of invasive species. Most of the affected areas have already been planted as part of the emergency restoration effort, but a few areas near the break site still need to be planted. Watering, thinning, and other follow-up maintenance activities are also ongoing in the replanted areas.

Other key factors in scaling the replanting effort were intensity of the planting effort (number of seedlings planted per square meter) and the age/size of the seedlings. The optimal planting density is a function of pre-Incident vegetation types, terrain, shade, slope, access, soil type, seedling size, and seedling species. Using these factors, the Trustees recommended a clumped planting pattern of mixed species, with an approximate density of 25 square feet per tree or 5.8 feet on center (AR #108). A total of eight species were planted. Conifers, including Western red cedar (*Thuja plicata*), Douglas fir (*Psuedotsuga menziesii*), Sitka spruce (*Picea sitchensis*), and Western hemlock (*Tsuga heterophylla*) accounted for 72% of the plantings. Deciduous trees accounted for the remaining trees, including big leaf maple (*Acer marcophyllum*), red alder (*Alnus rubra*), paper birch (*Betula papyrifera*), and cottonwood (*Populus balsamifera*) (AR #109).

The age/size of the seedlings is a factor in recovery of the forest canopy. Planting older and larger trees was considered as a means to accelerate recovery, but, for the reasons outlined in section 5.4, the Trustees chose to use the smaller seedlings.

Restoration Objectives

The overall goal of the emergency revegetation projects was to protect the burned areas from further injury and restore the area's terrestrial and riparian vegetation to pre-Incident or better condition. By restoring the vegetation lost in the fire, erosion was reduced, shade was created for the stream, and better habitats were available for fish, birds, and terrestrial species. The emergency restoration efforts also helped reduce the duration of the park closures and will help reduce the period of time that will elapse until the forest is re-established. While considerable progress was made during the emergency phase, completion of the plantings near the break site and maintenance of the revegetation efforts will be necessary to ensure the recovery of functioning forest and riparian habitats.

Probability of Success
The probability of success for this revegetation project is high. The emergency work conducted to date has been successful and the same techniques and approaches will be used. No major implementation problems are anticipated. As part of the restoration approach, the Trustees have chosen factors such as age, size, species, and density to ensure the success of the restoration objectives.

Performance Criteria and Monitoring
An overview of the technical specifications for the project is included in the Emergency Restoration Plan prepared the Company (AR #1). Those specifications cover the protocols for stabilization of soils and removal of non-native vegetation, including the species that will be removed and the areas of removal. Similar information is available for the planting of native vegetation. Long-term maintenance of the plantings and monitoring/removal of invasive-plant species would be provided through the maintenance fund to be managed by the City[39]. (See Section 5.2.4)

Benefits and Environmental Impacts
Potential impacts from the project are summarized here:

- **Erosion**—Revegetation efforts will involve digging, planting, and minor mechanical disturbance of soils. Therefore, the project has the potential to temporarily increase erosion in the watershed. These impacts are expected to be minor and temporary in nature. Work near the stream will be conducted in a manner to limit erosion and control sedimentation. Foot and vehicle disturbance will be kept to a minimum. When non-native vegetation is removed, the areas will be rapidly replanted to ensure that native species will be able to thrive.

- **Endangered Species**—No adverse impacts are expected for endangered species. Endangered salmon will be protected through erosion control measures and will benefit from the shade and habitat provided by a healthy riparian zone.

- **Wildlife Impacts**—No adverse impacts are expected for wildlife. Overall, wildlife are expected to benefit from healthy native vegetation, but wildlife activity may be temporarily disturbed because of the presence of field workers. If sensitive wildlife species are found during the project (e.g., nesting birds), the work may be modified or stopped to minimize impacts to wildlife.

- **Archaeology**—No known archaeological sites are planned for treatment work is not expected to unearth any sites. The Trustees are in consultation with the Tribes and the Office of Archaeology and Historic Preservation to outline steps that would be taken to ensure that any sites discovered sites would remain undisturbed by the proposed actions.

[39] AR #141

Evaluation
The Trustees find that the benefits of the project far outweigh any negative impacts. The project will provide ecological services of the same types lost as a result of the Incident. The revegetation and non-native plant control efforts will help compensate for injuries sustained by riparian habitats and provide habitat for terrestrial wildlife and birds. As the vegetation matures, the plantings will provide shade, reduce erosion, and minimize sedimentation of the Creek. As a collateral benefit, the mature vegetation will provide recreational and aesthetic benefits for hikers, fishermen, and joggers that utilize the area.

5.2.4 Long-term Monitoring and Maintenance

Monitoring and maintenance are essential elements of any restoration project. Each of the restoration projects will have a monitoring and maintenance element to document recovery, evaluate long-term performance, and provide for routine repairs and upkeep. In addition, other restoration projects that develop over time will also have monitoring and maintenance components. The monitoring actions will help to document the recovery of the Creek and the success of the individual projects. The monitoring will also help to detect problems at an early stage, when repairs and adjustments may yet be relatively simple and inexpensive. Similarly, routine maintenance of the project sites will help prevent small problems from growing. The Trustees believe that these maintenance and monitoring efforts will help to advance the effectiveness of the overall restoration plan and help ensure public health, safety, and enjoyment *of the restoration sites.*

Rather than attaching a small fund to each project, the Trustees and the Company will establish a $500,000 fund to cover all long-term monitoring and maintenance actions.[40]

The primary goals of the monitoring and maintenance activities are to ensure that the habitat projects function as designed and are maintained and repaired as necessary. In the restoration ecology and wetland engineering literature, this process of monitoring and mid-course adjustment is known as adaptive management.[41] Monitoring is also important for measuring success, informing the local public and other interested parties regarding the progress of the

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[40] A number of monitoring actions are routinely attached to permit approvals for projects conducting work in wetlands and streams. Monitoring that is required for compliance with the permits for the Cemetery Creek and Salmon Park projects, or other proposed construction activities, are directly covered under those projects. These compliance conditions are intended to assure the regulatory agencies that the project will be constructed as planned and to minimize construction-related environmental impacts. For example, compliance monitoring and maintenance may include: use and maintenance of temporary erosion controls (e.g., silt fences); use and maintenance of fish screens to exclude fish from the project area; testing of fill materials to demonstrate they do not contain contaminants; monitoring of water quality and turbidity during construction; cleanup and restoration of staging and parking areas; watering and monitoring to ensure survival of plantings; and submission of an As-Built Report after project completion.

[41] http://www.epa.gov/owow/wetlands/restore/principles.html#17 and http://www.epa.gov/owow/wetlands/restore/).

projects, and improving the understanding of restoration science and design of future restoration projects.[42]

The restoration activities will use commonly accepted monitoring protocols and typical maintenance practices. The maintenance and monitoring projects are not anticipated to have any deleterious impacts. Unless a need for major repairs or mid-course corrections is identified, the monitoring and maintenance actions are anticipated to cause only minimal disturbance to the restoration sites—primarily through foot traffic of the scientific and maintenance crews. The occasional removal of hazardous trees may require use of trucks and other equipment. Maintenance crews will attempt to minimize impacts to sensitive areas when such upkeep is required.

The specific details of the monitoring and maintenance projects (i.e., primary and reference locations, frequency, sample size, etc.) will depend on specific project objectives, whether changes to this plan become necessary, and the completion of the detailed design documents for each of the plan elements. The Trustees anticipate that the maintenance fund will be used for the following actions:

Monitoring

The main objectives of monitoring are to ensure that the habitat restoration projects function as designed and to identify corrective actions to ensure that these projects continue to function over time. Monitoring will be used to assess long-term effectiveness of the restoration and to determine the need for corrective actions. It is anticipated that a variety of biological, physical, and chemical parameters will be monitored to meet these objectives.

Biological Parameters

- Vegetation surveys to determine species composition, density, plant health, mortality, percentage cover, canopy closure percentage, presence of invasive species, and herbivore damage (e.g., girdling by beaver) in impact and restoration areas;

- Fish community surveys to assess use of the stream and restoration sites by anadromous and resident fish. Such monitoring will include surveys of fish spawning areas (e.g. redd and carcass surveys) and use of the restoration areas by adult and juvenile fish;

- Macroinvertebrate community surveys to assist our understanding of the recovery of the stream ecology, habitat quality, and also to serve as indicators of the quality and quantity of food resources available to salmon, trout, and other aquatic animals; and

[42] Periodic monitoring and maintenance reports will be prepared for the various projects.

- Riparian wildlife/terrestrial community surveys to document the presence, relative abundance, and habitat utilization of birds and terrestrial wildlife.

Physical and Chemical Parameters

- Riparian and stream habitat surveys to assess the persistence and function of instream wood structures (e.g. large woody debris), pool/riffle ratios, and channel characteristics;

- Surveys to identify the presence of dead and dying trees in the impact zone that may pose a safety hazard to the public;

- Erosion surveys to identify problem areas within the burn zone and restoration sites; and

- Water quality monitoring in the creek and restoration sites, which may include parameters such as temperature, turbidity, pH, dissolved oxygen, etc.

Photodocumentation

- Permanent photo points will be located at each restoration site to document seasonal and annual changes.

Maintenance

Results from the monitoring surveys will be used to help identify problem areas so that corrective actions can be taken to ensure recovery of the creek and riparian zone, and restoration projects function as intended. These actions include maintenance of:

Riparian Restoration Areas

- Riparian plantings throughout the Whatcom Creek corridor will require maintenance until they are established;

- Typical maintenance activities include removal of dead material, replanting, removal of invasive species, and protection from small mammal predation.

Stream Restoration Sites

- Habitat modifications and log structures placed in Whatcom Creek and at the Salmon Park and Cemetery Creek restoration sites to create habitat, trap sediment, and influence stream dynamics will be maintained to ensure their continued function for the intended purposes;

- Other structures such as ponds or connecting channels will be maintained to ensure they continue to function as designed.

Removal of Hazard Trees

- Removal of dead trees in the impact area to reduce safety hazards to the public.

Erosion Control

- Riparian areas impacted by the fire may need ongoing erosion control (e.g., mulching, plantings, cribbing) during recovery.

5.3 Non-Preferred Alternatives

The Trustees considered the following restoration projects to replace ecological and human-service losses resulting from the Incident. All of the non-preferred projects were expected to be beneficial, but the Trustees rejected these projects because better alternatives existed or because the alternative did not meet one or more of the evaluation criteria discussed above.

No Action—The Trustees considered the no-action alternative but rejected this option as the sole alternative because although natural recovery would occur over varying time scales for the various injured resources, the interim losses suffered would not be compensated under the no-action alternative.

Interpretive Center—This proposal involved creating an interpretive environmental center. The Trustees agree with many of the goals of this project but have determined that other proposed projects would more effectively restore fish and wildlife injuries and losses resulting from the Incident. The Trustees do intend to incorporate educational features and opportunities, where feasible, into the project designs. For example, the Salmon Park and Cemetery Creek projects will be designed to provide access, viewing, and recreational, and educational opportunities for the public by integrating trails, stream overlooks, and educational kiosks and markers.

Carcass Planting—Distributing salmonid carcasses in the Creek was considered as a strategy to restore the nutrient base and macroinvertebrate communities in the stream (AR #111-113). These nutrients and macroinvertebrates would, in turn, provide an increased food source for juvenile salmonids. Although this was a viable alternative, the return of many chum salmon to the Creek in the late summer and fall of 1999 provided a natural source of nutrients. Nutrients, in general, are not thought to be a limiting factor to creek restoration. Therefore, this proposal was determined to be unnecessary.

Additional Channel Habitat Modifications and Woody Debris in Whatcom Creek—These options involve creation or enhancement of instream features such as pools, gravel bars, riffles, glides, and runs (AR #114, 123, 134, 136). Most of these actions were conducted during the emergency phase of the Incident to reposition gravel that was disturbed during the streambed agitation work and replace woody debris that was removed (AR #1). Further channel habitat modifications in the Creek are not preferred because better restoration alternatives are available and because the necessary heavy machinery in the streambed has a potential to set back the recovery process. The Cemetery Creek and Salmon Park restoration projects identified in the preferred alternative involve modifications of existing or historical stream channels and placement of woody debris to enhance fish habitat. These projects are discussed in Section 5.2.2.

Debris Removal—The purpose of this project was to remove garbage and debris from the Creek to benefit habitat and aesthetic values. The Trustees have determined that much of the garbage was removed during the emergency response phase of the Incident and a specific restoration project focused on debris removal does not appear to be necessary at this time. If debris does become an issue, the maintenance fund could be utilized to address the problem. (See Section 5.2.4.)

Fish Passage—This project involved creating upstream passage for anadromous salmonids at Middle Falls, thereby increasing available spawning habitat and potentially greater fish production. The proposal involved creating a logjam below the falls to form a step pool. This would reduce the height of the falls to a level that salmon could jump. The Trustees have rejected this specific alternative because better restoration alternatives are available. The Trustees had concerns about the technical feasibility and life span of the step pool (AR #114, 134), competition with resident fish above the falls (AR #25, 115, 135), and potential aesthetic impacts to the falls.

Sewer Line Upgrades—This option involved upgrading the sewer line on the lower section of the Creek to make fish passage easier. Although relocation or removal of the sewer line from its current location (where it acts as a "check-dam") may allow the stream to function naturally for a certain distance upstream, the improvements in habitat would be minor relative to the costs, environmental disturbance, and engineering effort necessary to relocate the sewer line. Furthermore, fish are able to pass the sewer line in its current configuration. Therefore, the Trustees have rejected this alternative.

Temperature Modifications—The Trustees have determined that water temperature is one of the limiting factors for salmonid productivity in the Creek (AR #15). Higher-than-optimal summer water temperatures are stressful (AR #26) and result in reduced growth and survival (Figure 27). Prevailing water temperatures are partly due to natural causes (the outlet of Lake Whatcom occurs in a warm, shallow bay and surface water temperatures routinely reach 20°C or more during summer months) and partly due to human causes (surface spillway, reduced summer flows due to regional water use, and loss of riparian forests along the lake and creek). Several temperature modification alternatives were evaluated, including searching for cold water from deep sections of Lake Whatcom, managing spilled water to reduce water temperatures, and adding groundwater flows to the Creek (AR #15). All of these alternatives have potential merit but were rejected because of volume of water necessary, technical feasibility, and concerns about sustainability.

Off-site Land Acquisition—The Trustees considered both on-site and off-site land acquisitions to help compensate for the lost ecological and human-use services (AR #15). The goals of the land acquisition are to prevent future development and promote ecological and recreational uses. A specific off-site acquisition project proposed by the Company was rejected by the Trustees because the land was already protected by conservation easements (AR #82, 83). Acquiring

lands in Whatcom Creek watershed was a priority because on-site acquisition would directly compensate for the human uses, while off-site acquisition would potentially benefit a different set of users. Furthermore, the relative scarcity of public lands within the urban boundary, as well as developmental pressures, make lands along the Creek much more valuable. Off-site acquisition was not necessary because on-site parcels of land were available.

Alternative Designs for Cemetery Creek and Salmon Park—At the request of the Trustees, the Company and its contractor, Inter-Fluve, Inc., developed a series of conceptual plans for the creation of fisheries habitats at the Cemetery Creek and Salmon Park sites (AR #118-122). These alternatives varied in the overall size of the projects, the locations of the pools and stream channels, amounts of woody debris, and the preservation of trees on the site. These various alternatives were reviewed for potential benefits and environmental impacts, as well as construction feasibility and regulatory and permitting concerns. These alternatives were reviewed by the Trustees and modified to increase the fisheries benefits and minimize the impacts to existing habitats. This iterative review and modification process resulted in the preferred plan in Section 5.2.2 .

Stocking—Following the Incident, the recreational fishery was closed, and it remains closed to allow recovery of sustainable populations of resident and anadromous fish stocks in the lower basin. The Trustees considered stocking sterile trout to help open a season as quickly as possible. There are, however, concerns regarding competition for food with surviving resident and anadromous fish stocks (AR #115, 135). Therefore, the Trustees have rejected this alternative.

Whatcom Falls Hatchery Upgrades—The Trustees considered improvements to the hatchery in the Park as compensation for the lost fishing opportunities in the Creek. Warm water temperatures currently preclude year-round hatchery operations. As a result, the hatchery is prevented from rearing certain species and cannot raise fish to recreationally harvested sizes. The alternative involved trying to find a source of colder water so that the hatchery could operate through the summer months. These fish would then be available for recreational stocking of lakes in the area. The Trustees rejected this proposal because of the costs and feasibility associated with providing cooler water and the broader concerns over stocking of hatchery-reared fish (AR #115, 127).

Planting Large Trees—The focus of forest revegetation efforts to date has been the planting of seedlings. The Trustees evaluated whether planting older and larger trees would enhance the recovery rate of the forest canopy. The Trustees determined that while the technology exists to move large (up to 50-foot) trees, the costs and maintenance needs are high, survival of the trees can be low, and their growth rates may be retarded for several years. Smaller trees have a high survival rate and have inherently more rapid growth; after overcoming the temporary stress of transplantation, small trees quickly resume their growth. A smaller tree will recover sooner and may actually be taller than a larger transplanted tree ten years later (AR #116). Furthermore, planting large trees would require temporary roads and heavy equipment in areas that are

sensitive to disturbance. Smaller trees can be hand-carried and planted without the use of heavy equipment. As a result, the Trustees rejected the concept of widespread planting of large trees, but may selectively plant 5- to 10-foot trees where access is feasible (e.g., near access roads).

Gabion Removal—Gabion (rock-filled wire basket) removal would provide a flood benefit; however, it is not directly related to the injury and difficult to scale. In addition, gabions are located downstream of the burn and not in the area affected most by the Incident. Although habitat improvements can be made following gabion removal, the Trustees believe that other projects provide greater ecological and recreational benefits.

Automobile Use Reduction—The suggestion to fund a program to pay people who work and commute to downtown Bellingham to ride their bikes, walk, or take the bus instead of driving has the potential of reducing air and water pollution within the Whatcom Creek watershed and Bellingham as a whole. This project was proposed as part of the Lake Whatcom/Whatcom Creek residential pledge project (AR #117). These benefits, although real, are extremely difficult to quantify and very difficult to monitor for success.

5.4 Restoration Summary

A total of thirty-four specific restoration alternatives and/or restoration locations were identified. These restoration alternatives were evaluated for restoration location and site characteristics, restoration description, overall goal of restoration, objectives, implementation issues, economic feasibility issues, and methods of monitoring and judgment of success.

Table 5 summarizes the injuries and preferred restoration alternatives for the Incident.

Table 5: Injuries and preferred restoration alternatives

Preferred Alternative	Injury Categories	Description and Benefits
Completion of planting and invasive- species control	Vegetation, Wildlife, Salmonids, Water Quality, Recreation	The vegetation projects implemented during Emergency Restoration Phase will be completed. The burn zone was replanted and areas dominated by invasive vegetation prior to spill were restored using native vegetation. The planting of trees and removal of invasive vegetation will have multiple benefits to the park, terrestrial wildlife, and help to protect water quality in Whatcom Creek.
Acceptance of 4-acre parcel along Whatcom Creek near confluence with Cemetery Creek	Vegetation, Wildlife, Salmonids, Water Quality, Recreation	Acceptance of the transfer of this parcel will help protect Whatcom Creek. This parcel was selected for acquisition for protection from development, connectivity of wildlife habitat, parks and greenways, and to leverage future restoration projects. Restoration projects conducted on this site will be specifically designed to benefit fish, wildlife and riparian habitat. Trails along the edge of the parcel will provide recreational benefits.
Acceptance of 9.5-acre parcel along Whatcom Creek at Woburn Street	Vegetation, Wildlife, Salmonids, Water Quality, Recreation	Acceptance of the transfer of this parcel will expand Whatcom Falls Park. The additional land will provide increased access to park trails and creek for public use such as hiking, nature watching, fishing. The acquisition of the riparian area will preclude development and protect an important spawning and rearing area for salmonids. The acquisition will also benefit water quality, vegetation, and wildlife.
Recreational Improvements to 9.5-acre parcel	Recreation	Construction of a small parking lot and restrooms facility. These improvements will benefit recreational use of the park, but will use an existing access road and be designed to minimize impacts on fish and wildlife habitat.
Salmon Park Project	Fish, Aquatic Biota, Recreation, Wildlife, Water Quality	Construction of off-channel salmonid habitat near Racine Street will improve winter refuge habitat for juvenile salmonids and provide benefits to aquatic and terrestrial wildlife. Creation of backwater channel will also benefit public uses such as nature watching and tribal and recreational fisheries.
Cemetery Creek Project	Fish, Aquatic Biota, Recreation, Wildlife, Water Quality	Construction of pools, wetlands and salmonid rearing habitat on lower Cemetery Creek will benefit salmon and also provide public uses such as nature watching and tribal and recreational fisheries.
Monitoring and Maintenance	All	Funding for long-term monitoring of Whatcom Creek and restoration projects. Funding for maintenance of the restoration projects and parklands injured by the Incident.

6.0 COORDINATION WITH OTHER PROGRAMS, PLANS, AND REGULATORY AUTHORITIES

6.0 Coordination with Other Programs, Plans and Regulatory Authorities

6.1 Overview

Two major federal laws guiding the restoration of the injured resources and services are the Oil Pollution Act and the NEPA. The Oil Pollution Act and its regulations provide the basic framework for natural resource damage assessment and restoration. The NEPA sets forth a specific process of impact analysis and public review. In addition, the Trustees must comply with other applicable laws, regulations and policies at the federal, state, tribal, and local levels. The potentially relevant laws, regulations, and policies are set forth below.

In addition to laws and regulations, the Trustees must consider relevant environment or economic programs or plans that are ongoing or planned in or near the affected environment. For example, as previously noted, the restoration projects may be occurring, in part, in an urban park that is subject to comprehensive planning. A number of documents have been and will be produced as a part of that park and City planning process. Additionally, the Creek has been the focus of community-based restoration efforts. The Trustees will work with the sponsors of the ongoing restoration projects to ensure that restoration activities for the Incident neither impede nor duplicate such programs or plans. By coordinating restoration with other relevant programs and plans, the Trustees can enhance the overall effort to improve the environment of the Creek.

In initiating this final RP/EA, the Trustees have elected to combine the restoration plan required under the Oil Pollution Act with the environmental processes required under the NEPA. This will enable the Trustees to implement restoration more rapidly than if these processes had been undertaken sequentially.

6.2 Key Statutes, Regulations and Policies

There are a number of federal, state, tribal, and local statutes, regulations, treaties and policies that govern or are relevant to damage assessment and restoration.

Oil Pollution Act of 1990, 33 U.S.C. §§ 2701, *et seq.*; 15 CFR Part 990

The Oil Pollution Act (OPA) establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries, and implement restoration. Section 1006(e)(1) of OPA (33 U.S.C. § 2706 (e)(1)) requires the President, acting through the Under Secretary of Commerce for Oceans and Atmosphere (NOAA), to promulgate regulations for the assessment of natural resource damages resulting from a discharge or substantial threat of a discharge of oil. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services.

This rule provides a framework for conducting sound natural resource damage assessments that achieve restoration. The process emphasizes both public involvement and participation by the RP(s). The Trustees have followed the regulations in this assessment.

National Environmental Policy Act, as amended, 42 U.S.C. §§ 4321, *et seq.*, 40 CFR Parts 1500-1508

Congress enacted the National Environmental Policy Act (NEPA) in 1969 to establish a national policy for the protection of the environment. NEPA applies to federal agency actions that affect the quality of the human environment. NEPA established the Council on Environmental Quality (CEQ) to advise the President and to carry out certain other responsibilities relating to implementation of NEPA by federal agencies. Pursuant to Presidential Executive Order, federal agencies are obligated to comply with the NEPA regulations adopted by the Council on Environmental Quality. These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing environmental documentation to comply with NEPA. NEPA requires that an Environmental Assessment (EA) be prepared in order to determine whether the proposed restoration actions will have a significant effect on the quality of the human environment.

Generally, when it is uncertain whether an action will have a significant effect, federal agencies will begin the NEPA planning process by preparing an Environmental Assessment. The Environmental Assessment may undergo a public review and comment period. Federal agencies may then review the comments and make a determination. Depending on whether an impact is considered significant, an environmental impact statement or a finding of no significance (FONSI) will be issued.

The Trustees have integrated this final RP/EA with the NEPA process to comply, in part, with those requirements. This integrated process allows the Trustees to meet the public involvement requirements of the Oil Pollution Act and NEPA concurrently. This final RP/EA is intended to accomplish partial NEPA compliance by:

- Summarizing the current environmental setting;
- Describing the purpose and need for restoration action;
- Identifying alternative actions;
- Assessing the preferred actions' environmental consequences; and
- Summarizing opportunities for public participation in the decision process.

Project-specific NEPA documents may need to be prepared for those proposed restoration projects not already analyzed in an environment assessment or environmental impact statement. There are similar state requirements (Ch. 43.21C RCW) that will need to be met as part of the regulatory evaluation of some of the restoration projects.

Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. §§ 1251, *et seq.*
The Clean Water Act (CWA) is the principal law governing pollution control and water quality of the nation's waterways. Section 404 of the law authorizes a permit program for the disposal of dredged or fill material into navigable waters. The U.S. Army Corps of Engineers administers the program. In general, restoration projects that move significant amounts of material into or out of waters or wetlands (e.g., hydrologic restoration of marshes) require Section 404 permits. Under Section 401 of the CWA, restoration projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards (Section 401). Generally, restoration projects with minor wetland impacts (i.e., a project covered by a U.S. Army Corps of Engineers general permit) do not require Section 401 certification, while projects with potentially large or cumulative impacts do. The Trustees anticipate that the Salmon Park and Cemetery Creek restoration projects will require Section 404 permits.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 U.S.C. §§ 1801, *et seq.*, 50 CFR Part 600
In 1996, the Act was reauthorized and changed by amendments to emphasize a new standard by requiring that fisheries be managed at maximum sustainable levels and that new approaches be taken in habitat conservation. This habitat is called essential fish habitat (EFH), defined broadly to include "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (62 Fed. Reg. 66551, § 600.10 Definitions). The MSFCMA requires consultation for all federal agency actions that may adversely affect essential fish habitat. Under Section 305(b)(4) of the Act, the National Marine Fisheries Service is required to provide advisory essential fish habitat conservation and enhancement recommendations to federal and state agencies for actions that adversely affect essential fish habitat. These essential fish habitat consultations will be combined with existing interagency consultations and environmental review procedures that may be required under other statutes. In the situation where federal agency actions are subject to Endangered Species Act Section 7 consultations, such consultations will be combined to accommodate the substantive requirements of both the Endangered Species Act and essential fish habitat. The Trustees will consult with NMFS prior to implementation of any restoration project occurring in an area covered by the Pacific Fishery Management Council.

Coastal Zone Management Act, 16 U.S.C. §§ 1451, *et seq.*, 15 CFR Part 923
The goal of the Coastal Zone Management Act (CZMA) is to preserve, protect, develop, and, where possible, restore and enhance the nation's coastal resources. The federal government provides grants to states with federally approved coastal management programs. The State of Washington has a federally approved program. Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural

resources of the coastal zone shall be consistent, to the maximum extent practicable, with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the state the opportunity to concur that the project is consistent with the state's coastal policies. The regulations outline the consistency procedures.

The Trustees do not believe that any of the proposed projects will adversely affect the state's coastal zone, but will consult the CZMA to ensure that any applicable projects are consistent to the maximum extent practicable with the enforceable policies of the state coastal program.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601, *et seq.*

The Act provides the basic legal framework for cleanup and restoration of the nation's hazardous-substances sites. Generally, parties responsible for contamination of sites and the current owners or operators of contaminated sites are liable for the cost of cleanup and restoration. CERCLA establishes a hazard ranking system for assessing the nation's contaminated sites with the most contaminated sites being placed on the National Priorities List (NPL). To the extent that restoration projects are proposed for areas containing hazardous substances, the Trustees will avoid exacerbating any potential risk posed by such substances and will undertake no actions which might constitute "arrangement for disposal of hazardous substances." At this time, the Trustees are not aware of any potential hazardous-substance problem associated with the areas where restoration projects will occur.

Model Toxics Control Act (MTCA), Ch. 70.105D RCW (1989) and Ch. 173-340 WAC (1992). MTCA, Washington's toxic cleanup law, mandates that site cleanups protect the state's citizens and the environment. The regulations established cleanup standards which provide a uniform, statewide approach to cleanup that can be applied on a site-by-site basis; and requirements for cleanup actions, which involve evaluating the best methodology to achieve the cleanup standards at a site. MTCA is the state equivalent of the Federal Superfund program and is managed by WDOE. WDOE is a Trustee for this site so MTCA compliance will be inherent in the Trustee decisionmaking process.

Endangered Species Act, 16 U.S.C. §§ 1531, *et seq.*, 50 CFR Parts 17, 222, 224

The Act directs all federal agencies to conserve endangered and threatened species and their habitats and encourages such agencies to utilize their authority to further these purposes. Under the ESA, NOAA, through NMFS, and the Department of the Interior, through the USFWS, publish lists of endangered and threatened species. Section 7 of the Act requires that federal agencies consult with these agencies to minimize the effects of federal actions on endangered and threatened species. The Trustees have determined that several of the preferred ecological alternatives will benefit some endangered species, notably chinook salmon. Certain projects that require significant construction activity may disturb endangered species, although the regulatory permits and consultation conditions typically set forth a number of operating measures designed to prevent or mitigate any such disturbances. Section 7 consultations will be conducted as part

of the permitting process for the in-water projects, such as Salmon Park, Cemetery Creek, and the park improvements.

Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661, *et seq.*
The Fish and Wildlife Coordination Act (FWCA) requires that federal agencies consult with the USFWS, NMFS, and state wildlife agencies for activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, the NEPA or other federal permit, license, or review requirements.

In the case of restoration actions for this Incident, the fact that the three consulting agencies for the Fish and Wildlife Coordination Act (i.e., USFWS, NMFS and WDFW) are represented by the Trustees means that FWCA compliance will be inherent in the Trustee decision-making process.

Rivers and Harbors Act, 33 U.S.C. §§ 401, *et seq.*
The Rivers and Harbors Act regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the U.S. Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters. Restoration actions that require Section 404 Clean Water Act permits are likely also to require permits under Section 10 of the Rivers and Harbors Act; however, a single permit usually serves for both. Therefore, the Trustees can ensure compliance with the Rivers and Harbors Act through the same mechanism.

Executive Order 12898: Environmental Justice, as amended
On February 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This Executive Order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The Environmental Protection Agency and the Council on Environmental Quality have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under the NEPA and of developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations.

The Lummi Nation and Nooksack Tribe constitute distinct, separate communities of Native Americans who rely on Treaty-reserved fish and shellfish resources for subsistence, economic, and spiritual purposes. Other members of low-income communities may rely on fishery resources for subsistence purposes. The Trustees have not identified any disproportionate, adverse impacts on human health or environmental effects on implementation of the Preferred Alternative on Native Americans or other minority or low-income populations and believe that

the projects will be beneficial to these communities. The Tribes are Trustees for this Incident and their representation will be inherent in the Trustee decisionmaking process.

Executive Order 11988: Construction in Floodplains
This 1977 Executive Order directs federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of development in floodplains wherever there is a practicable alternative. Each agency is responsible for evaluating the potential effects of any action it may take in a floodplain.

Before taking an action, the federal agency must determine whether the proposed action will occur in a floodplain. For major federal actions significantly affecting the quality of the human environment, the evaluation will be included in the agency's NEPA compliance document(s). The agency must consider alternatives to avoid adverse effects and incompatible development in floodplains. If the only practicable alternative requires siting in a floodplain, the agency must: 1) design or modify the action to minimize potential harm; and 2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the floodplain. The Trustees will take the appropriate steps to comply with EO 11988 should any of the preferred alternatives be located in the floodplain.

Treaty of Point Elliott, 12 Stat. 927 (1855)
The Treaty of Point Elliott to which the Lummi Nation, the Nooksack Tribe and the United States are parties, reserves to the tribal signatories, among other rights, the right of taking fish at all usual and accustomed places and the rights of hunting and gathering. Among the places where the Lummi Nation and the Nooksack Tribe reserved fishing, hunting and gathering rights are the Creek. Under federal court decisions including United States v. Washington, 312 Fed. Supp. 384 (WD WA, 1974), these Tribes are co-managers of the fisheries resources found in the Creek and of those fisheries resources that utilize the Creek for spawning and rearing.

6.3 Other Potentially Applicable Laws and Regulations

This section lists other laws that potentially affect the restoration activities. The statutes or their implementing regulations may require permits from federal or state permitting authorities. The permitting process also may require an evaluation of statutes other than those listed below.

Archaeological Resources Protection Act, 16 U.S.C. §§ 470, *et seq.*

Clean Air Act, 42 U.S.C. §§ 7401, *et seq.*

Marine Mammal Protection Act, 16 U.S.C. §§ 1361, *et seq.*

Migratory Bird Treaty Act, 16 U.S.C. §§ 703, *et seq.*

National Historic Preservation Act, 16 U.S.C. §§ 470, *et seq.*

Treaty of Point Elliott, 1855. S. Doc. 319, 58-2, vol. 2:43, 12 Stat. 927 (1855)

6.4 Cedar and Salmon Cultural Framework

In addition to the potentially applicable federal, state, and local laws and regulations, the Trustees have also considered Tribal policies, priorities, and guiding principles. For many centuries, the native people of the Pacific Northwest based their economy, culture, and religion on salmon fishing. The Western red cedar tree also was also critical to the tribes for shelter, clothing, transportation, and art. The Trustees have attempted to address this cultural framework through salmon restoration and planting of cedar trees and other native vegetation along the Creek.

7.0 Response to Comments

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7.0 Response to Comments

The Oil Pollution Act of 1990 (33 U.S.C. § 2701 et seq.), and the NOAA Damage Assessment Regulations (15 C.F.R. Part 990 et seq.) require that the public be provided an opportunity to review and comment on oil spill restoration plans. The Trustees prepared a draft restoration plan for the Olympic Pipe Line Incident. The plan was made available for public review and comment on March 7, 2002 (AR #142). Public advertisements announcing the availability of the draft Damage Assessment and Restoration Plan (DARP) and the public meeting were placed in the Seattle Times, Seattle Post-Intelligencer, and Bellingham Herald (AR #146-148). Copies of the plan were made available at the Bellingham City Hall, Bellingham Library, and Bellingham Department of Public Works. Copies of the plan were provided free of charge to all interested parties. The City of Bellingham arranged for public tours of the proposed restoration sites and developed a video restoration tour that was broadcast on the local cable network (AR #149). The Trustees prepared a summary brochure on the proposed projects (AR #150) and held a public meeting at the Bellingham City Council Chambers on March 20, 2002 to present the plan. A copy of the presentation and a videotape of the meeting are included in the Record (AR #151, 152). The Trustees made copies of the Administrative Record available at locations in Seattle and Bellingham. Finally, the Trustees prepared a publicly accessible Internet site (www.darcnw.noaa.gov/whatcom.htm) and posted copies of the Notice of Intent to Conduct Restoration Planning, the draft restoration plan, and photographs of the Incident.

The public comment period closed on April 8, 2002. A total of three sets of comments were received on the plan from the following individuals and organizations:

- Rich Elliott, Davis Wright Tremaine, representing Equilon
- Wendy Scherrer, Nooksack Salmon Enhancement Association (NSEA)
- Marlene Robinson

Copies of the written comments received during the comment period and the public meeting presentation are included in the Administrative Record.

7.1 Overview of Comments:

In general, comments were in favor of the preferred alternatives and helpful in clarifying the descriptions of the losses and proposed restoration projects. However, two commenters questioned the adequacy of the long-term maintenance and monitoring component of the plan. No comments suggested additional categories of injuries or losses that should have been addressed during the restoration planning process. Finally, no adverse comments were received regarding the technical sufficiency of the Trustees' assessment and quantification of natural resource injuries.

The comments pertained to five main categories: 1) questions regarding the long-term maintenance and monitoring budget; 2) proposals for education and community projects; 3) questions and comments on the proposed restoration options; 4) comments on the restoration planning process; and 5) requests to clarify, add, or delete text in the document.

This section summarizes and responds to the comments. Comments are organized by general themes and similar comments are combined.

7.2 Comments on Long-Term Monitoring & Maintenance:

Comment: *The commenter expressed concern that the proposed long-term monitoring and maintenance will not ensure pre-incident restoration. The commenter asks whether the Trustees could show that the current cost figures for maintenance and monitoring tasks are adequate. The commenter recommended building more flexibility into the plan. The commenter requested clarification of the budget, the role of the City of Bellingham, and the length of activity associated with long-term monitoring and maintenance. (NSEA) (Robinson)*

Response: The proposed restoration plan was developed to bring the affected natural resources back to their pre-spill condition and compensate for the interim loss of natural resources while recovery occurs. The Trustees are developing a more detailed budget, schedule, and scope of work for the maintenance and monitoring plan. As part of this effort, the Trustees have confirmed that the maintenance and monitoring budget is adequate. The Trustees are developing an agreement for the management of the maintenance and monitoring plan. The categories of monitoring activities, as well as monitoring protocols and reporting criteria, will be included in the agreement. The City of Bellingham will implement the maintenance and monitoring fund through its Environmental Resources Division of Public Works as lead, in coordination with the Parks Department, for all maintenance, monitoring, and restoration activities. The Trustees did not assume that all tasks associated with the maintenance and monitoring of trees, slopes, fish, water quality, structures, macroinvertebrates, and restoration projects generally, would be funded by this fund. Administration costs will be addressed in the management agreement. Further, the City of Bellingham is committed to incorporating the maintenance and monitoring activities into existing programs, and will not overrun the budget with administration costs.

Comment: *The commenter was concerned that the Olympic Pipe Line Company is not being held responsible for the costs of all aspects of the Incident throughout all the years of restoration. The commenter asked why the Company should not have liability for the potential failures of restoration projects and for maintenance, monitoring and administration. (Robinson)*

Response: The Trustees believe Olympic Pipe Line has been held accountable and that injuries to the stream will be compensated by this plan. Given the options available, the Trustees chose to maximize restoration projects and acquisition, but the plan still has a substantial monitoring and maintenance effort. The company has responsibility for ensuring that the projects operate as anticipated and the company will be directly responsible for monitoring and mid-course corrections during construction to ensure that the projects are built properly, including initial survival of vegetation and proper hydrologic function. The monitoring and maintenance budget is designed to address longer term issues once the construction is complete and the project is functioning as designed.

Comment: *The commenter asked who is responsible if there is a slope failure and asked about risks from dangerous trees and who is responsible for liability if someone is hurt from falling tree parts? The commenter also asked whether the park would need to be kept closed longer than anticipated in the plan..(Robinson)*

Response: Trees in the gorge are not in a public access area. Steps have been taken to eliminate the hazard tree risks in areas open to the public. Trees in areas open to the public are being monitored and have been removed by Olympic Pipe Line as hazards when identified. The Plan anticipates that the availability of new Park areas will compensate for continued Park closures in areas that remain hazardous.

7.3 Comments on Education & Community Involvement:

Comment: *The commenter proposed the amendment of restoration activities to include education and community involvement. The commenter requested inclusion of the fact that Whatcom Creek provides sites for educational programs and suggested amending the language regarding lost human-use services to include educational programs. The commenter proposed the establishment of a dedicated fund for a community education and participation program and suggested a $1.85 million estimate of costs over 10 years. (NSEA) (Robinson)*

Response: The Trustees considered education projects along with other restoration alternatives and concluded that while there are existing programs and funds available for salmon and water quality education, large blocks of funding for land acquisition and habitat restoration projects are harder to obtain. Therefore, the Trustees disagree with the suggestion that a fund be established for restoration education specific to Whatcom Creek. However, each of the proposed restoration projects will have interpretive signage.

7.4 Comments on the Proposed Restoration Options:

Comment: *The commenter approved of the Preferred Alternative to acquire land and focus on fishery enhancement activities. The commenter approved of the Trustees' diligent work in immediate restoration and their use of the best available science in initial assessment and emergency restoration activities. The commenter also approved of the innovation and cooperation between the Trustees and the Olympic Pipe Line Company. (NSEA) (Robinson)*

Response: The Trustees concur that a cooperative, restoration-based settlement benefits both the public and the environment. The Trustees also agree that the proposed land acquisition along the creek and construction of off-channel salmonid habitats at Salmon Park and Cemetery Creek will provide direct and long-term benefits to Whatcom Creek.

Comment: *The commenter identified the loss of shade as an issue and mentioned increasing the shade cover over other sections of the Creek. The commenter noted that two good places for increasing the shade are the open section through the Diehl Ford property and the gabioned areas. (NSEA) (Robinson)*

Response: Creation of shade was discussed during the restoration planning process. Temperature is certainly an issue on Whatcom Creek, now, as it was before the Incident. The Trustees feel that replanting of the burn area was an important step in recovering that shade function and note that almost 38,000 trees were planted to restore the affected riparian areas. The Trustees considered planting larger trees but after discussion with various experts, concluded that the larger trees would have a lower rate of survival and growth, and would potentially result in further injury to vegetation because heavy equipment and roads would be necessary to transport and plan large trees.

Comment: *The commenter asked how water quality in Whatcom Creek would be improved to compensate for soil contamination. The commenter also asked whether measures could be taken to reduce contamination inputs. (NSEA)*

Response: There has not been an ongoing impairment of surface water quality from the Incident. The only remaining groundwater contamination is at the Water Treatment Plan. Under the state regulatory process, a groundwater treatment system is operating near the break site and long-term remediation of that contamination is an obligation that Olympic Pipe Line retains until the contamination is removed.

Comment: *The commenter noted that the proposed 4- acre acquisition site has noxious weeds and bad fill material and asked who would be responsible for managing and paying for the design and restoration work at that site? (NSEA)*

Response: Restoration projects will be pursued on both of the properties acquired as part of this plan. The City's Environmental Resource Division will seek grant and other funding, with matching funds from current City activities. The Department of Ecology has analyzed the fill material on Haskell's property and a No Further Action order was issued. Noxious weeds will be included in ongoing noxious weed control programs. The ERD will be responsible for restoration projects on this site. The Parks Department will be responsible for trail development.

Comment: *The commenter requested a description of recovery efforts to date. (NSEA)*

Response: The draft restoration plan includes a summary of the recovery efforts implemented to date for the Olympic Pipe Line Incident. More detailed information is included in the Administrative Record Documents, including the emergency restoration plan and vegetation planting efforts.

7.5 Comments on Development of the Plan:

Comment: *The commenter reported that it has been difficult to wait so long for a long-term restoration plan. The commenter wrote that the process of developing the RP/EA was secretive and was concerned that the NSEA was never consulted. The commenter recommended that NSEA be included as a primary partner in long-term restoration. (Robinson)*

Response: The restoration efforts were not developed in secrecy. The emergency restoration plan was made available for public review. A Notice of Intent to conduct restoration planning was published in the Bellingham Herald. The restoration concepts in the draft restoration plan were presented with alternatives for public review and comment. Information requests were made to NSEA in development of the plan. Restoration planning is inherently time-consuming, as the Trustees must conduct studies and surveys to evaluate injuries to natural resources in order to determine appropriate restoration alternatives. Because of the extent of the initial injuries, much of the restoration work had to be implemented on an emergency basis to stabilize the area.

7.6 Clarifications, Additions, And Deletions:

Comment: *The commenter asked what "a diverse suite of fish and other organisms" means. The commenter also asked for more details concerning the word "suite" in the phrase "a suite of proposed restoration alternatives." (NSEA)*

Response: Suite typically refers to a group of species. In this case, it refers to the community of finfish, shellfish, lamprey, aquatic insects, and crustaceans that were known to inhabit the Creek prior to the Incident. The second use of the word reflects a range of related or similar restoration projects.

Comment: *The commenter asked what "lost human-use restoration" means. (NSEA)*

Response: One of the services provided by natural resources is human use, including recreational use. An example of a lost human use is a closure of a park or recreational fishery. Under OPA, the Trustees may assess and restore these losses. In this Incident, the proposed land acquisitions and park improvements are designed, in part, to restore or compensate for the lost human uses.

Comment: *The commenter asserts that the phrase "no action with natural recovery" is misrepresentative of the restoration alternative it describes and asked that it be changed to "no action." The commenter also requested that, at another point in the document, the phrase "natural recovery" be replaced with "no action." (NSEA)*

Response: The no-action alternative is the same as natural recovery. Biological communities have a large capacity to heal themselves provided that other stressors are reduced. In some instances, taking no action to allow natural recovery may be more beneficial to the injured resource, and the Trustees have chosen this option where appropriate.

Comment: *The commenter requested other changes in language at three points in the document: (1) replace "sea-run rainbow trout" with "steelhead", (2) replace "resident" with "resident and anadromous", and (3) clarify a sentence describing Whatcom Creek as an important resource. (NSEA)*

Response: The language has been changed to reflect the commenter's suggestions.

Comment: *The commenter requested that the restoration plan include mention of the loss of 15,000 hatchery rainbow trout in Bellingham Technical College Hatchery.(NSEA)*

Response: The loss of the hatchery fish is included in the fish kill numbers cited in the restoration plan and is addressed in the detailed fish kill report prepared by Washington Department of Fish and Wildlife that is included in the Administrative Record. The Trustees note that OPLC directly paid claims for losses at the hatchery resulting from the spill (D. Doty, WDWF, Pers. Comm.).

Comment: *The commenter requested inclusion of a sentence regarding NSEA's implementation of prior restoration on Whatcom Creek, as well as a change of language clarifying NSEA's role in the installation of a fish ladder. (NSEA)*

Response: The Trustees recognize that NSEA has made important contributions to the Creek's restoration prior to the Incident. Others groups, including schools, civic groups, non-profits, federal and state agencies, City of Bellingham, Whatcom County, and tribes have also had a role in the restoration of Whatcom Creek, either through the work of NSEA or on their own. The Trustees will clarify the role of NSEA with regard to installation of the fish ladder.

Comment: *The commenter requested inclusion, at two points each in the document, of the fact that Whatcom Creek provides the largest chum recreational fishery in Washington State, that Whatcom Creek is a resource for commercial fishing in Bellingham Bay, and that all of the trout at Bellingham Technical College's hatchery died as a result of the Incident. (NSEA)*

Response: The commenter's language has been added. However, while it is true that one of the services provided by the Creek is the support of commercial fisheries, the Plan is not intended to address private losses incurred by commercial fisherman or other private business losses. Under OPA, claims for those losses must be brought by the private claimants.

Comment: *The commenter requested inclusion of the fact that two boys and a young man died as a result of the Incident. (NSEA)*

Response: The Trustees discussed this issue at some length and decided that mentioning the loss of life in the restoration plan might mislead some readers to believe that the proposed restoration alternatives were designed to address or compensate for the loss of life. Instead, the Trustees included a statement in the introduction of the plan clarifying that the proposed restoration alternatives were designed only to compensate for injuries to natural resources. This should not be interpreted as a lack of recognition or compassion by the Trustees for the death of the three individuals.

Comment: *The commenter requested deletion of a reference to Equilon having been the operator of the Olympic Pipe Line Company at the time of the Incident. (Equilon)*

Response: The Trustees have no compelling information that supports changing the language in the restoration plan. The U.S. Department of Justice and U.S. Environmental Protection Agency name Equilon as the operator of the Olympic Pipe Line Company at the time of the Incident.

Comment: *The commenter suggested that the description of human use losses in Section 1.10 include the loss of environmental education (NSEA)*

Response: The description has been added. However, the Trustees believe these losses are included in the overall park closure. The park closure analysis included estimated lost visits for all activities, including those for educational purposes. The proposed park enhancements and land acquisition should provide opportunity for environmental education along with other outdoor recreation activities.

8.0 PREPARERS, AGENCIES, AND PERSONS CONSULTED

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9.0 REFERENCES

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10.0 Appendices

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10.0 Appendices

10.1 Acronyms and Glossary

Acronyms

AR	Administrative Record
BMPs	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
°C	Centigrade (degrees)
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
Draft RP/EA	Draft Restoration Plan and Environmental Assessment
DSAYs	Discounted Service Acre-Years
EA	Environmental Assessment
EFH	Essential Fish Habitat (under MSFCMA)
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Ecologically Significant Unit
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
GPS	Global Positioning System
HAZMAT	NOAA's Hazardous Materials Response and Assessment Division
HEA	Habitat Equivalency Analysis
JRC	Joint Restoration Committee
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MTCA	Model Toxics Control Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRDA	Natural Resource Damage Assessment
OAHP	Office of Archaeology and Historic Preservation
OPA	Oil Pollution Act of 1990
OPLC	Olympic Pipe Line Company (the Company)
PHABSIM	Physical Habitat Simulation Model
RCW	Revised Code of Washington

RDA	Resource Damage Assessment
RP(s)	Responsible Party or Parties
RP/EA	Restoration Plan and Environmental Assessment
SEPA	State Environmental Policy Act
SIMAP	Spill Impact Map
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology

Glossary

anadromous: fish, such as salmon, that live in the ocean but reproduce in freshwater
benthic: relating to, or occurring at the bottom of a body of water
biota: the flora and fauna of a region
estuarine: relating to, or formed in an estuary- an inlet of the sea influenced by freshwater
gabion: a basket or cage filled with earth or rocks and used especially in building a support or abutment
intertidal: The region of the shoreline between the high tide mark and the low tide mark.
invasive species: a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health
invertebrate: lacking a spinal column (backbone or vertebrae); of or relating to invertebrate animals, such as crustaceans, mollusks, worms, gastropods and insects, that lack a backbone or spinal column
macroinvertebrate: An invertebrate visible without the aid of magnification
marine: of or relating to the sea
planform: pattern of a stream channel as seen from the air (e.g. straight or meandering)
riparian: relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater
riprap: a loose assemblage of broken stones erected in water or on soft ground as a foundation
refugia: a place or source of shelter or safety; a sanctuary
salmonid: any of a family (Salmonidae) including salmon or trout
trophic: of or relating to nutrition, generally referring to flow of food or energy from one ecological level to another.
watershed: a region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water

10.2 Index to the Administrative Record

Record Number	Author	Date	Title
001	OPLC	1999	Emergency Restoration Plan for Whatcom Creek and Whatcom Falls Park, Bellingham, Washington
002	NOAA Damage Assessment Center	2000	Whatcom Creek Incident: Preassessment Data Report, Final Draft, 3/20/00.
003	OPLC	1999	Recap Ferndale Station to Bayview Products Terminal 16" pipeline Displacement Activities (Spill Volume)
004	US EPA	1999	Olympic Pipe Line Major Gasoline Spill Whatcom Creek POLREP #16 Bellingham, Washington
005	Stone, V.A.	2000	Whatcom Creek Water Quality in the 1990s and the ecological effects of a gasoline pipeline leak and fire in Bellingham, WA.
006	Co-Trustees	2000	Memorandum of Agreement for the Whatcom Creek Incident
007	Eissinger, A. (Nahkeeta Northwest)	1995	City of Bellingham Wildlife and Habitat Assessment; an Inventory of Existing Conditions and Background Information and Wildlife Habitat Plan
008	Nakano Associates	1995	Whatcom Creek Trail Master Plan
009	City of Bellingham Department of Planning and Community Development	1999	Permit for Whatcom Creek Trail
010	Ashbrook, C., and D. Doty	2000	Fish and wildlife in-stream mortality assessment following the Olympic Pipeline gasoline spill in Bellingham, Washington on June 10, 1999, Final Report
011	City of Bellingham Parks and Recreation Department	1999	Whatcom Falls Park Closure Maps
012	National Marine Fisheries Service	1999	Chinook Salmon, (*Oncorhynchus tshawytscha*), Puget Sound ESU Listed Threatened, March 1999
013	State of Washington RDA Committee	1999	RDA Committee public meeting notes- Hearing on Assessment, 12 July, 1999
014	US EPA	1999	Incident Summary Report
015	OPLC	2000	Whatcom Creek Draft Long-Term Restoration Plan and Appendices
016	City of Bellingham	1995	Watershed Master Plan, September, 1995
017	City of Bellingham	1999	Whatcom Creek Waterfront Action Program (WCWAP) Summary (http://www.cob.org/oncd/source/htm/special_proj/wcwap/INDEX.HTM)
018	City of Bellingham	1988	Shoreline Management Master Program Update 1988
019	City of Bellingham Department of Planning and Community Development	1995	1995 Bellingham Comprehensive Plan
020	WDOE	1999	Lake Whatcom Watershed Cooperative Drinking Water Project. Results of 1998 Water, Sediment and Fish Tissue Sampling.

021	Thayer, D.V.	1977	Whatcom Creek Salmon Rearing
022	USGS	2002	Physical Habitat Simulation (PHABSIM) Software
023	City of Bellingham	2002	JRC meeting notes
024	Nooksack Salmon Enhancement Association	1997	Nooksack Salmon Enhancement Projects
025	Stanford, J. and F. Hauer	2002	Mitigating the impacts of Stream and Lake regulation in the Flathead River Catchment, Montana, USA: An ecosystem perspective
026	Sullivan, K., Martin, D., Cardwell, R., Toll, J. and S. Duke.	2000	An analysis of the Effects of Temperature on Salmonids of the Pacific Northwest with Implications for Selecting Temperature Criteria
027	Johnson, J., and J. McGowan	1999	Cemetery Creek Sea-Run Cutthroat Trout Rescue Plan
028	WDOE	2000	Bellingham Bay Pilot Project, Fact Sheet: Bellingham Bay Comprehensive Strategy, Final EIS,
029	WDFW	2001	List of State Species of Concern
030	USFWS	2001	Endangered, Threatened, Proposed and Candidate Species, Critical Habitat and Species of Concern in the Western Portion of Washington State, North Pacific Ecoregion as prepared by the US Fish and Wildlife Service, Western Washington Office.
031	City of Bellingham Parks and Recreation Department	1990	Trail Guide
032	City of Bellingham Department of Public Works	2001	Washington Heritage Registry sites in Bellingham
033	American Fisheries Society	1992	Investigation and valuation of fish kills
034	City of Bellingham	2001	Archival list of OPLC Unified Command Documents
035	Albers, P., and M. Gay	1982	Unweathered and Weathered Aviation Kerosene: Chemical Characterization and Effects of Hatching Success of Duck Eggs
036	Berry, W., and J. Brammer	1977	Toxicity of Water-Soluble Gasoline Fractions to Fourth-Instar Larvae of the Mosquito *Aedes aegypti.*
037	Brocksen, R., and H. Bailey	1973	Respiratory Response of Juvenile Chinook Salmon and Striped Bass Exposed to Benzene, a Water-soluble Component of Crude Oil
038	Bue, B.G, Sharr, S., and J.E Seeb	1998	Evidence of Damage to Pink Salmon Populations Inhabiting Prince William Sound, Alaska, Two Generations after the Exxon Valdez Spill.
039	Carls, M., Rice, S., and J.E. Hose	1999	Sensitivity of Fish Embryos to Weathered Crude Oil: Part I. Low-level exposure during incubation causes malformations, genetic damage, and mortality in larval Pacific Herring (*Clupea pallasi*).
040	Carls, M.G, Heintz, R., Moles, A., Rice, S.D., and J.W. Short	2001	Long-Term Biological Damage: What is Known, and How Should That Influence Decisions on Response, Assessment, and Restoration
041	Cline, P., Delfino, J., and P. Rao	1991	Partitioning of Aromatic Constituents into Water from Gasoline and Other Complex Solvent Mixtures
042	CONCAWE	1996	Acute Aquatic Toxicity of Gasolines; Report on CONCAWE Test Program

043	CONCAWE	1992	Gasolines
044	DeGraeve, G., Elder, R., Woods, D., and H. Bergman	1982	Effects of Naphthalene and Benzene on Fathead Minnows and Rainbow Trout
045	Delzer, G., Zogorski, J., Lopes, T., and R. Bosshart	1996	Occurrence of Gasoline Oxygenate MTBE and BTEX Compounds in Urban Stormwater in the United States, 1991-95.
046	Derveel, W., Nadeau, R., and G. Case	1995	A Screening-Level Evaluation of Impacts to a Montana Lotic Macroinvertebrate Community From a Fuel Oil Spill.
047	Devlin, E., Brammer, J., and R. Puyear	1982	Acute Toxicity of Toluene to Three Age Groups of Fathead Minnows (*Pimephales promelas*)
048	French-Mckay, D.	2001	Development and Application of an Oil Toxicity and Exposure Model, OilToxEx.
049	Galassi, S., Mingazzini, M., Vigano, L., Cesareo, D., and M. Tosato	1987	Approaches to Modeling Toxic Response of Aquatic Organisms to Aromatic Hydrocarbons
050	Graves, N.	1985	A Northern Idaho Gasoline Spill and Cleanup Using Stream Bed Agitation
051	Heintz, R., Short, J., and S. Rice	1999	Sensitivity of Fish Embryos to Weathered Crude Oil: Part II. Increased Mortality of Pink Salmon (*Oncorhynchus gorbuscha*) embryos incubating downstream from weathered Exxon Valdez crude oil.
052	Heintz, R.A, Rice, S.D., and B. Bue	1996	Field and Laboratory Evidence for Reduced Fitness in Pink Salmon that Incubate in Oiled Gravel.
053	Hodson, P., Dixon, D., and K. Kaiser	1984	Measurement of Median Lethal Dose as a Rapid Indicator of Contaminant Toxicity to Fish
054	Korn, S., Moles, A., and S. Rice	1979	Effects of Temperature on the Median Tolerance Limit of Pink Salmon and Shrimp Exposed to Toluene, Naphthalene, and Cook Inlet Crude
055	Marty, G.D., Heintz, R.A, and D.E. Hinton	1997	Histology and Teratology of Pink Salmon Larvae near the Time of Emergence from Gravel Substrate in the Laboratory
056	Moles, A.	1980	Sensitivity of Parasitized Coho Salmon Fry to Crude Oil, Toluene, and Naphthalene
057	Moles, A., Rice, S., and S. Korn	1979	Sensitivity of Alaskan Freshwater and Anadromous Fishes to Prudhoe Bay Crude Oil and Benzene
058	Morrow, J.	1974	Effects of Crude Oil and Some of its Components on Young Coho and Sockeye Salmon
059	Morrow, J.	1973	Oil-Induced Mortalities in Juvenile Coho and Sockeye Salmon
060	Pickering, Q., Carle, D., Pilli, A., Willingham, T., and J. Lazorchak	1989	Effects of Pollution on Freshwater Organisms
061	Pontasch, K. and M. Brusven	1988	Diversity and Community Comparison Indices: Assessing Macroinvertebrate Recovery Following a Gasoline Spill
062	Pontasch, K. and M. Brusven	1989	Macroinvertebrate and Periphyton Response to Streambed Agitation for Release of Substrate-Trapped Hydrocarbons
063	Pontasch, K., and M. Brusven	1987	Periphyton Response to a Gasoline Spill in Wolf Lodge Creek, Idaho
064	Rice, S.D, D Moles et al.	1984	Effects of Petroleum Hydrocarbons on Alaskan Aquatic Organisms

065	Schultz, D., and L. Tebo	1975	Boone Creek Oil Spill
066	Sharr, S., Moffitt, S.D., and A.K Craig	1996	Effects of the Exxon Valdez on Pink Salmon Embryos and Preemergent Fry
067	Stein, J.E, Krahn, M.M., Collier, T.K. and J.P. Meador	1998	Oil Spill Response: Assessing Exposure and Effects in Fishery Resources
068	Swartz, R.C. Schults, D., Oxretich, R., Lamberson, J., Cole, F., DeWitt, T., Redmond, M., and S. Ferraro	1995	Σ PAH: A Model to Predict the Toxicity of Polynuclear Aromatic Hydrocarbon Mixtures in Field-Collected Sediments
069	Wakehan, S., Davis, A., and J. Karas	1983	Mesocosm Experiments to Determine the Fate and Persistence of Volatile Organic Compounds in Coastal Seawater
070	Walsh, D., Armstrong, J., Bartley, T., Salman, H., and P. Frank	1977	Residues of Emulsified Xylene in Aquatic Weed Control and their Impact on Rainbow Trout
071	Neff, J.	2000	Appendix B- Development of Petroleum Fraction Specific Toxicity Values for the Protection of Aquatic Receptors
072	Neff, J.	2002	Monocyclic Aromatic Hydrocarbons.
073	AMOCO Oil	1999	Amoco Regular Lead-Free Gasoline-Gasoline Automotive, Material Safety Data Sheet
074	Landis, W.	1999	Consensus, Site Specific Action Levels for BETX, Gasoline and Naphthalene. August 18, 1999 JRC Meeting
075	Huyck, V., and E. Paulson (Eds.)	1997	Petroleum in the Freshwater Environment: An Annotated Bibliography.
076	NOAA	1995	Physical Process Affecting the Movement and Spreading of Oils in Inland Waters.
077	Taylor, E., Steen, A., and D. Fritz	1995	A review of environmental effects from oil spills into inland waters
078	Roni, P., and A. Fayram	2000	Estimating winter salmonid abundance in small western Washington Streams: a comparison of three techniques
079	Geiger, D., Brooke, L., and D. Call	1990	Acute Toxicities of Organic Chemicals to Fathead Minnows (*Pimephales promelas*).
080	Ball, R.	1948	Recovery of marked fish following a second poisoning of the population in Ford Lake, Michigan
081	NOAA	2000	Habitat Equivalency Analysis: An Overview
082	City of Bellingham	1998	Conservation and Public Easement: Padden Creek Gorge Area 78943
083	City of Bellingham	1998	Conservation and Public Easement: Padden Creek Gorge Area 78944
084	Labay, A.B. and D. Buzan	1998	A Comparison of Fish Kill Counting Procedures on a Small, Narrow Stream
085	Baker, D., and Everhope, L.	1999	Wildlife Surveys for Whatcom Creek Incident, June 12 - 14, 1999.
086	OPLC	1999	Whatcom Creek Sampling and Chemical Analytical Analysis Plan, June 10, 1999
087	R2 Consultants	2000	Whatcom Creek Snorkel Observations
088	GeoEngineers	1999	Site Characterization and Remediation Report, Pipeline Release Areas, Whatcom Creek Incident, Bellingham, Washington, Volume I of II
089	GeoEngineers	1999	Site Characterization and Remediation Report, Pipeline Release Areas, Whatcom Creek Incident, Bellingham,

			Washington, Volume II of II
090	City of Bellingham	1999	Closure Notice for Whatcom Falls Park and Trails
091	French-McKay, D.	2000	Preassessment Modeling of Fates and Marine Injuries Resulting from the June 1999 Gasoline Spill into Whatcom Creek
092	Locke, Gary	1999	Designation of City of Bellingham as a Natural Resource Trustee
093	Internet Information	1999	Compilation of Internet Information from Whatcom County, City of Bellingham, the OPLC, and others
094	Bellingham Herald	1999	Compilation of Newspaper Articles
095	Seattle Post Intelligencer	1999	Compilation of Newspaper Articles
096	Seattle Times	1999	Compilation of Newspaper Articles
097	Oregonian	1999	Compilation of Newspaper Articles
098	Washington State DNR	1999	Whatcom Creek Fire Department of Natural Resources Photo Interpretation of Burn Zone- ArcView Shape Files (Digital Original and brief text description)
099	Pentilla, D.	1999	Observations made around the mouth of Whatcom Creek, Bellingham, June 15, 1999.
100	Manifold, S., Colebrook, B., Baldwin, L. Grace, L., and C. Behee	2000	Whatcom Creek Invasives Survey Report, February 2000 (Digital Original, printed copy of text)
101	WDFW	1999	Emergency Closure Notice
102	WDFW	1999	Extension of Emergency Closure
103	Belt, G., Laughlin, J., and T. Merrill	1992	Design of Forest Riparian Buffer Strips for the Protection of Water Quality: Analysis of Scientific Literature.
104	Waples, R., and C. Do.	1994	Genetic risk associated with supplementation of Pacific salmonids: Captive broodstock programs.
105	Minshall, G., Robinson, C., and D. Lawrence	1997	Postfire responses of Lotic Ecosystems in Yellowstone National Park, U.S.A.
106	Waters, T.F	1995	Sediments in Streams: Sources, Biological Effects, and Control.
107	Everest, F., Beschta, R., Scrivener, J., Koski, K., Sedell, J. and C.J. Sederholm.	1987	Fine Sediment and Salmonid Production: A Paradox. pp 98-142 in Salo, E., and T. Cundy (Eds.) Streamside Management: Forestry and Fisheries Interactions.
108	City of Bellingham Park Department	2000	Comments on Tree Planting Plan Summary Whatcom Falls Park Area, 2/24/00
109	Cantrell and Associates	2000	Tree Planting Plan Summary Whatcom Falls Park Area, 2/17/00
110	Clark, J.	2001	Proposed Park Improvements
111	Helfield, J. and R. Naiman. 2001.	2001	Nutrients from salmon carcasses enhance streamside forest growth and long-term salmon production. (Ecology)
112	Michael, Hal	2000	Use of carcasses to enhance stream productivity
113	Michael, Hal	2000	Protocols and Guidelines for Distributing Salmonid Carcasses to Enhance Stream Productivity in Washington State
114	Hyatt, T. and R. Naiman	2001	The Residence Time of Large Woody Debris in the Queets

			River, Washington
115	WDFW	1997	Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids
116	Ball, J., and D, Graper	1993	Planting a Tree with a Tree Moving Machine
117	WDOE	1999	Whatcom Watersheds Pledge Project
118	Inter-Fluve	2001	Salmon Park and Cemetery Creek Enhancement Plan for Fisheries Habitat, Draft Preliminary Design Report, 12/13/01
119	Inter-Fluve	2001	Salmon Park and Cemetery Creek Conceptual Enhancement Plan for Fisheries Habitat, 10% Design Report, 1/01
120	Inter-Fluve	2001	Salmon Park and Cemetery Creek Enhancement Plan for Fisheries Habitat, Draft Preliminary Design Report, 3/22/01
121	Inter-Fluve	2001	Salmon Park and Cemetery Creek Enhancement Plan for Fisheries Habitat, Preliminary Design Report, 4/11/01
122	Inter-Fluve	2001	Salmon Park and Cemetery Creek Enhancement Plan for Fisheries Habitat, Draft Preliminary Design Report, 11/30/01
123	Roni, Phil	2001	Responses of Fishes and Salamanders to Instream Restoration Efforts in Western Oregon and Washington
124	Ronald Jepson and Associates	1998	Binding Site Plan for Haskell Corporation Business Park
125	City of Bellingham	1998	Letter and attachments from Patricia Decker to Al Jansen Regarding planned development for Whatcom Reach Property
126	Inter-Fluve	2001	Wetland Delineation for the Salmon Park and Cemetery Creek; Enhancement Plan for Fisheries Habitat, 5/01
127	Bonneville Power Administration	1990	Analysis of Salmon and Steelhead Supplementation
128	Brown, J.; Smith, J., and J. Kapler (eds.)	2000	Wildland fire in ecosystems: effects of fire on flora
129	Robichaud, P., Beyers, J., and D. Neary	2000	Evaluating the Effectiveness of Postfire Rehabilitation Treatments
130	Spina, A., and D. Tormey	2000	Postfire Sediment Deposition in Geographically Restricted Steelhead Habitat
131	Gresswell, R.	1999	Fire and Aquatic Ecosystems in forested Biomes of North America
132	Rinne, J.	1996	Short-term effects of wildfire on fishes and aquatic macroinvertebrates in the southwestern United States
133	Smith, J. (ed.)	2000	Wildland Fire in Ecosystems: Effects of Fire on Fauna
134	Roper, B., Konnoff, D., Heller, D., and K. Wieman	1998	Durability of Pacific Northwest Instream Structures Following Floods
135	Adams, S., Frissell, C., and B. Rieman	2001	Geography of Invasion in Mountain Streams: Consequences of Headwater Lake Fish Introductions
136	Schmetterling, D., Pierce, R.	1999	Success of Instream Habitat Structures After a 50-Year

			Flood in Gold Creek, Montana.
137	Co-Trustees	2002	Notice of Intent to Conduct Restoration Planning
138	U. S Government	1855	1855 Point Elliott Treaty Area for the Lummi Nation and Nooksack Tribe
139	Helton, D.	2002	Request to State Office of Archaeology and Historic Preservation for Section 106 Review
140	Whitlam, R.	2002	Response to Request for Section 106 Review
141	Jefferson, M.	2002	Letter regarding Tribal Participation
142	Co-Trustees	2002	Draft Restoration Plan and Environmental Assessment for the June 10, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington
143	Elliot, R	2002	Comments on Draft RP/EA
144	Scherrer, W	2002	Comments on Draft RP/EA
145	Robinson, M	2002	Comments on Draft RP/EA
146	Bellingham Herald	2002	Public Notice
147	Seattle Times	2002	Public Notice
148	Seattle Post-Intelligencer	2002	Public Notice
149	City of Bellingham	2002	Whatcom Creek Restoration: An update (videotape)
150	WDOE	2002	Restoring Whatcom, Hanna, and Cemetery Creeks
151	City of Bellingham	2002	Whatcom Creek Restoration Plan Public Presentation, March 2002
152	City of Bellingham	2002	Public Meeting of the Draft Restoration Plan of Whatcom, Hanna, and Cemetery Creek, March 20, 2002 (videotape)

10.3 Summary of the Emergency Restoration Actions

A number of early remediation and emergency restoration activities were implemented and were coordinated with the emergency response and cleanup and oriented at reducing injuries to natural resources or restoring injured resources. Many of these activities have generated restoration benefits to the natural resources and resource services affected by the Incident. The emergency restoration activities that have been completed or are ongoing include:

- **Stream and Soil Remediation**—Agitation of stream sediments to release trapped gasoline. Contaminated soils were removed and treated.
- **Stream Restoration**—Replacement and rearrangement of stream gravel and cobble and introduction of large woody debris to create a stream physiography that is more conductive to fish production.
- **Invasive-Plant Control**—Removal of non-native vegetation and control of burned areas to facilitate re-establishment of a native plant community.
- **Tree Planting**—Thousands of tree seedlings have been planted throughout the burn zone to help re-establish a tree canopy.
- **Soil Erosion and Sedimentation Mitigation**—Areas at high risk to erosion after the fire were closed to pedestrian traffic. Native groundcovers were planted.
- **Valencia Street Bridge Improvements**—The Company rebuilt the Valencia Street Bridge, reconstructed the confluence of Fever Creek and Whatcom Creek to improve fish passage, and built a recreational trail bridge over Fever Creek at its intersection with Whatcom Park trail.

10.4 Calculation of "Discounted Service Acre Years" Created

Table 6: Calculation of "Discounted Service Acre-Years" Created for Salmon Park and Cemetery Creek Projects

A	B	C	D	E	F	G
Year	Percent Services Provided	Affected Area (Project Size in acres)	Service-Acres Gained Per Year (B x C)	Discount Factor (@ 3% per annum)	Present Value of Service-Acres Gained Per Year (D x E)	Cumulative Discounted Service Acre-Years (DSAYs)
2002	0.00	0.9	0.000	1.000	0.000	0.000
2003	0.05	0.9	0.045	0.970	0.044	0.044
2004	0.10	0.9	0.090	0.941	0.085	0.128
2005	0.15	0.9	0.135	0.913	0.123	0.252
2006	0.20	0.9	0.180	0.885	0.159	0.411
2007	0.25	0.9	0.225	0.859	0.193	0.604
2008	0.30	0.9	0.270	0.833	0.225	0.829
2009	0.35	0.9	0.315	0.808	0.255	1.084
2010	0.40	0.9	0.360	0.784	0.282	1.366
2011	0.45	0.9	0.405	0.760	0.308	1.674
2012	0.50	0.9	0.450	0.737	0.332	2.005
2013	0.55	0.9	0.495	0.715	0.354	2.359
2014	0.60	0.9	0.540	0.694	0.375	2.734
2015	0.65	0.9	0.585	0.673	0.394	3.128
2016	0.70	0.9	0.630	0.653	0.411	3.539
2017	0.75	0.9	0.675	0.633	0.427	3.967
2018	0.80	0.9	0.720	0.614	0.442	4.409
2019	0.85	0.9	0.765	0.596	0.456	4.865
2020	0.90	0.9	0.810	0.578	0.468	5.333
2021	0.95	0.9	0.855	0.561	0.479	5.812
2022	1.00	0.9	0.900	0.544	0.489	6.302
2023	1.00	0.9	0.900	0.527	0.475	6.776
2024	1.00	0.9	0.900	0.512	0.460	7.237
2025	1.00	0.9	0.900	0.496	0.447	7.683
2026	1.00	0.9	0.900	0.481	0.433	8.117
2027	1.00	0.9	0.900	0.467	0.420	8.537
2028	1.00	0.9	0.900	0.453	0.408	8.945
2029	1.00	0.9	0.900	0.439	0.395	9.340
2030	1.00	0.9	0.900	0.426	0.384	9.724

2031	1.00	0.9	0.900	0.413	0.372	10.096
2032	1.00	0.9	0.900	0.401	0.361	10.457
2033	1.00	0.9	0.900	0.389	0.350	10.807
2034	1.00	0.9	0.900	0.377	0.340	11.146
2035	1.00	0.9	0.900	0.366	0.329	11.476
2036	1.00	0.9	0.900	0.355	0.320	11.795
2037	1.00	0.9	0.900	0.344	0.310	12.105
2038	1.00	0.9	0.900	0.334	0.301	12.406
2039	1.00	0.9	0.900	0.324	0.292	12.697
2040	1.00	0.9	0.900	0.314	0.283	12.980
2041	1.00	0.9	0.900	0.305	0.274	13.255
2042	1.00	0.9	0.900	0.296	0.266	13.521
2043	1.00	0.9	0.900	0.287	0.258	13.779
2044	1.00	0.9	0.900	0.278	0.250	14.029
2045	1.00	0.9	0.900	0.270	0.243	14.272
2046	1.00	0.9	0.900	0.262	0.236	14.508
2047	1.00	0.9	0.900	0.254	0.229	14.736
2048	1.00	0.9	0.900	0.246	0.222	14.958
2049	1.00	0.9	0.900	0.239	0.215	15.173
2050	1.00	0.9	0.900	0.232	0.209	15.382
2051	1.00	0.9	0.900	0.225	0.202	15.584
2052	1.00	0.9	0.900	0.218	0.196	15.780
2053	1.00	0.9	0.900	0.212	0.190	15.971
2054	1.00	0.9	0.900	0.205	0.185	16.155
2055	1.00	0.9	0.900	0.199	0.179	16.334
2056	1.00	0.9	0.900	0.193	0.174	16.508
2057	1.00	0.9	0.900	0.187	0.169	16.677
2058	1.00	0.9	0.900	0.182	0.163	16.840
2059	1.00	0.9	0.900	0.176	0.159	16.999
2060	1.00	0.9	0.900	0.171	0.154	17.153
2061	1.00	0.9	0.900	0.166	0.149	17.302
2062	1.00	0.9	0.900	0.161	0.145	17.447
2063	1.00	0.9	0.900	0.156	0.140	17.587
2064	1.00	0.9	0.900	0.151	0.136	17.723
2065	1.00	0.9	0.900	0.147	0.132	17.855
2066	1.00	0.9	0.900	0.142	0.128	17.983
2067	1.00	0.9	0.900	0.138	0.124	18.108
2068	1.00	0.9	0.900	0.134	0.121	18.228
2069	1.00	0.9	0.900	0.130	0.117	18.345
2070	1.00	0.9	0.900	0.126	0.113	18.458

2071	1.00	0.9	0.900	0.122	0.110	18.568
2072	1.00	0.9	0.900	0.119	0.107	18.675
2073	1.00	0.9	0.900	0.115	0.104	18.779
2074	1.00	0.9	0.900	0.112	0.100	18.879
2075	1.00	0.9	0.900	0.108	0.097	18.977
2076	1.00	0.9	0.900	0.105	0.094	19.071
2077	1.00	0.9	0.900	0.102	0.092	19.163
2078	1.00	0.9	0.900	0.099	0.089	19.252
2079	1.00	0.9	0.900	0.096	0.086	19.338
2080	1.00	0.9	0.900	0.093	0.084	19.421
2081	1.00	0.9	0.900	0.090	0.081	19.503
2082	1.00	0.9	0.900	0.087	0.079	19.581
2083	1.00	0.9	0.900	0.085	0.076	19.658
2084	1.00	0.9	0.900	0.082	0.074	19.732
2085	1.00	0.9	0.900	0.080	0.072	19.804
2086	1.00	0.9	0.900	0.077	0.070	19.873
2087	1.00	0.9	0.900	0.075	0.068	19.941
2088	1.00	0.9	0.900	0.073	0.066	20.006
2089	1.00	0.9	0.900	0.071	0.064	20.070
2090	1.00	0.9	0.900	0.069	0.062	20.132
2091	1.00	0.9	0.900	0.066	0.060	20.191
2092	1.00	0.9	0.900	0.064	0.058	20.249
2093	1.00	0.9	0.900	0.063	0.056	20.306
2094	1.00	0.9	0.900	0.061	0.055	20.360
2095	1.00	0.9	0.900	0.059	0.053	20.413
2096	1.00	0.9	0.900	0.057	0.051	20.465
2097	1.00	0.9	0.900	0.055	0.050	20.515
2098	1.00	0.9	0.900	0.054	0.048	20.563
2099	1.00	0.9	0.900	0.052	0.047	20.610
2100	1.00	0.9	0.900	0.051	0.045	20.655
2101	1.00	0.9	0.900	0.049	0.044	20.699
2102	1.00	0.9	0.900	0.048	0.043	20.742

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10.5 Design Information for Cemetery Creek and Salmon Park Projects

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12.0 Finding of No Significant Impact (FONSI)

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Finding of No Significant Impact under the National Environmental Policy Act

Final Restoration Plan and Environmental Assessment
for the
June 10, 1999 Olympic Pipe Line Gasoline Spill
Whatcom Creek, Bellingham, Washington

United States Department of the Interior
U.S. Fish and Wildlife Service
Western Washington Fish and Wildlife Office
Lacey, Washington

Introduction and Proposed Action

The United States Department of the Interior through the U.S. Fish and Wildlife Service is a participating Natural Resource Trustee in the natural resource damage assessment and restoration process for the June 10, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington, and the resulting explosion and fire ("the Incident"). Pursuant to the Oil Pollution Act of 1990 (33 U.S.C. §§ 2701, *et seq.*), it is the Natural Resource Trustee's (Trustees) responsibility to determine the nature and extent of natural resource injuries, select appropriate restoration projects, and implement or oversee restoration. Other participating Trustees include: the National Oceanic and Atmospheric Administration, the State of Washington, the City of Bellingham, the Nooksack Tribe, and the Lummi Nation.

I. Alternative Considered

In compliance with the National Environmental Policy Act, the U.S. Fish and Wildlife Service in concert with the other Natural Resource Trustees, and with the cooperation and input of the Olympic Pipe Line Company (the Responsible Party) developed a Restoration Plan/Environmental Assessment (RP/EA) to compensate the public for injuries to natural resources and ecological services resulting from the Incident. In order to return the injured natural resources and services to their baseline conditions and compensate for interim losses of those resources and services, the Trustees evaluated a total of 34 specific types of restoration alternatives and/or restoration locations which include a No-action/Natural Recovery Alternative, and several ecological, and lost human use restoration alternatives.

The No-action/Natural Recovery Alternative was considered but rejected as the sole alternative due to the varying time scales of recovery for the various injured resources, and the inability of this alternative to compensate for interim losses suffered due to the Incident. The Preferred Alternative selected combines several aspects of both the human use and the ecological alternatives considered and consists of: 1) the acquisition of two land parcels (totaling 13.5

acres) along Whatcom Creek for future habitat restoration projects, 2) the construction of off-channel fish habitat including pools, wetlands, and rearing areas, and, 3) the funding of long-term monitoring and maintenance of the various restoration projects by the Responsible Party.

II. Effects and Finding of No Significant Impact

The Trustees believe that the Proposed Action and Preferred Alternative will restore trust resources injured during the Incident and provide beneficial cumulative impacts by increasing habitat for fish and wildlife. Impacts such as noise, visual disturbance and stream sedimentation upon fish and wildlife species will be short-term and limited to construction activities of the various restoration projects of the Preferred Alternative. These impacts will be minimized by best management practices and other avoidance and mitigation measures as required by the various regulatory agencies.

On May 17, 2002, the U.S. Fish and Wildlife Service concurred with the U.S. Army Corps of Engineer's determination of "may affect, not likely to adversely affect" for bull trout (*Salvelinus confluentus*) and bald eagle (*Haliaeetus leucocephalus*) in a biological evaluation of the Preferred Alternative as evaluated in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

III. Public Review and Comment

The Trustees made the draft RP/EA available to the public for a 30-day comment period, and a public meeting on the proposed restoration actions was held in Bellingham, Washington on March 20, 2002. All comments received during the comment period were considered by the Trustees and addressed in the final RP/EA.

IV. Conclusion and Determination

Based upon an environmental review and evaluation of the final RP/EA of the June 19, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington, it is my determination that the Preferred Alternative of several restoration projects and land acquisition do not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of Section 102 (2)(C) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement is not required.

Anne Badgley

Regional Director, Region 1, Fish and Wildlife Service
Authorized Official for U.S. Department of the Interior
Olympic Pipe Line Gasoline Spill/Natural Resource Damage Assessment

7/11/02
Date

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Assistant Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

AUG 27 2002

TO ALL INTERESTED GOVERNMENT AGENCIES AND PUBLIC GROUPS:

Under the National Environmental Policy Act, an Environmental Assessment (EA) has been performed on the following action:

TITLE: Olympic Pipe Line Gasoline Spill

LOCATION: Whatcom Creek, Bellingham, Washington

SUMMARY: The Trustees for the Olympic Pipe Line Gasoline spill have completed an Environmental Assessment (EA) to restore natural resources injured by the release of gasoline and resulting fire in Whatcom Creek, Bellingham, Washington. The EA includes restoration projects for the following five identified categories of natural resources affected by the spill: vegetation; fisheries; water quality; wildlife; and human uses. The following restoration projects have been identified: acceptance of a 9.5-acre property above Woburn Street near the Creek to expand Whatcom Falls Park ("the Park") and compensate for losses to public and ecological services; acceptance of a 4-acre property along the Creek to compensate for losses to public and ecological services and provide land for future habitat restoration projects; construction of park improvements to the Woburn Street property, including restroom and public access features, to compensate the public for lost use of the park; construction of off-channel salmonid habitat at the Salmon Park project near Racine Street to compensate for impacts to fish habitat from the Incident; construction of pools, wetlands, and salmonid rearing habitat near the mouth of Cemetery Creek to compensate for impacts to fish habitats from the Incident; funding by the Olympic Pipe Line Company for long-term monitoring of the Creek and the various restoration projects; and funding by the Olympic Pipe Line Company for maintenance of the restoration projects and parklands injured by the Incident.

RESPONSIBLE OFFICIAL: William T. Hogarth, Ph.D.
Assistant Administrator for Fisheries
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910
Telephone: 301-713-2239

The public and other interested parties have participated in public meetings during the NRDA RP/EA process. The environmental review process has led us to conclude that these restoration actions will not have a significant effect on the human environment. Consequently, the National Oceanic and Atmospheric Administration submitted the plan for an issuance of a finding of no

significant impact (FONSI) which was approved. Therefore, an environmental impact statement will not be prepared. A copy of the finding of no significant impact including the supporting EA is available upon request to the Responsible Official indicated above. If you have any comments, please send one copy to the Responsible Official and one copy to me at the NOAA Office of Strategic Planning, Room 6121, U.S. Department of Commerce, Washington, D.C. 20230.

Sincerely,

For James P. Burgess, III
NEPA Coordinator

Enclosure

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Restoration Plan and Environmental Assessment for the June 10, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington

The National Oceanic and Atmospheric Administration (NOAA) is the lead federal agency for the National Environmental Policy Act (NEPA) compliance for the Restoration Plan and Environmental Assessment (RP/EA) for the June 10, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington. Other cooperating agencies include the U.S. Department of the Interior through the U.S. Fish and Wildlife Service, the Washington Department of Ecology, the Washington Department of Fish and Wildlife, the Washington Department of Natural Resources, the City of Bellingham, the Nooksack Tribe, and the Lummi Nation (the Trustees). These parties participated in damage assessment and restoration planning activities to address injuries to natural resources and resource services resulting from the spill.

The Trustees (identified above) evaluated several types of restoration alternatives: the no action/natural recovery alternative, ecological restoration alternatives, and lost human use restoration alternatives. Within those alternatives, several restoration projects were evaluated to determine what projects would best meet the goals and objectives of the Trustees. The Trustees concluded that their preferred restoration alternatives would be a mix of both the ecological and the lost human use alternatives. The draft RP/EA was presented to the public and all comments were addressed prior to finalizing the RP/EA. The preferred alternative projects addressed in the RP/EA include:

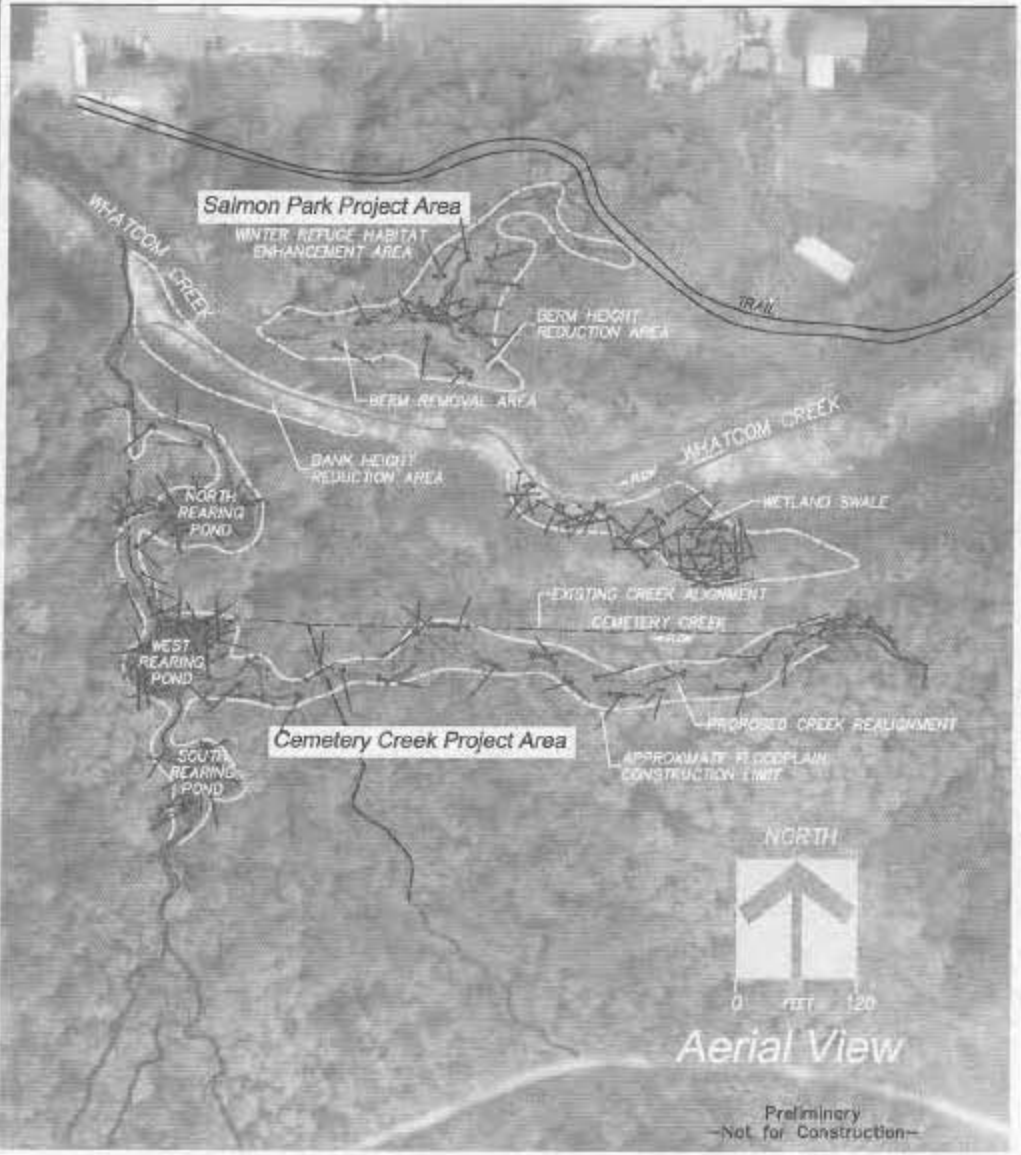
- Acceptance of a 9.5-acre property above Woburn Street near the Creek to expand Whatcom Falls Park ("the Park") and compensate for losses to public and ecological services
- Acceptance of a 4-acre property along the Creek to compensate for losses to public and ecological services and provides land for future habitat restoration projects
- Construction of park improvements to the Woburn Street property, including restroom and public access features, to compensate the public for lost use of the Park
- Construction of off-channel salmonid habitat at the Salmon Park project near Racine Street to compensate for impacts to fish habitats from the Incident
- Construction of pools, wetlands, and salmonid rearing habitat near the mouth of Cemetery Creek to compensate for impacts to fish habitats from the Incident
- Funding by the Olympic Pipe Line Company for long-term monitoring of the Creek and the various restoration projects
- Funding by the Olympic Pipe Line Company for maintenance of the restoration projects and parklands injured by the Incident

DETERMINATION:

Based upon an environmental review and evaluation of the Final Restoration Plan and Environmental Assessment of the June 10, 1999 Olympic Pipe Line Gasoline Spill into Whatcom Creek, Bellingham, Washington, I have determined that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of Section 102 (2) (c) of the National Environmental Policy Act of 1969, as amended. Accordingly, an environmental impact statement is not required for this project.

William T. Hogarth Date 8-19-02

William T. Hogarth, Ph.D.
Assistant Administrator for Fisheries
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce



PROJECT PURPOSES/USES

~ ENHANCE AVAILABLE REARING AND SEASONAL REFUGE HABITATS TO ONE OF THE PRIMARY SALMONID SPAWNING AREAS IN WHATCOM CREEK

~ IMPROVE HABITAT CONDITIONS PRIMARILY FOR CUTTHROAT TROUT, WITH ADDITIONAL BENEFITS FOR COHO SALMON AND OTHER NATIVE FISH SPECIES

SALMON PARK

~ CREATE HIGH-FLOW FISH REFUGE AND REARING HABITAT ALONG WHATCOM CREEK

~ STREAMSIDE BERMS TO BE REMOVED AND THE STREAM BANKS MODIFIED TO RESTORE CHANNEL MIGRATION RATES, INCREASE FLOODPLAIN AREA, IMPROVE FLOOD STORAGE CAPACITY, AND FACILITATE NATURAL GENERATION OF SALMONID HABITAT

CEMETERY CREEK

~ CREATE A NEW STREAM CHANNEL AND THREE COLD WATER FISH REARING PONDS IN LOWER CEMETERY CREEK

~ IMPROVE THERMAL REFUGE HABITAT DURING PERIODS OF ELEVATED STREAM TEMPERATURES IN WHATCOM CREEK (SUMMERTIME)

~ PLACE LARGE WOODY DEBRIS IN PORTIONS OF CEMETERY CREEK AND WHATCOM CREEK TO IMPROVE HABITAT DIVERSITY AND COVER

~ CREATE MORE NATURALLY FUNCTIONING STREAM CORRIDORS

1 of 6

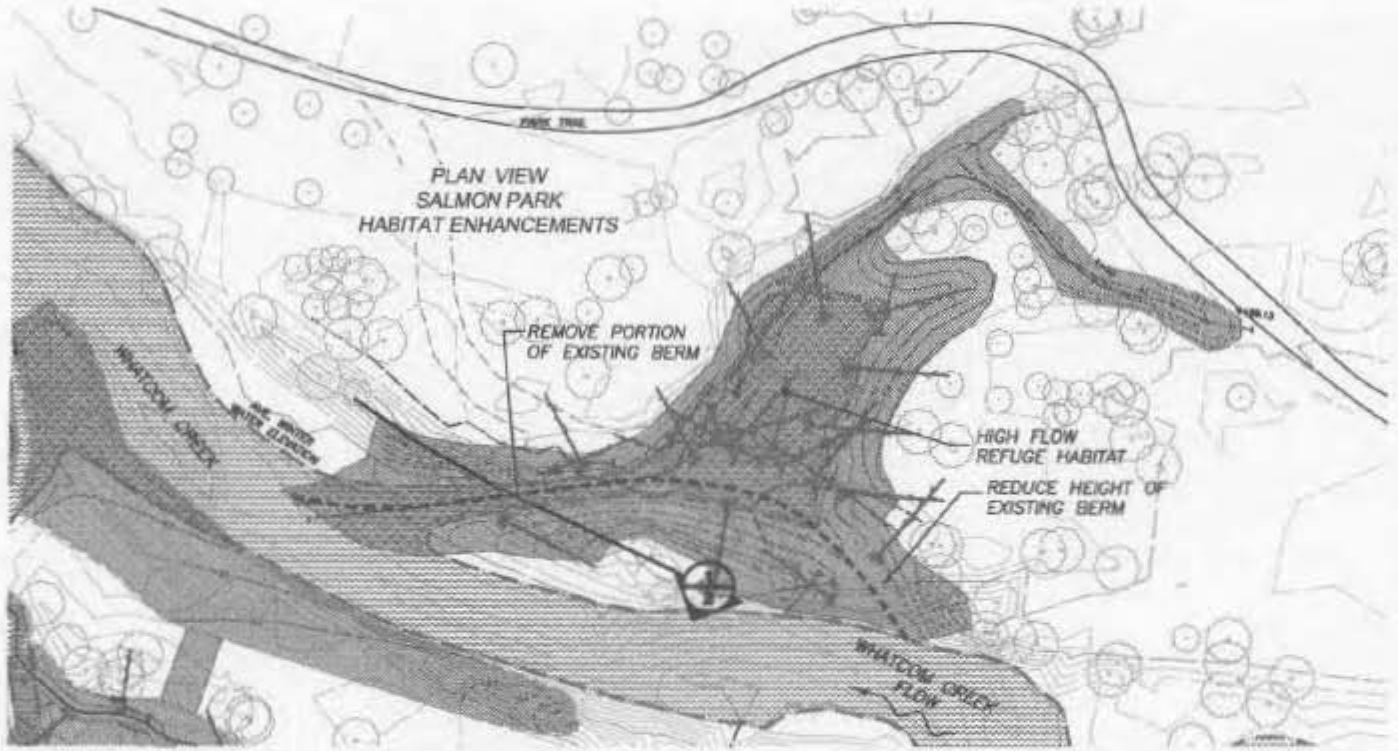
Aerial View
Enhancement Areas

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

PROJECT NO: 00-02-23

inter-fluve, inc.



NORTH

0 FEET 50

PLAN SCALE

Preliminary
-Not for Construction-

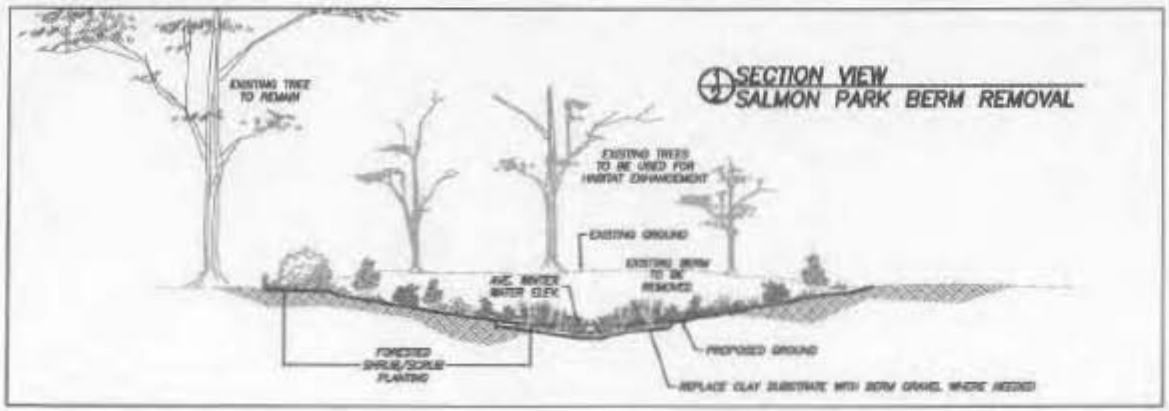
SALMON PARK
PLAN VIEW
HABITAT ENHANCEMENT

2 of 6

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT

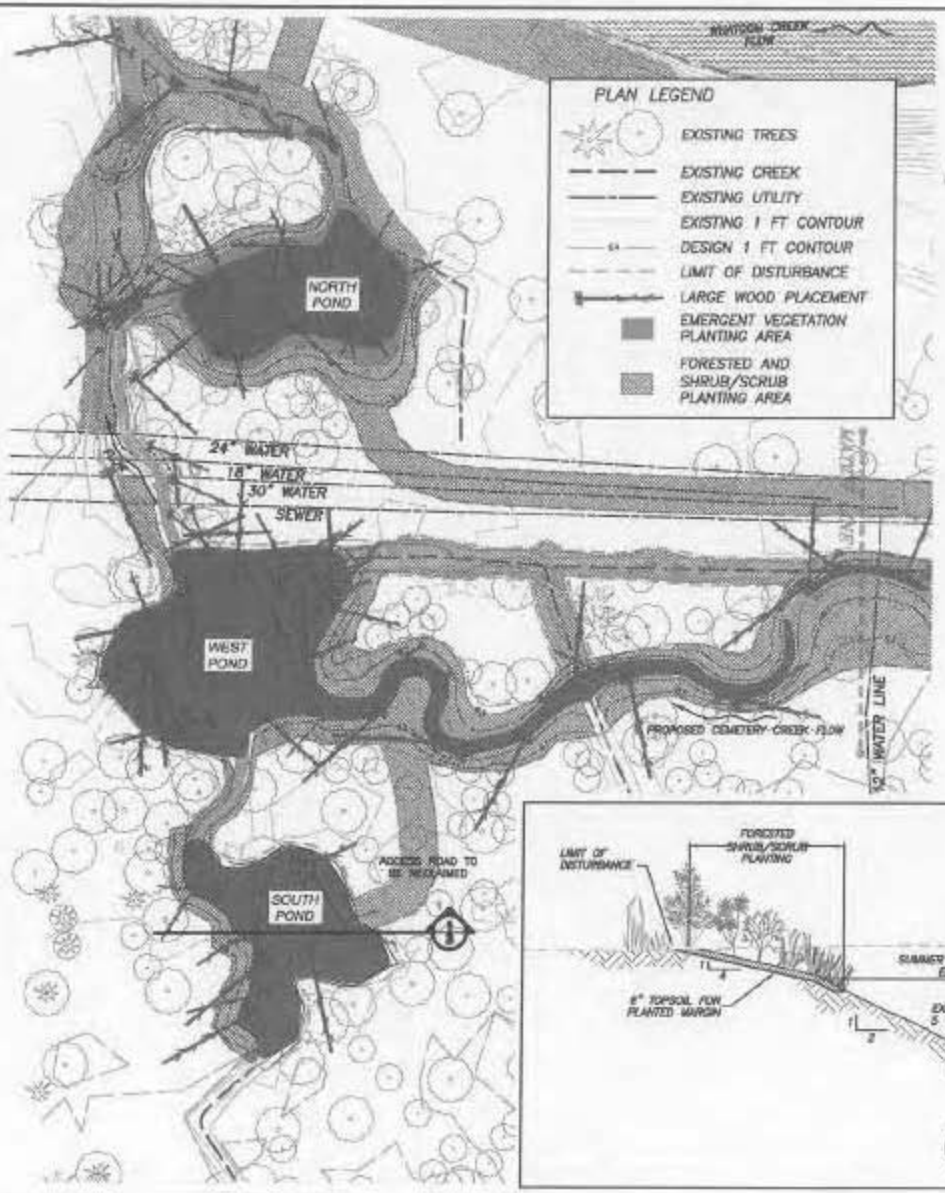
PROJECT NO. 00-02-21



PLAN LEGEND

- EXISTING TREES
- AVG. WINTER WATER ELEV.
- FUTURE CHANNEL CENTERLINE
- EXISTING SWALE OR DITCH
- EXISTING 1 FT CONTOUR
- DESIGN 1 FT CONTOUR
- LIMIT OF DISTURBANCE
- LARGE WOOD PLACEMENT
- FORESTED AND SHRUB/SCRUB PLANTING AREA

inter fluve, inc.



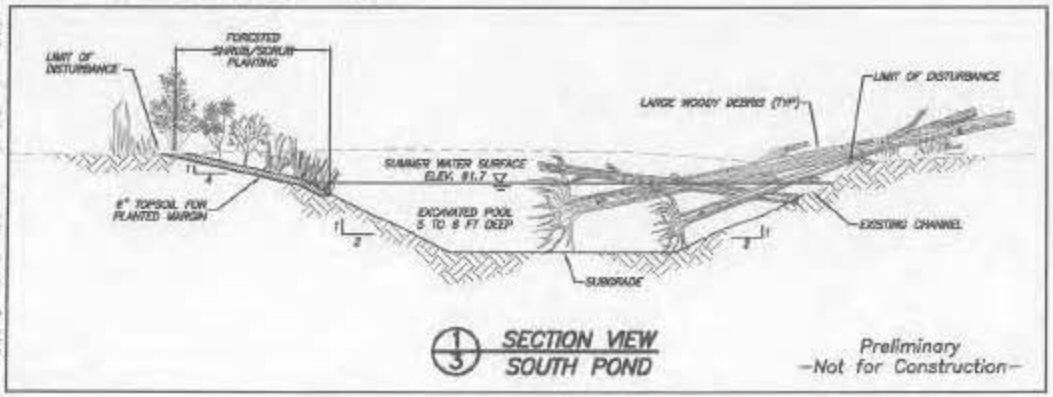
PLAN VIEW
CEMETERY CREEK
HABITAT ENHANCEMENTS

NORTH

0 FEET 50
PLAN SCALE

SALMONID HABITAT FEATURES

- ~ CREATION OF A MORE NATURALLY FUNCTIONING STREAM CORRIDOR AND THREE COLD-WATER FISH REARING PONDS IN LOWER CEMETERY CREEK
- ~ PROVIDES ADDITIONAL THERMAL REFUGE HABITAT DURING PERIODS OF ELEVATED WATER TEMPERATURES IN WHATCOM CREEK (SUMMERTIME)
- ~ NEAR STREAM VEGETATION PROVIDES SHADE AND FOOD CHAIN SUPPORT
- ~ LARGE WOOD PLACEMENTS FOR COVER, REFUGE, AND HABITAT DIVERSITY
- ~ ENLARGED CAPACITY FOR NATIVE SALMONIDS



1/3 SECTION VIEW
SOUTH POND

Preliminary
-Not for Construction-

3 of 6

Cemetery Creek
Plan View
Habitat Plan West

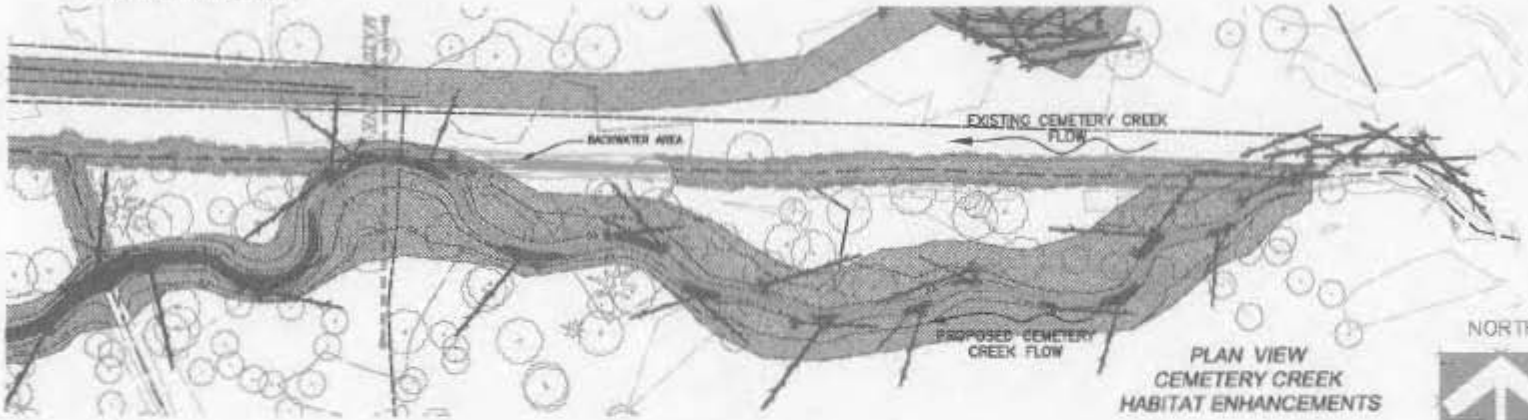
PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT

PROJECT NO: 00-02-23

inter-fluve, inc.

Preliminary
-Not for Construction-



PLAN VIEW
CEMETERY CREEK
HABITAT ENHANCEMENTS

NORTH

0 FEET 50
PLAN SCALE

PLAN LEGEND

- EXISTING TREES
- EXISTING CREEK
- EXISTING UTILITY
- EXISTING 1 FT CONTOUR
- 54 DESIGN 1 FT CONTOUR
- LIMIT OF DISTURBANCE
- DESIGN POOL
- LARGE WOOD PLACEMENT
- FORESTED AND SHRUB/SCRUB PLANTING AREA

CEMETERY CREEK HABITAT FEATURES

- ~ CREATION OF A MORE NATURALLY FUNCTIONING STREAM CORRIDOR
- ~ LARGE WOOD PLACEMENTS FOR COVER AND HABITAT DIVERSITY
- ~ BANK VEGETATION PROVIDES FOOD CHAIN SUPPORT, BANK STABILITY AND SHADE
- ~ EXISTING OVERHANGING TREES PROVIDE SHADE AND KEEP WATER TEMPERATURES LOW
- ~ IMPROVED NATURAL STREAM FUNCTION AND RIPARIAN INTERACTION
- ~ ENLARGED CAPACITY FOR CUTTHROAT TROUT

4 of 6

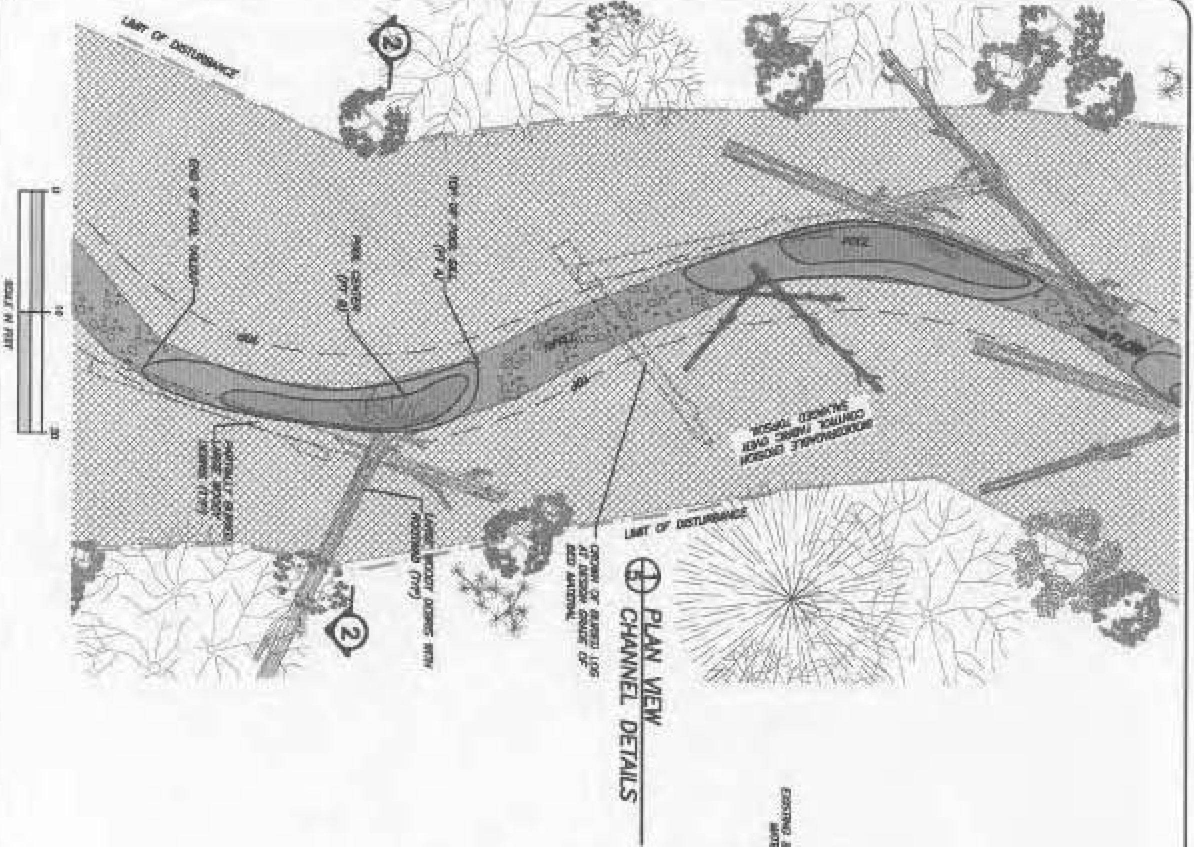
CEMETERY CREEK
PLAN VIEW
HABITAT PLAN EAST

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT

PROJECT NO. 09-27-21

inter-fluve, inc.



PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

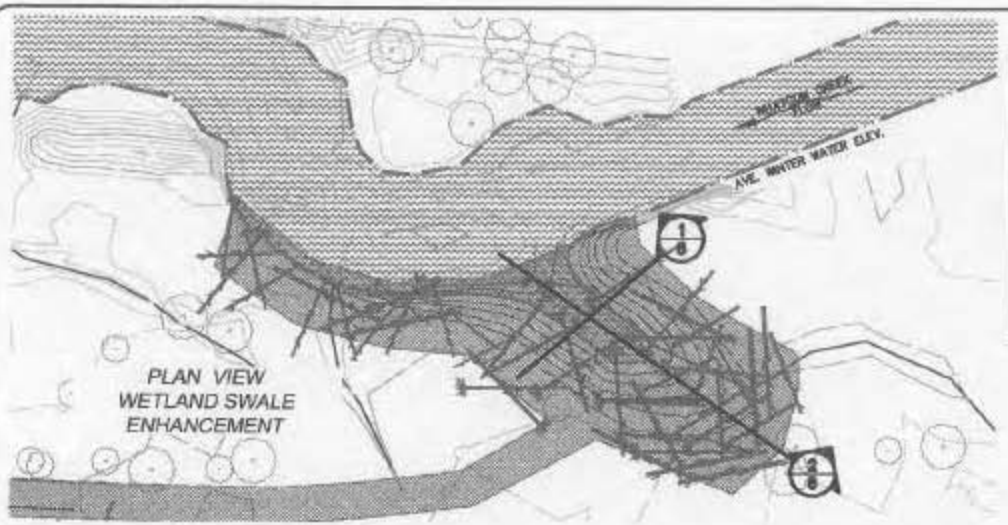
PROJECT NO: 00-112-23

CEMETERY CREEK TYPICAL CHANNEL DETAILS

DESIGNED BY	CHECKED BY
MM	LM
DRAWN BY	DATE
NS	11-30-01

5 of 6

Inter-fluve, inc.



PLAN LEGEND

- EXISTING TREES
- EXISTING CREEK
- EXISTING UTILITY
- EXISTING 1 FT CONTOUR
- DESIGN 1 FT CONTOUR
- LIMIT OF DISTURBANCE
- LARGE WOOD PLACEMENT
- FORESTED AND SHRUB/SCRUB PLANTING AREA

NORTH

0 FEET 50

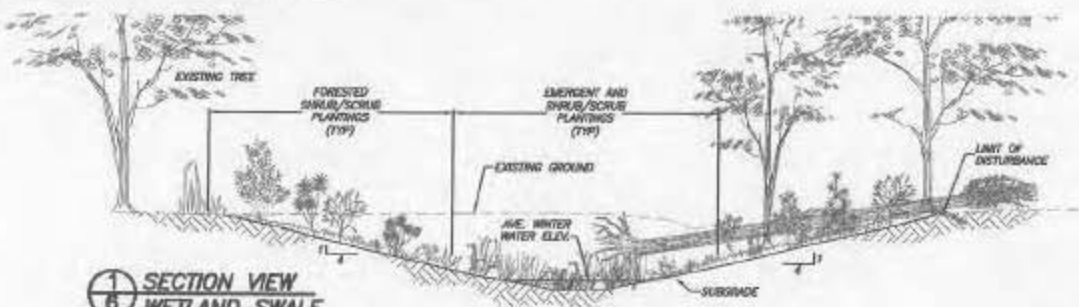
PLAN SCALE

HABITAT ENHANCEMENT AREA FEATURES

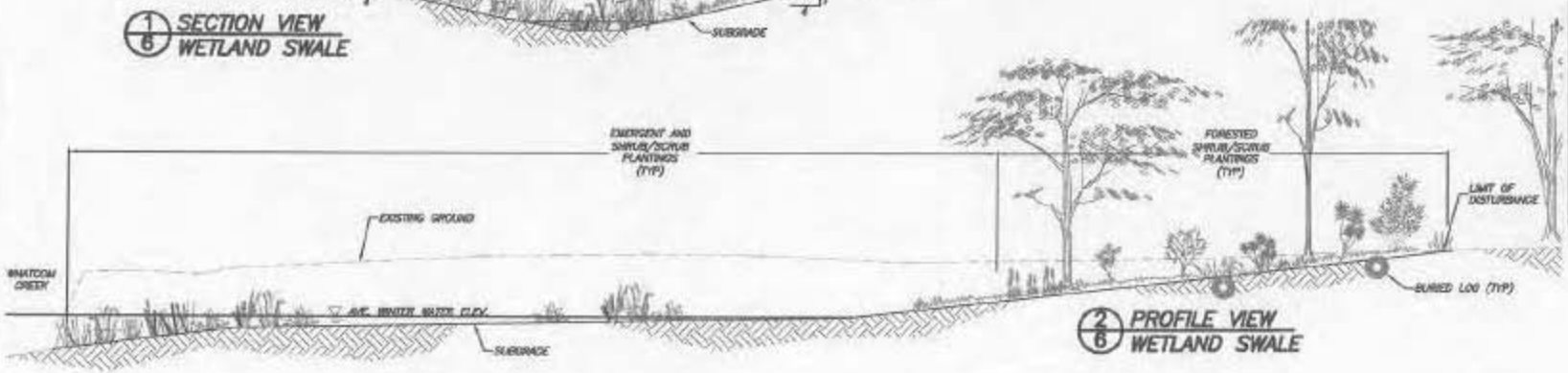
~ CREATION OF HIGH-FLOW FISH REFUGE HABITAT

~ TRANSITION VEGETATION PROVIDES SHADE AND FOOD CHAIN SUPPORT

~ ENHANCED WETLAND AREA ALONG WHATCOM CREEK



1/6 SECTION VIEW WETLAND SWALE



2/6 PROFILE VIEW WETLAND SWALE

DESIGNED BY	DRAWN BY	CHECKED BY
MM	LM	NS

6 of 6

Cemetery Creek
Plan View
Wetland Swale Enhancement

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

PROJECT NO. 00-02-23

inter-fluve, inc.

11.0 Figures and Photographs

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[43] Background photograph in Figure 32, 37-40 courtesy of Walker and Associates, Seattle Washington. Copyright 1999

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11.0 Figures and Photographs

Figure 1: Incident Location

Figure 2: Break Site

Figure 3: Excavation of Pipe

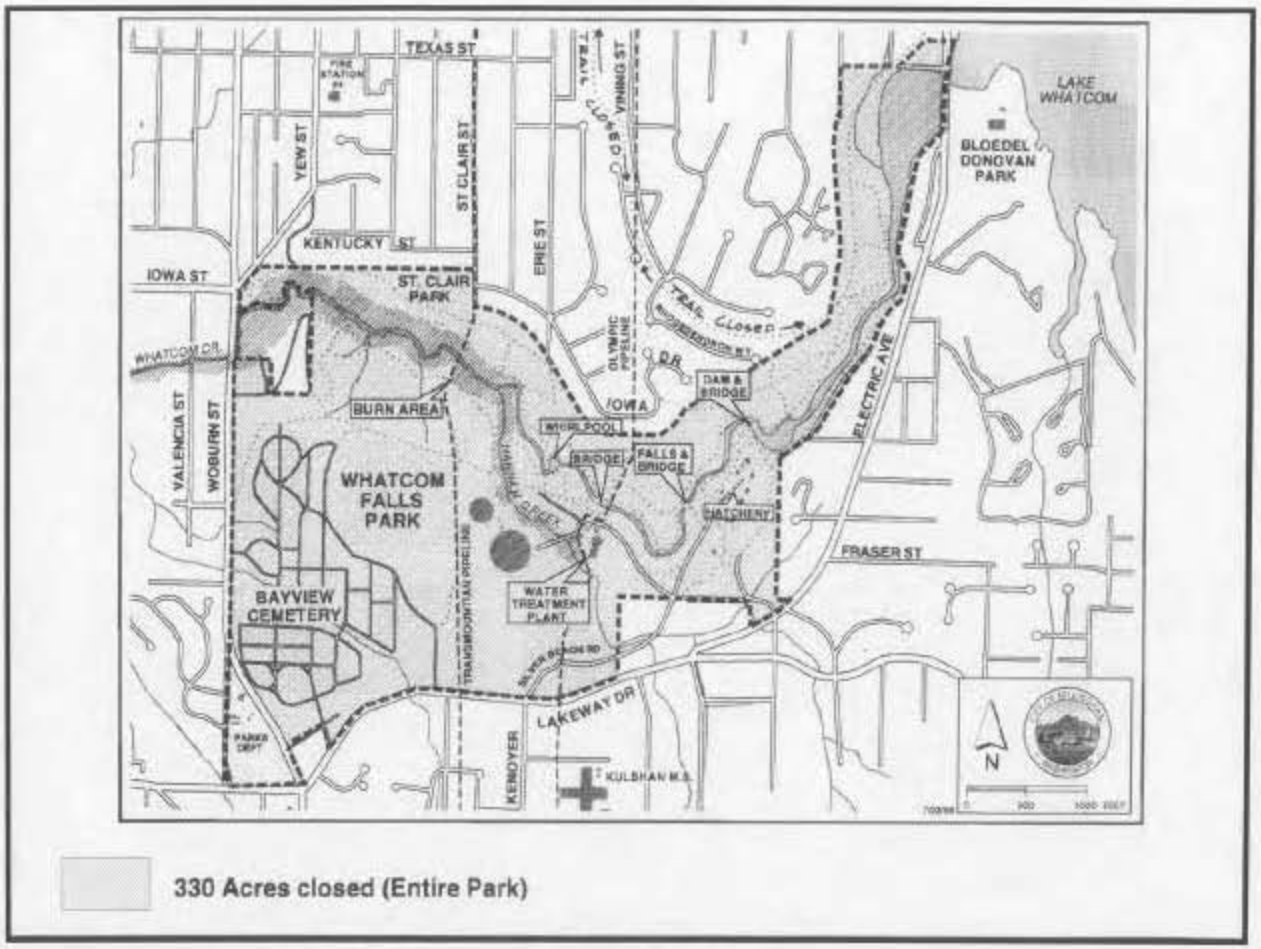


Figure 4: Map of Whatcom Falls Park Area. Closures from June 10-17, 1999

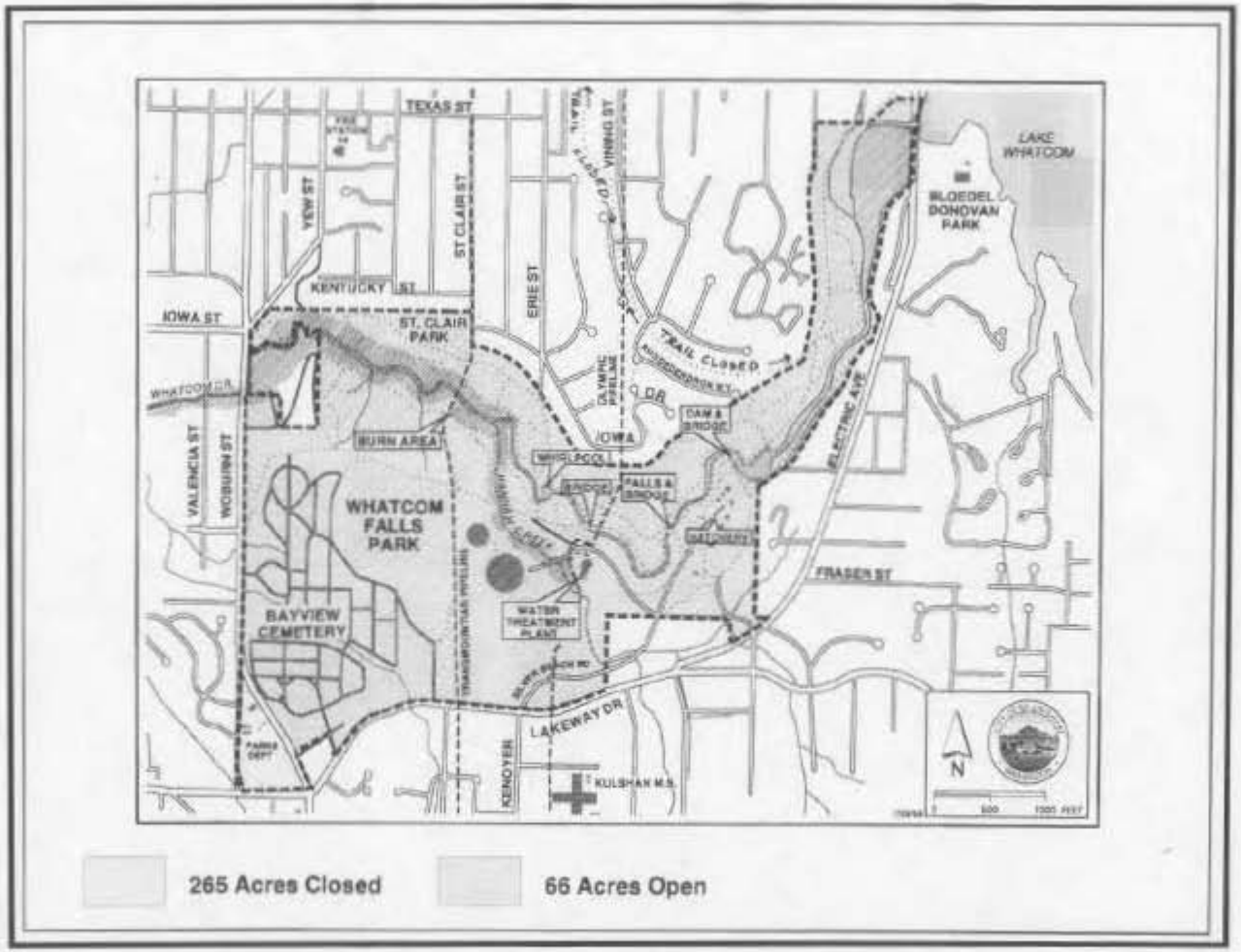


Figure 5: Map of Whatcom Falls Park. Closures from June 17-July 10, 1999

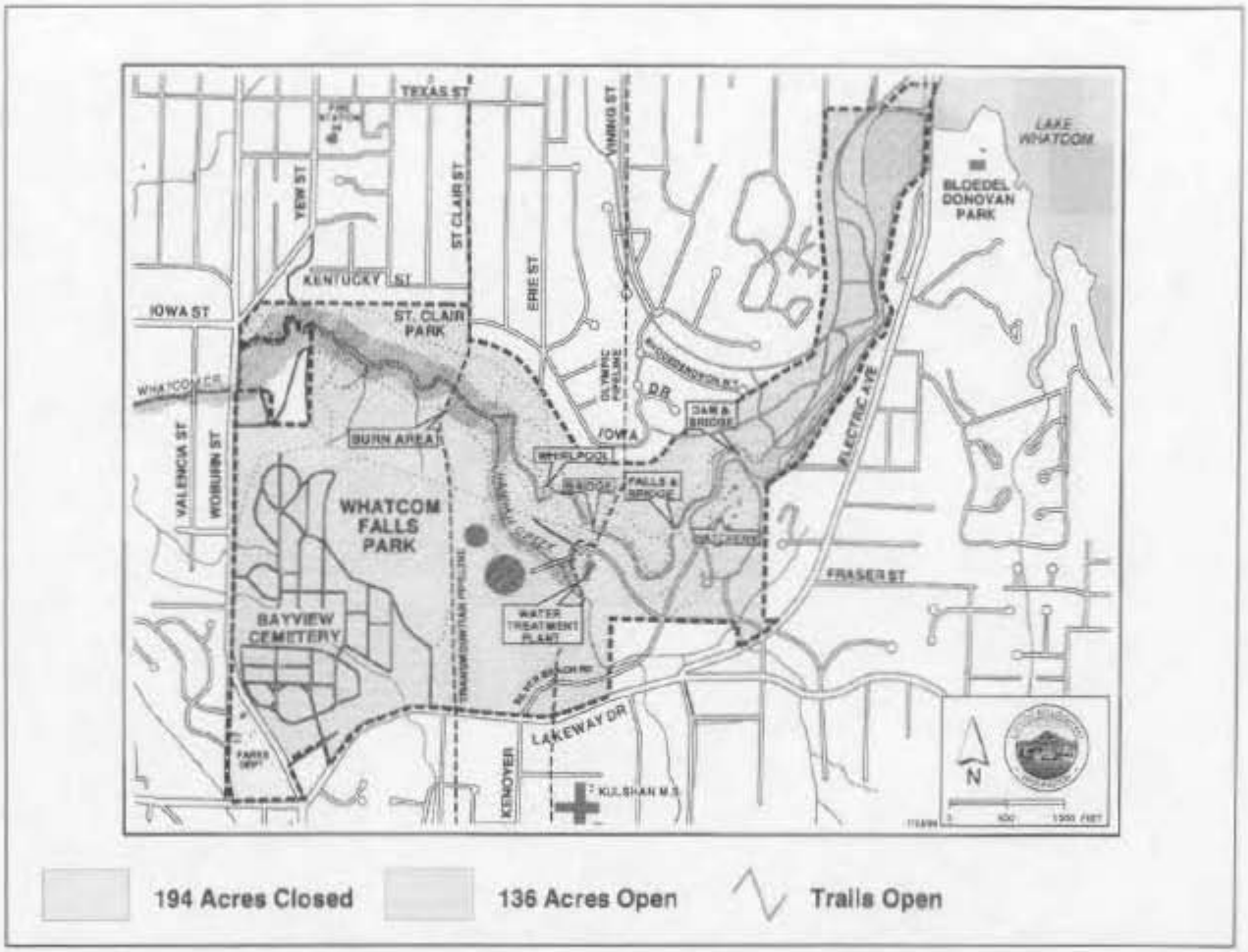


Figure 6: Map of Whatcom Falls Park. Closures from July 10-15, 1999

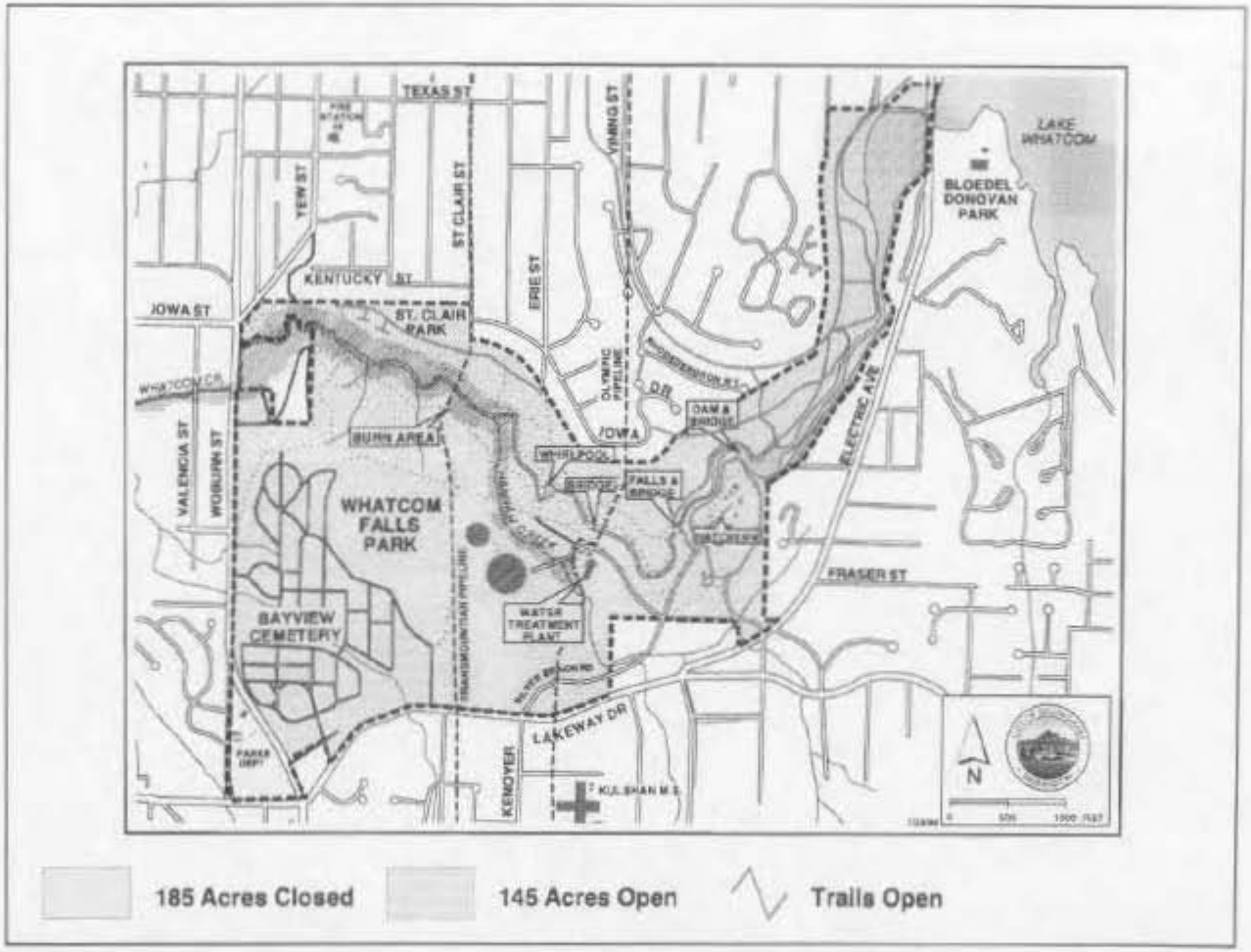
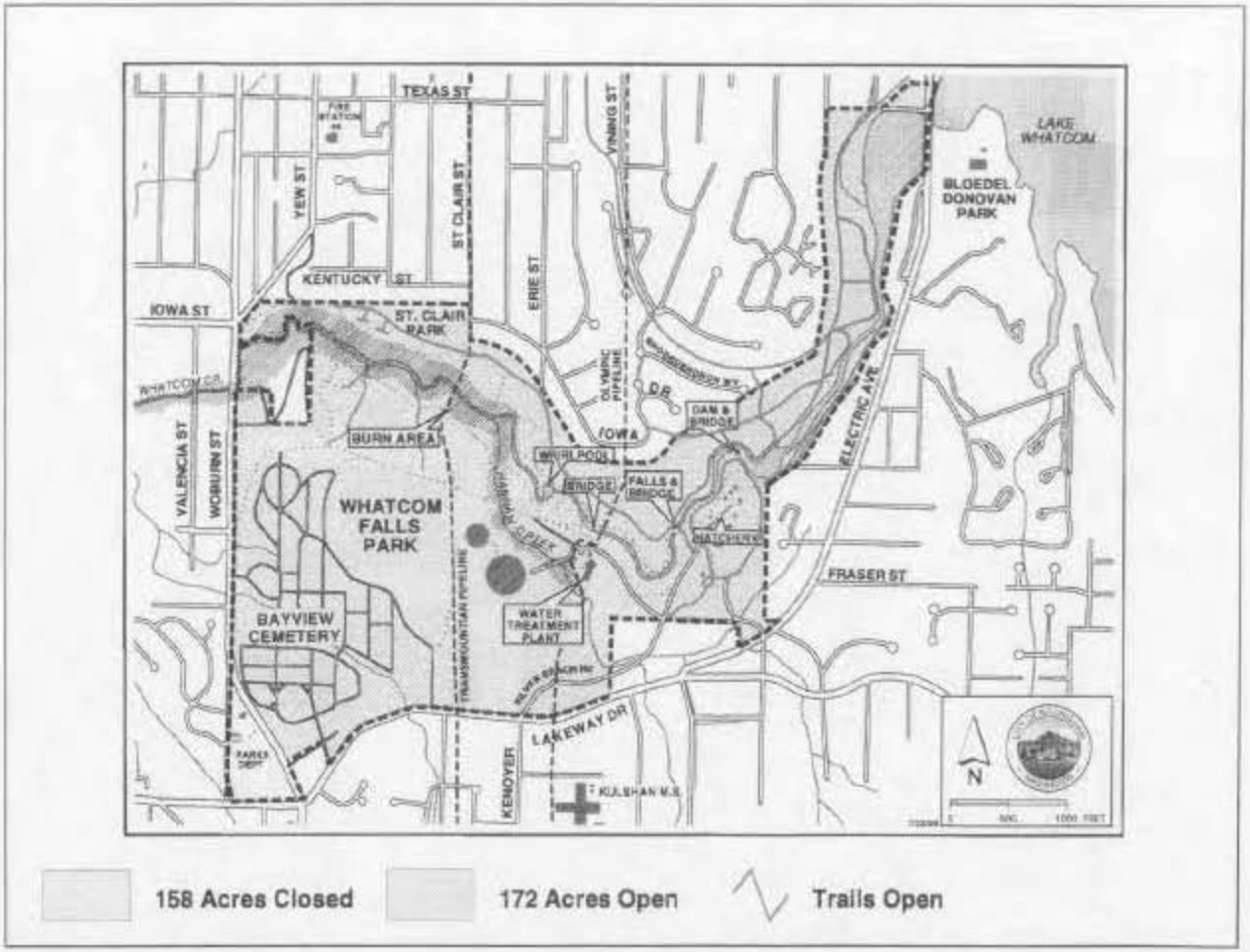


Figure 7: Map of Whatcom Falls Park. Closures from July 16-23, 1999



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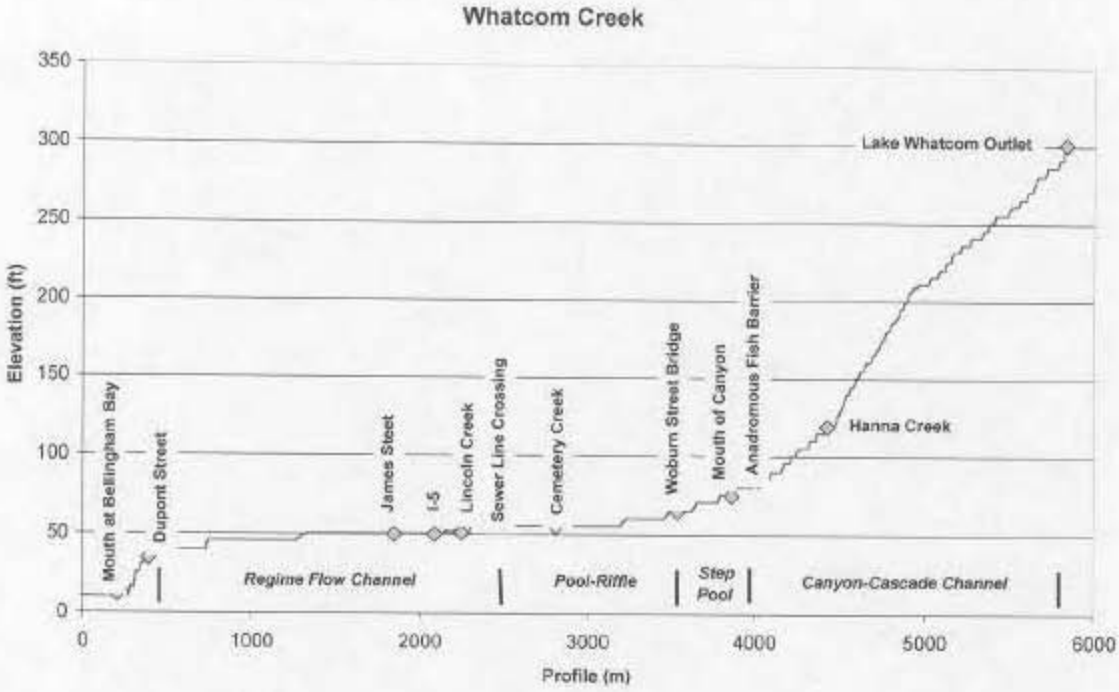


Figure 10: Whatcom Creek Vertical Profile

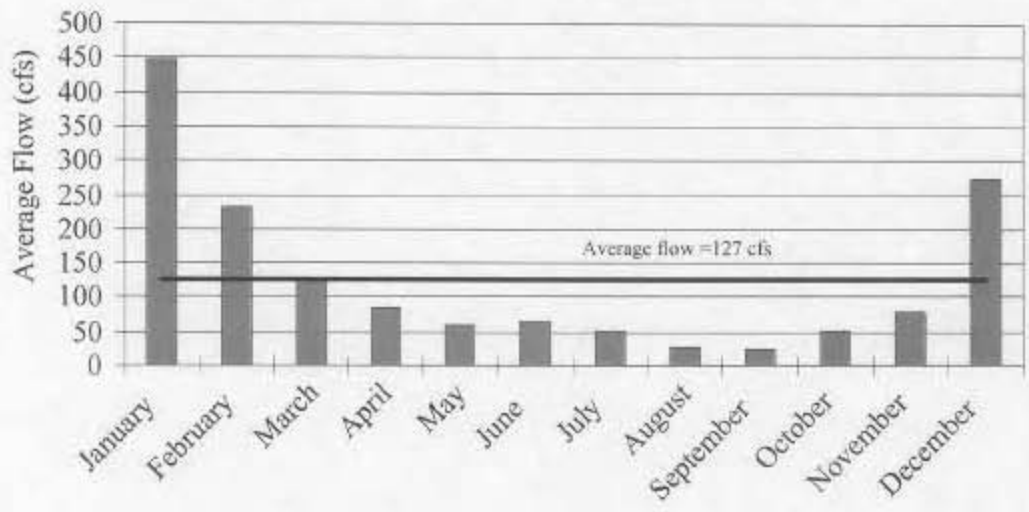


Figure 11: Average Monthly Flows for Whatcom Creek

Exhibit 4-1

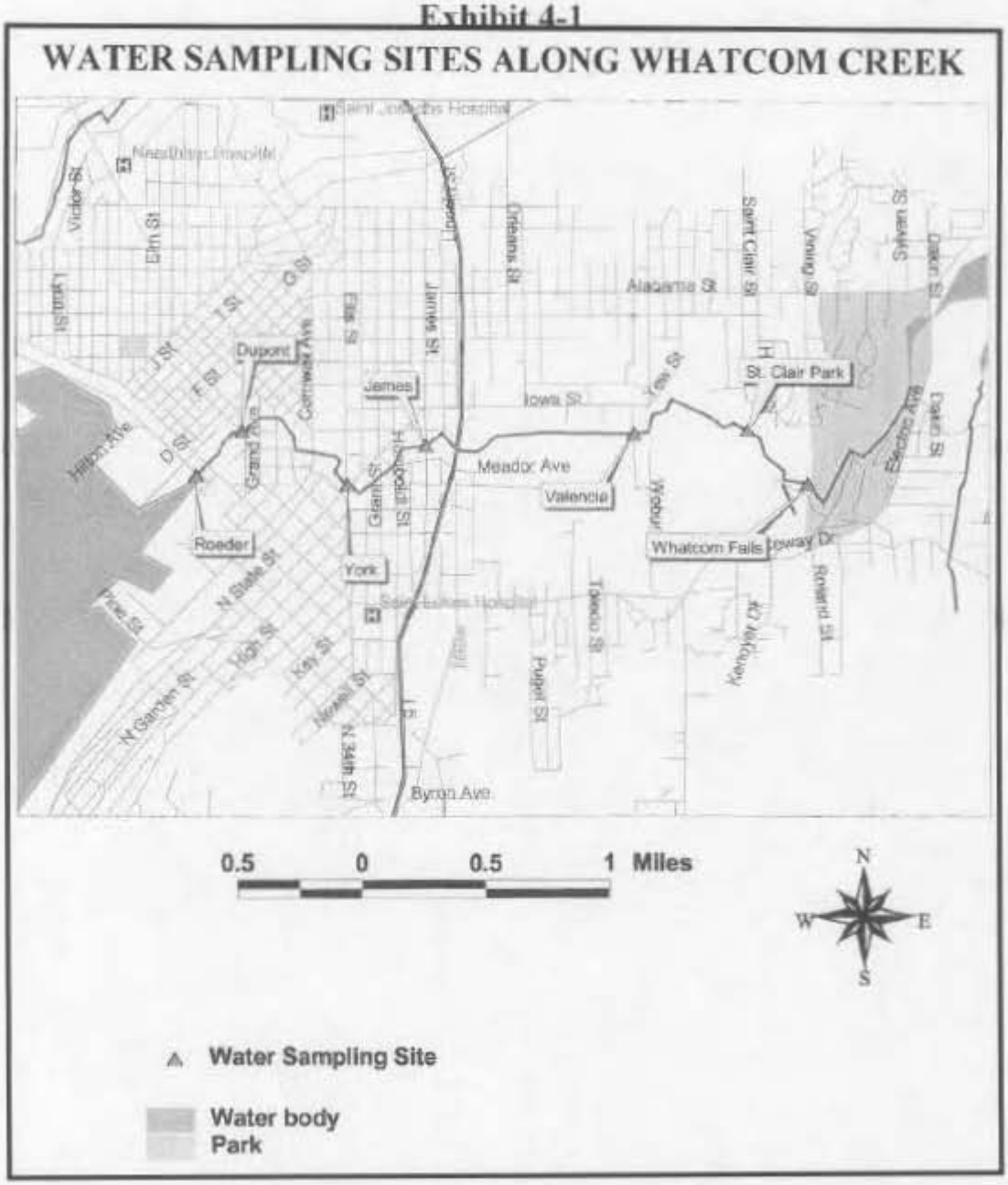
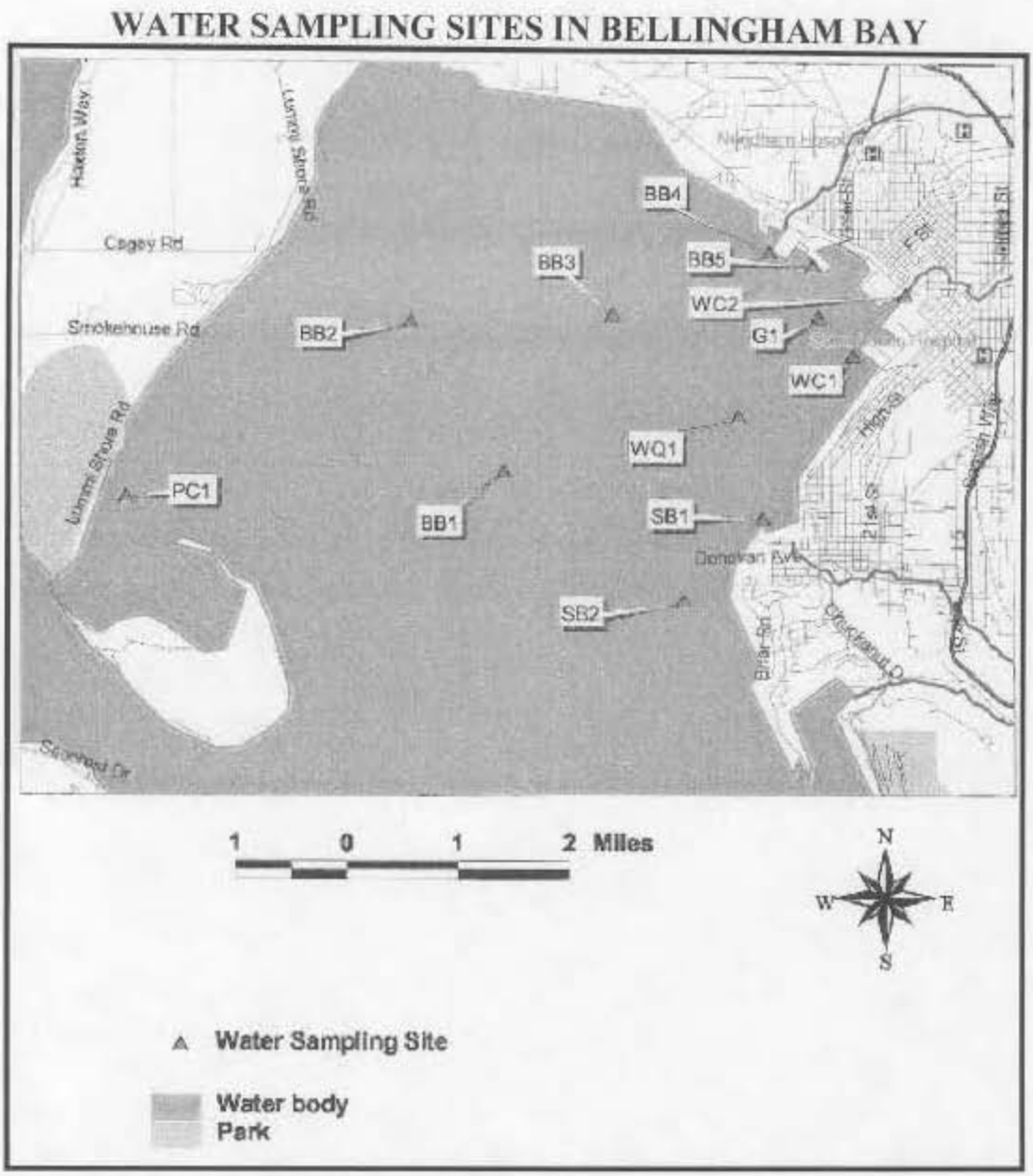


Figure 12: Map of Water Sampling Stations in Creek



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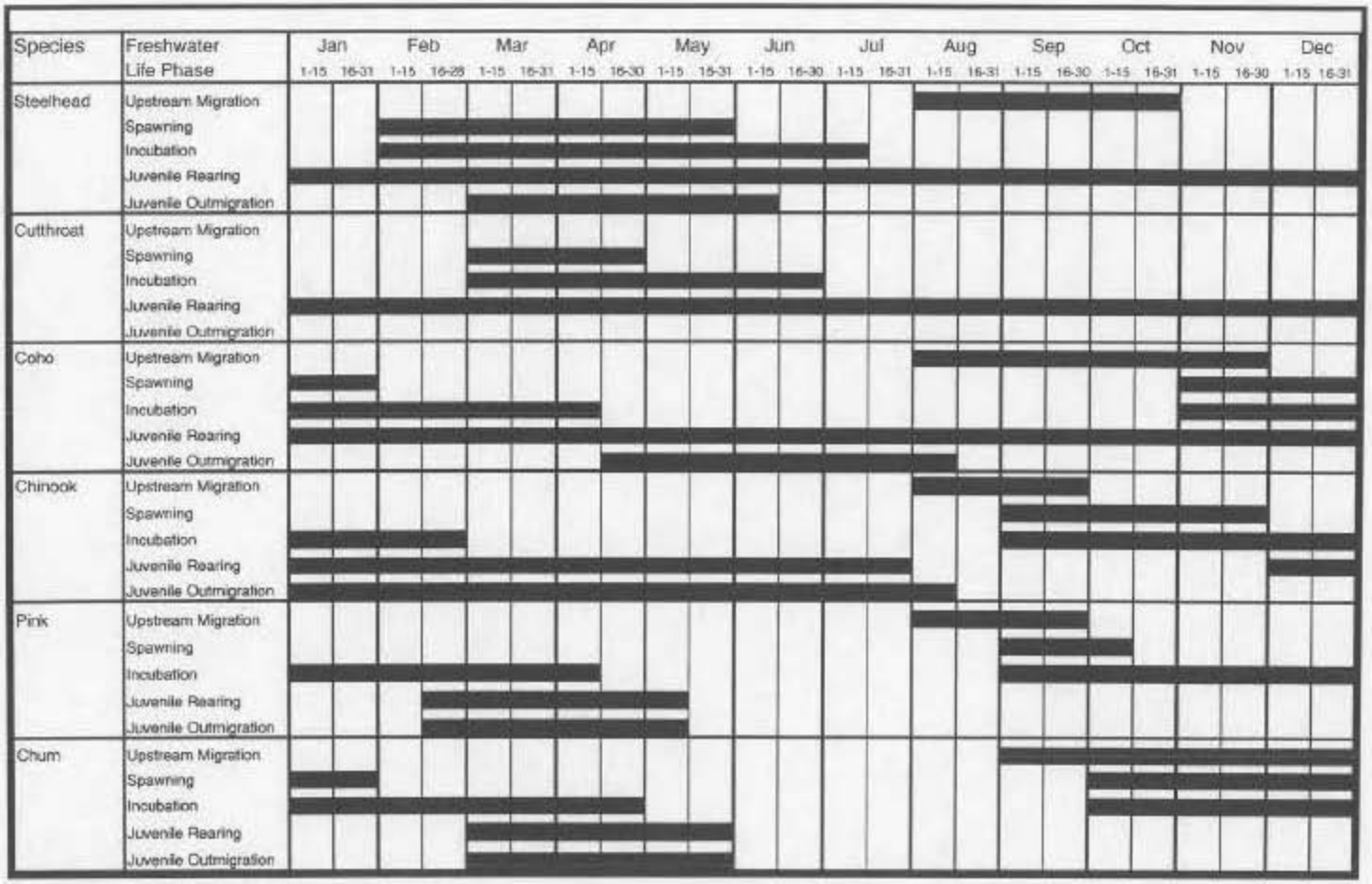

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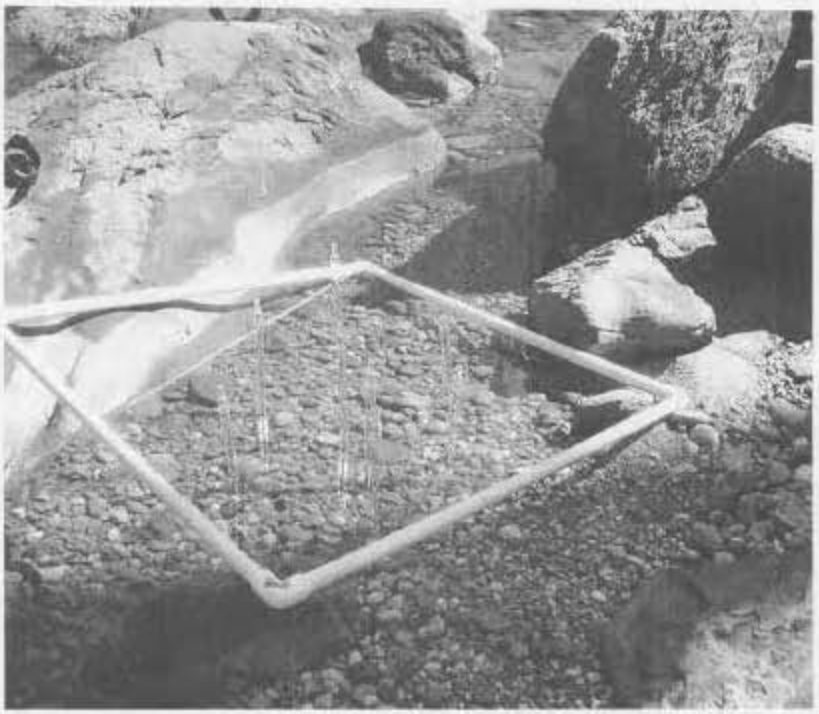

Figure 24: Sampling with pipette

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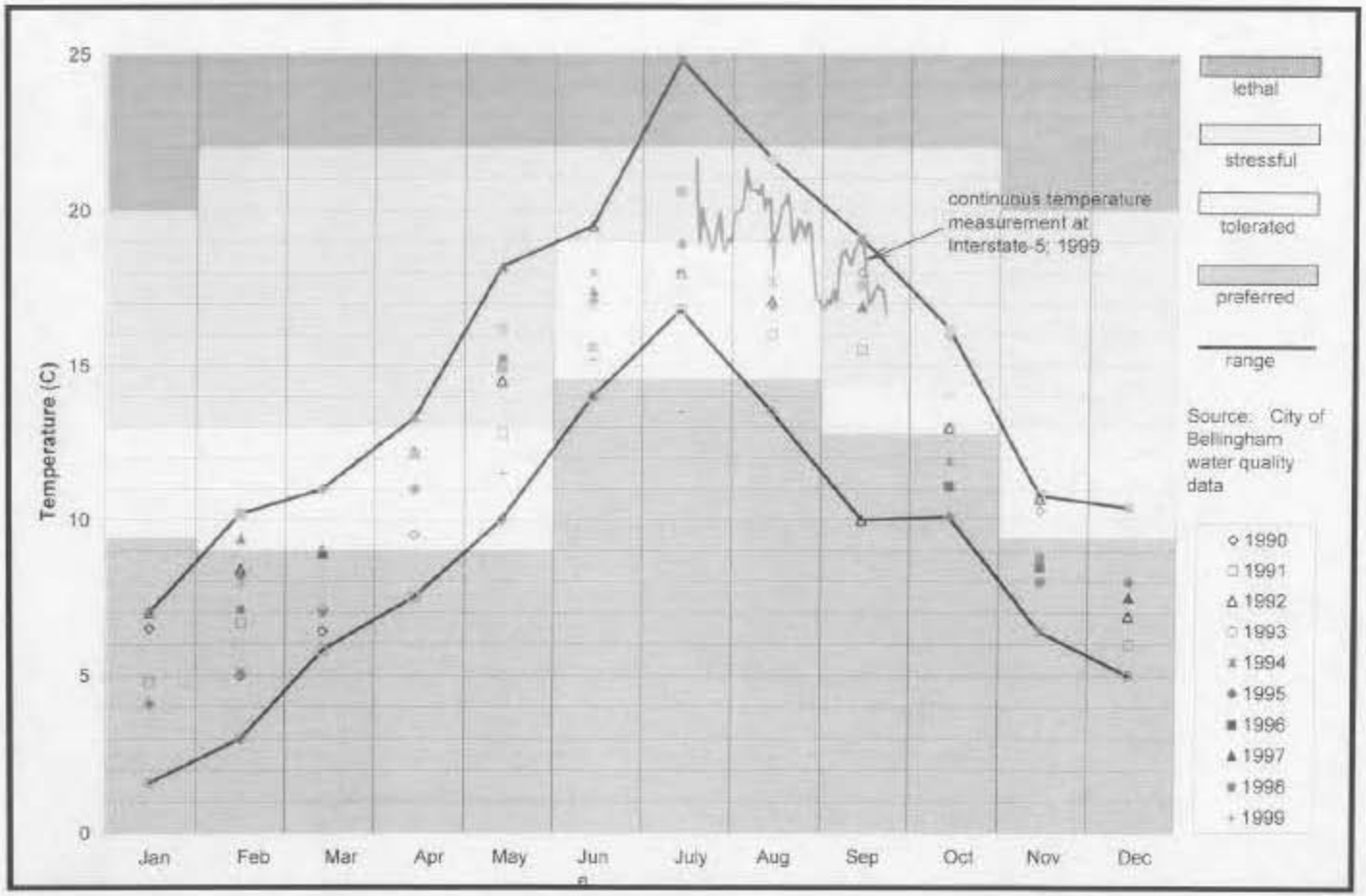

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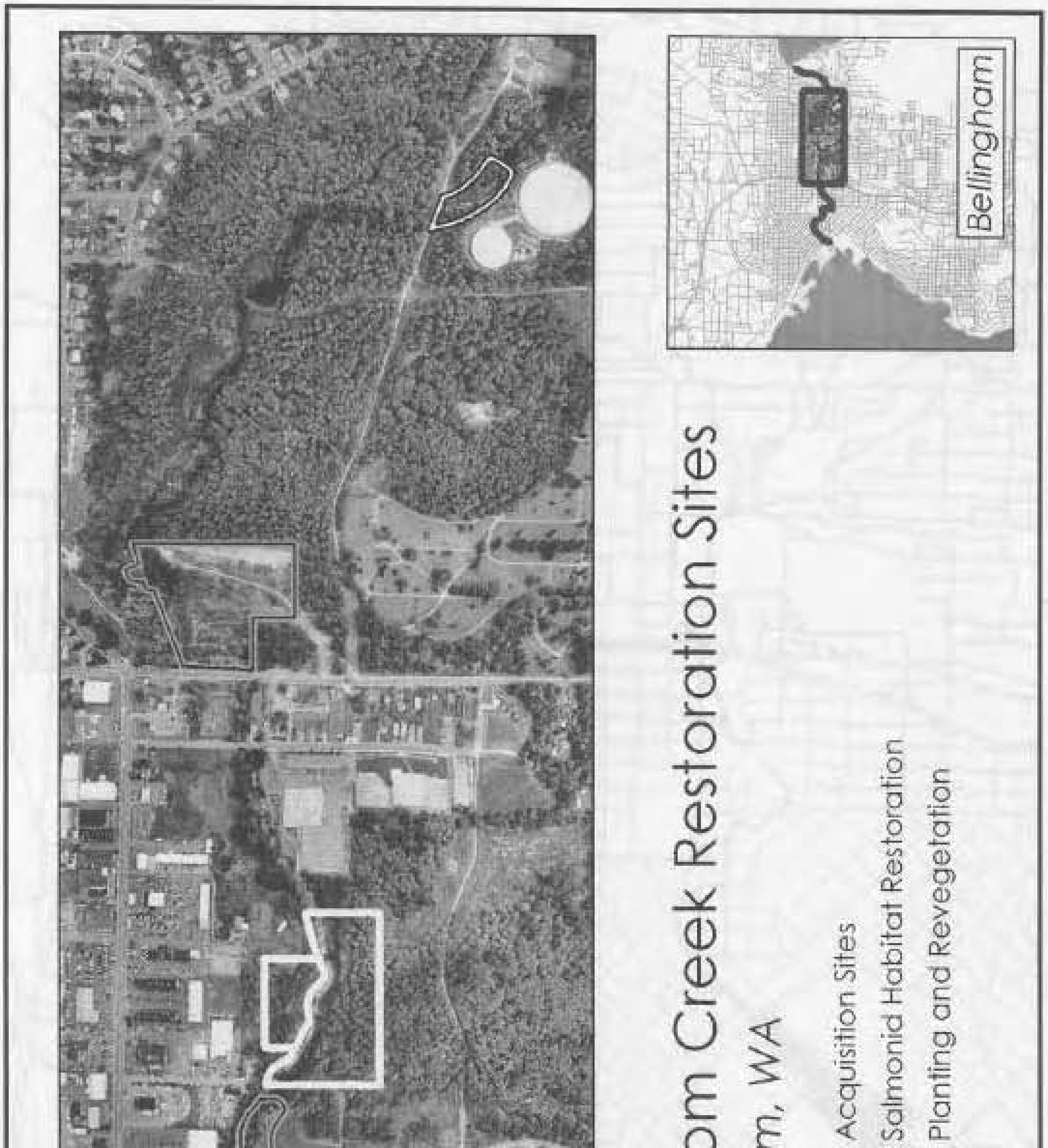

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Figure 34: Picture of Haskell project site (May 2000)

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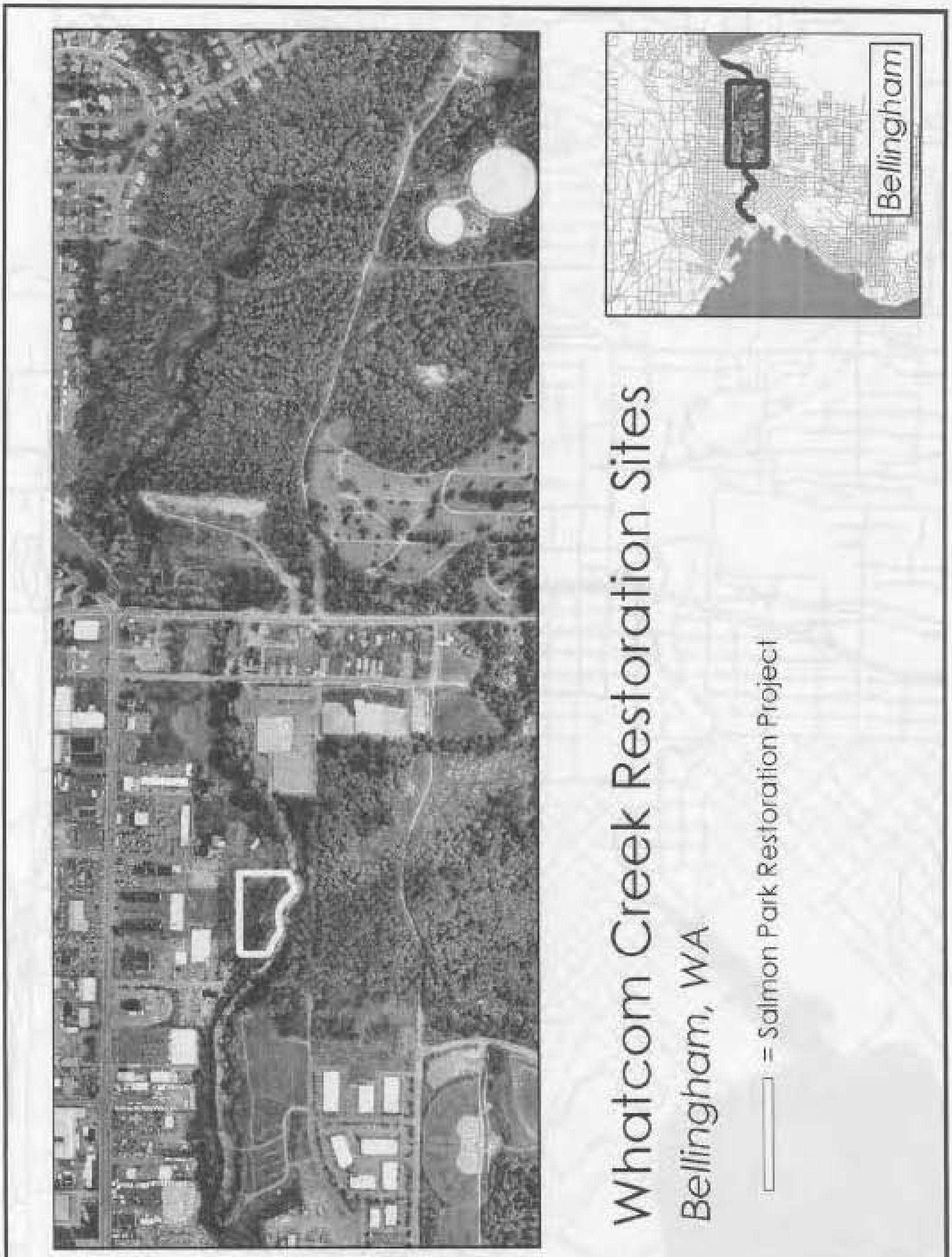


Figure 37: Salmon Park Location Map

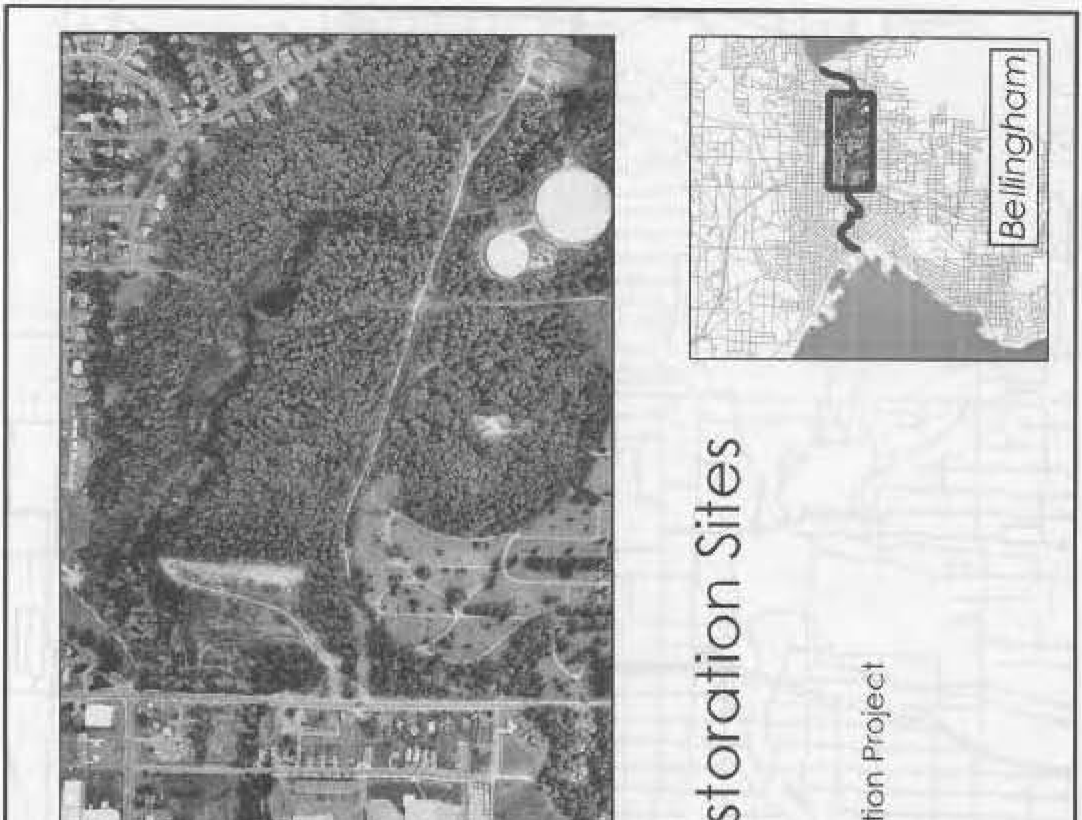


Figure 38: Cemetery Creek Project Location Map

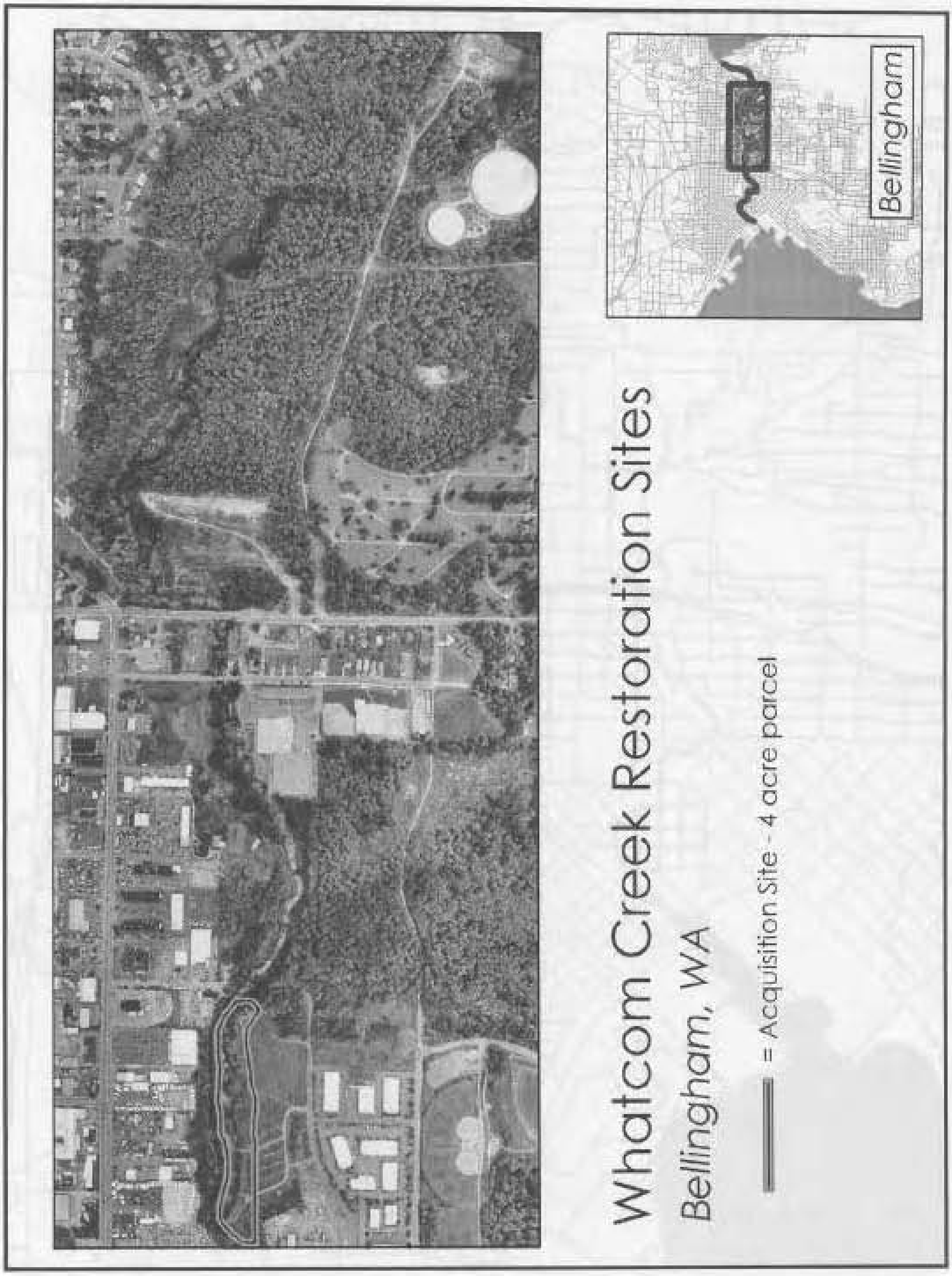


Figure 39: 4-Acre Acquisition Site

Figure 40: 9.5-Acre Acquisition Site

PROJECT PURPOSES/USES

- ENHANCE AVAILABLE REARING AND SEASONAL REFUGE HABITATS TO ONE OF THE PRIMARY SALMONID SPAWNING AREAS IN WHATCOM CREEK
- IMPROVE HABITAT CONDITIONS PRIMARILY FOR CUTTHROAT TROUT, WITH ADDITIONAL BENEFITS FOR COHO SALMON AND OTHER NATIVE FISH SPECIES

SALMON PARK

- CREATE HIGH-FLOW FISH REFUGE AND REARING HABITAT ALONG WHATCOM CREEK
- STREAMSIDE BERMS TO BE REMOVED AND THE STREAM BANKS MODIFIED TO RESTORE CHANNEL MIGRATION RATES, INCREASE FLOODPLAIN AREA, IMPROVE FLOOD STORAGE CAPACITY, AND FACILITATE NATURAL GENERATION OF SALMONID HABITAT

CEMETERY CREEK

- CREATE A NEW STREAM CHANNEL AND THREE COLD WATER FISH REARING PONDS IN LOWER CEMETERY CREEK
- IMPROVE THERMAL REFUGE HABITAT DURING PERIODS OF ELEVATED STREAM TEMPERATURES IN WHATCOM CREEK (SUMMERTIME)
- PLACE LARGE WOODY DEBRIS IN PORTIONS OF CEMETERY CREEK AND WHATCOM CREEK TO IMPROVE HABITAT DIVERSITY AND COVER
- CREATE MORE NATURALLY FUNCTIONING STREAM CORRIDORS

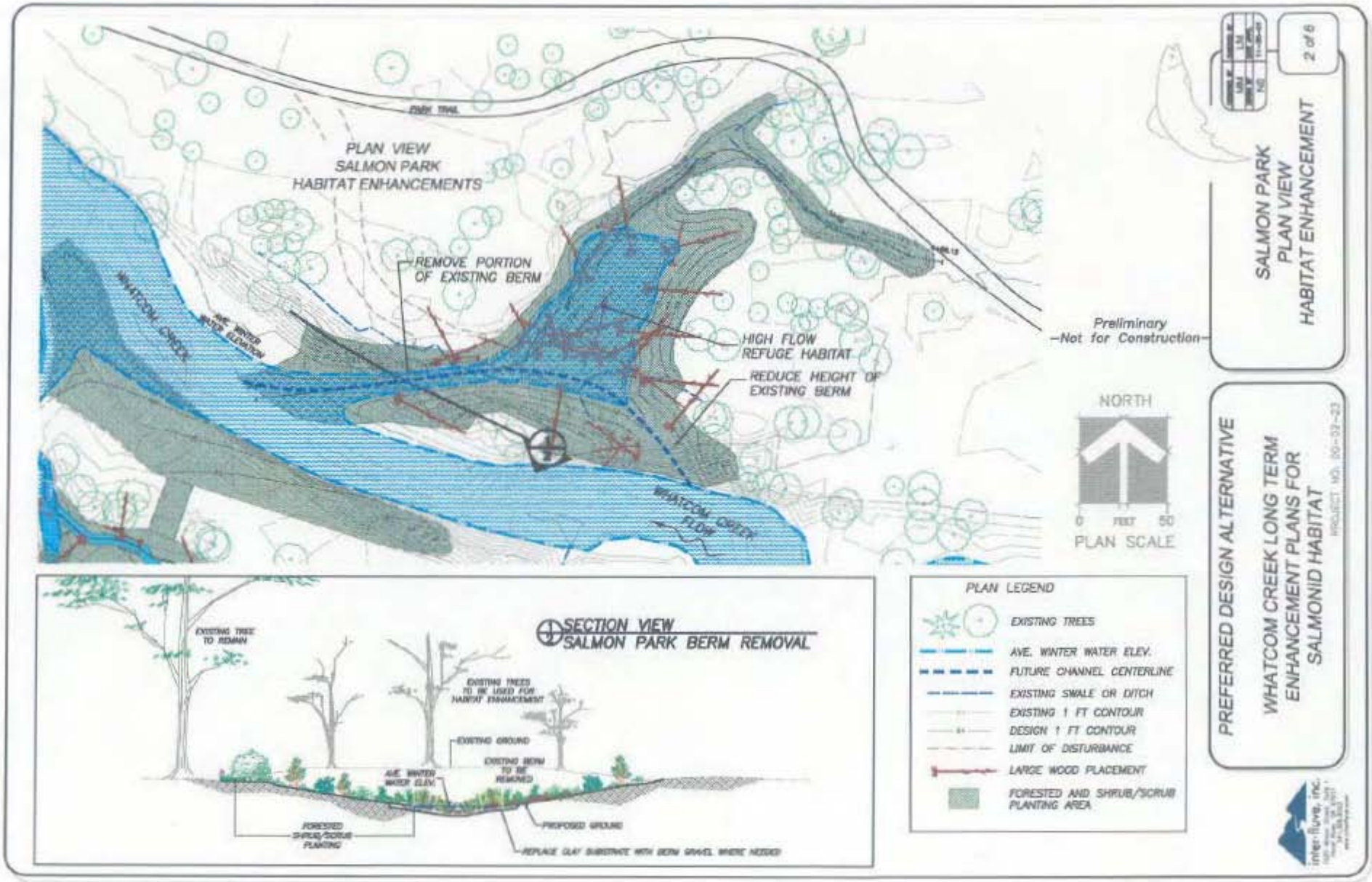
1 of 6

Aerial View
Enhancement Areas

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

inter fluve, inc.


PARK TRAIL
PLAN VIEW
SALMON PARK
HABITAT ENHANCEMENTS
REMOVE PORTION
OF EXISTING BERM
WHATCOM CANOE
AVE. WINTER
WATER ELEVATION
HIGH FLOW
REFUGE HABITAT
REDUCE HEIGHT OF
EXISTING BERM
WHATCOM CREEK
FLOW
Preliminary
-Not for Construction-
NORTH
0 FEET 50
PLAN SCALE
SECTION VIEW
SALMON PARK BERM REMOVAL
EXISTING TREE
TO REMAIN
EXISTING TREES
TO BE USED FOR
HABITAT ENHANCEMENT
EXISTING GROUND
EXISTING BERM
TO BE
REMOVED
AVE. WINTER
WATER ELEV.
FORESTED
SHRUB/SCRUB
PLANTING
PROPOSED GROUND
REPLACE CLAY SUBSTRATE WITH BERM GRAVEL WHERE NEEDED
PLAN LEGEND
EXISTING TREES
AVE. WINTER WATER ELEV.
FUTURE CHANNEL CENTERLINE
EXISTING SWALE OR DITCH
EXISTING 1 FT CONTOUR
DESIGN 1 FT CONTOUR
LIMIT OF DISTURBANCE
LARGE WOOD PLACEMENT
FORESTED AND SHRUB/SCRUB
PLANTING AREA
SALMON PARK
PLAN VIEW
HABITAT ENHANCEMENT
2 of 6
PREFERRED DESIGN ALTERNATIVE
WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT
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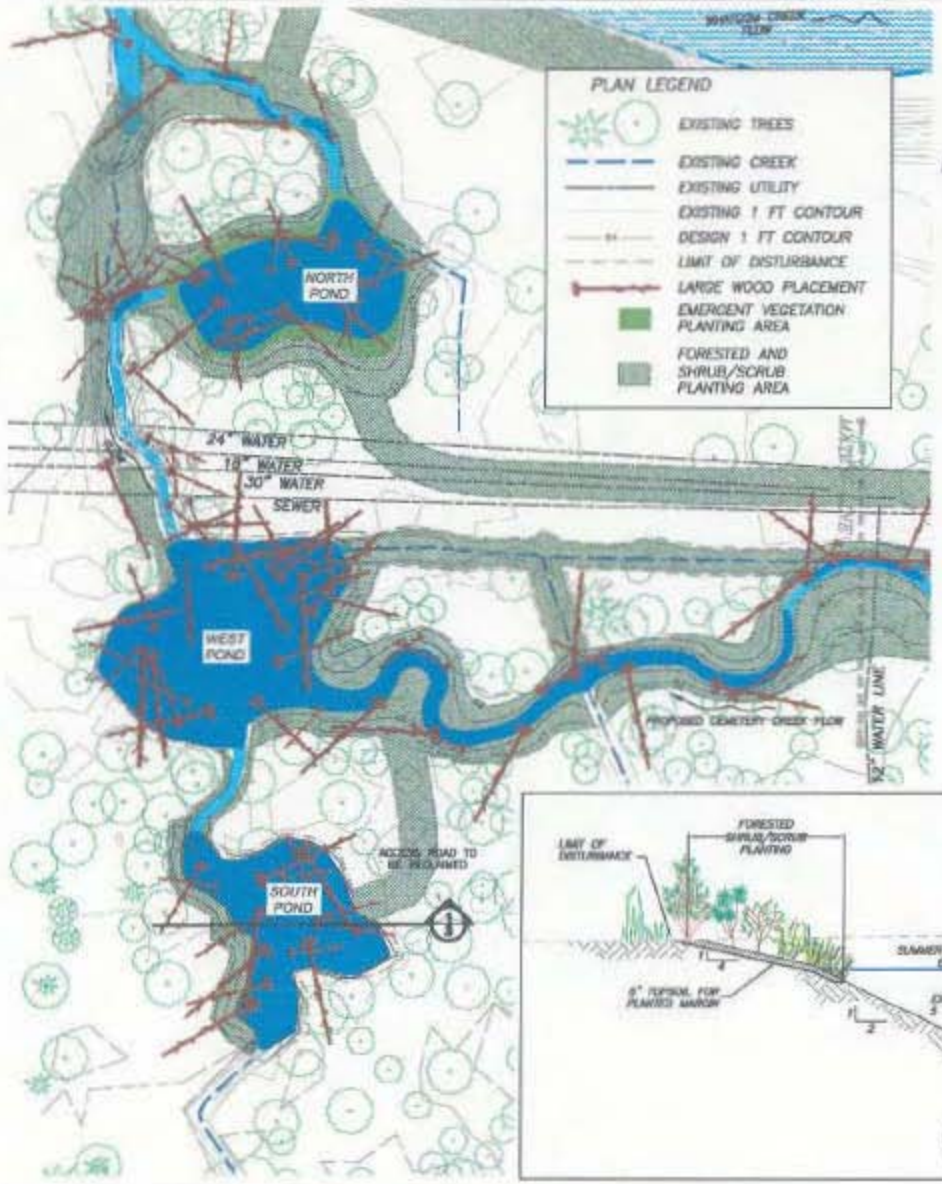


PLAN VIEW
CEMETERY CREEK
HABITAT ENHANCEMENTS

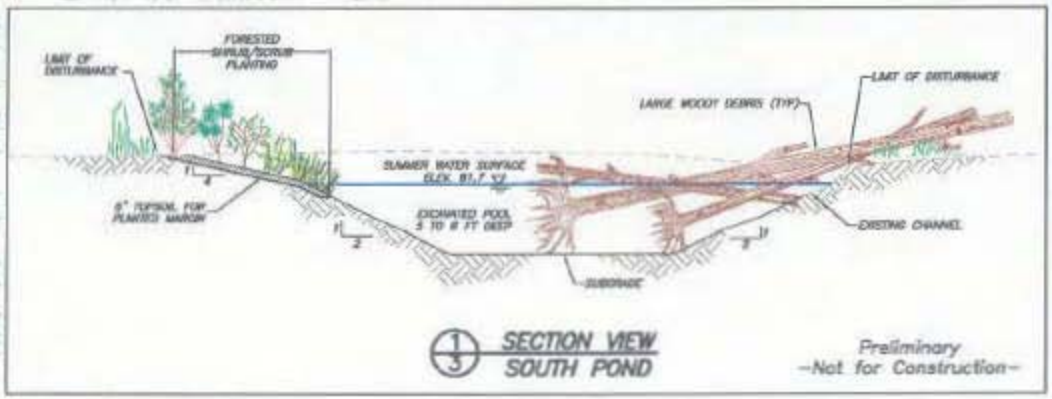
NORTH

0 FEET 50

PLAN SCALE

SALMONID HABITAT FEATURES

- ~ CREATION OF A MORE NATURALLY FUNCTIONING STREAM CORRIDOR AND THREE COLD-WATER FISH REARING PONDS IN LOWER CEMETERY CREEK
- ~ PROVIDES ADDITIONAL THERMAL REFUGE HABITAT DURING PERIODS OF ELEVATED WATER TEMPERATURES IN WHATCOM CREEK (SUMMERTIME)
- ~ NEAR STREAM VEGETATION PROVIDES SHADE AND FOOD CHAIN SUPPORT
- ~ LARGE WOOD PLACEMENTS FOR COVER, REFUGE, AND HABITAT DIVERSITY
- ~ ENLARGED CAPACITY FOR NATIVE SALMONIDS



1/3 SECTION VIEW
SOUTH POND

Preliminary
-Not for Construction-

3 of 6

Cemetery Creek
Plan View
Habitat Plan West

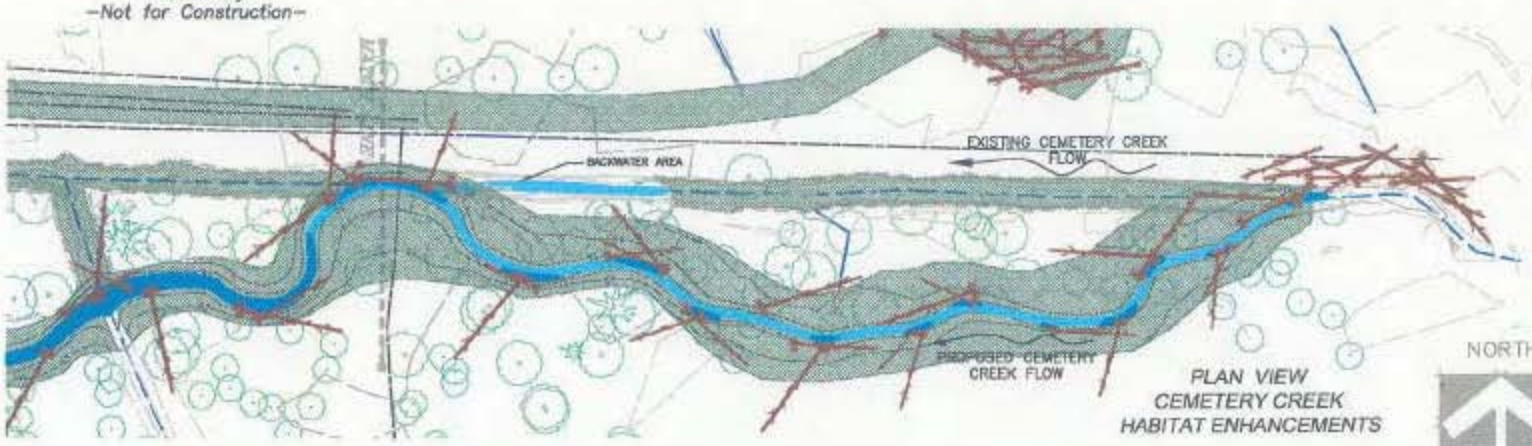
PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

PROJECT NO. 00-02-23

inter-fluve, inc.

Preliminary
-Not for Construction-



PLAN VIEW
CEMETERY CREEK
HABITAT ENHANCEMENTS

NORTH

0 FEET 50
PLAN SCALE

PLAN LEGEND

- EXISTING TREES
- EXISTING CREEK
- EXISTING UTILITY
- EXISTING 1 FT CONTOUR
- 54 DESIGN 1 FT CONTOUR
- LIMIT OF DISTURBANCE
- DESIGN POOL
- LARGE WOOD PLACEMENT
- FORESTED AND SHRUB/SCRUB PLANTING AREA

CEMETERY CREEK HABITAT FEATURES

- ~ CREATION OF A MORE NATURALLY FUNCTIONING STREAM CORRIDOR
- ~ LARGE WOOD PLACEMENTS FOR COVER AND HABITAT DIVERSITY
- ~ BANK VEGETATION PROVIDES FOOD CHAIN SUPPORT, BANK STABILITY AND SHADE
- ~ EXISTING OVERHANGING TREES PROVIDE SHADE AND KEEP WATER TEMPERATURES LOW
- ~ IMPROVED NATURAL STREAM FUNCTION AND RIPARIAN INTERACTION
- ~ ENLARGED CAPACITY FOR CUTTHROAT TROUT

DESIGNED BY	LM
DRAWN BY	SK/ AWL
CHECKED BY	11-28-01
APPROVED BY	NS

4 of 6

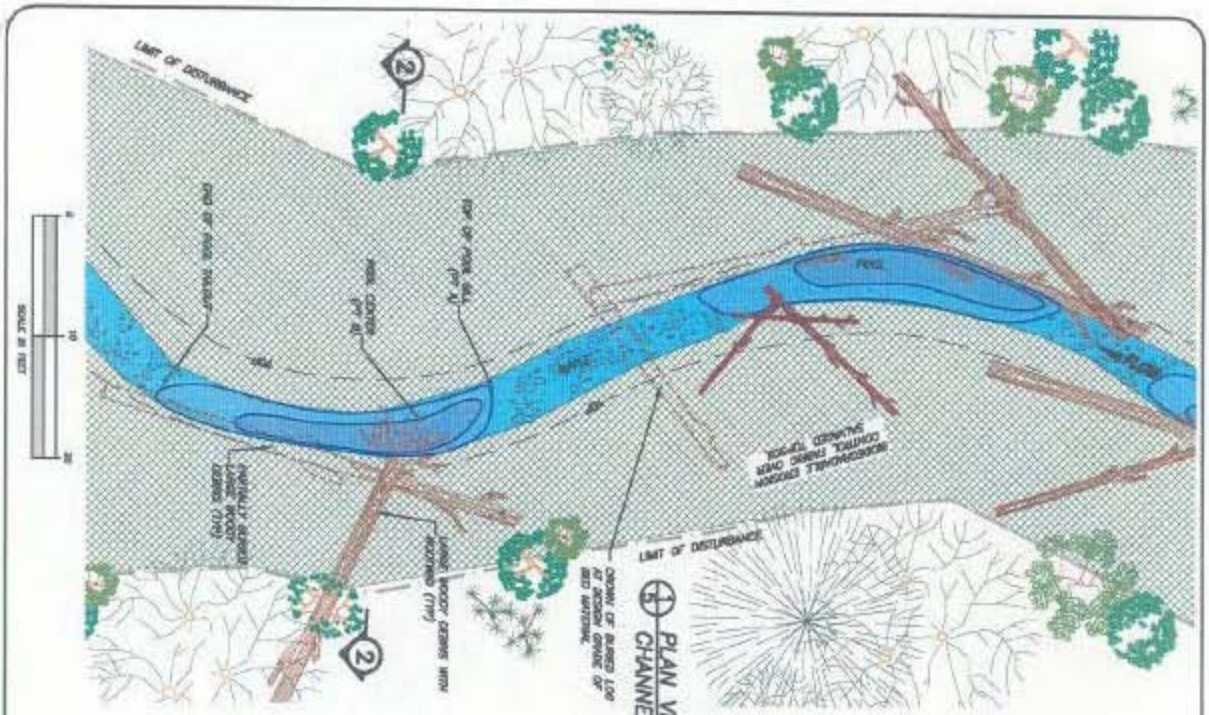
CEMETERY CREEK
PLAN VIEW
HABITAT PLAN EAST

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT

PROJECT NO. 00-02-23

inter-fluve, inc.



1 PLAN VIEW CHANNEL DETAILS

2 TYPICAL SECTION VIEW POOL

PREFERRED DESIGN ALTERNATIVE

WHATCOM CREEK LONG TERM ENHANCEMENT PLANS FOR SALMONID HABITAT

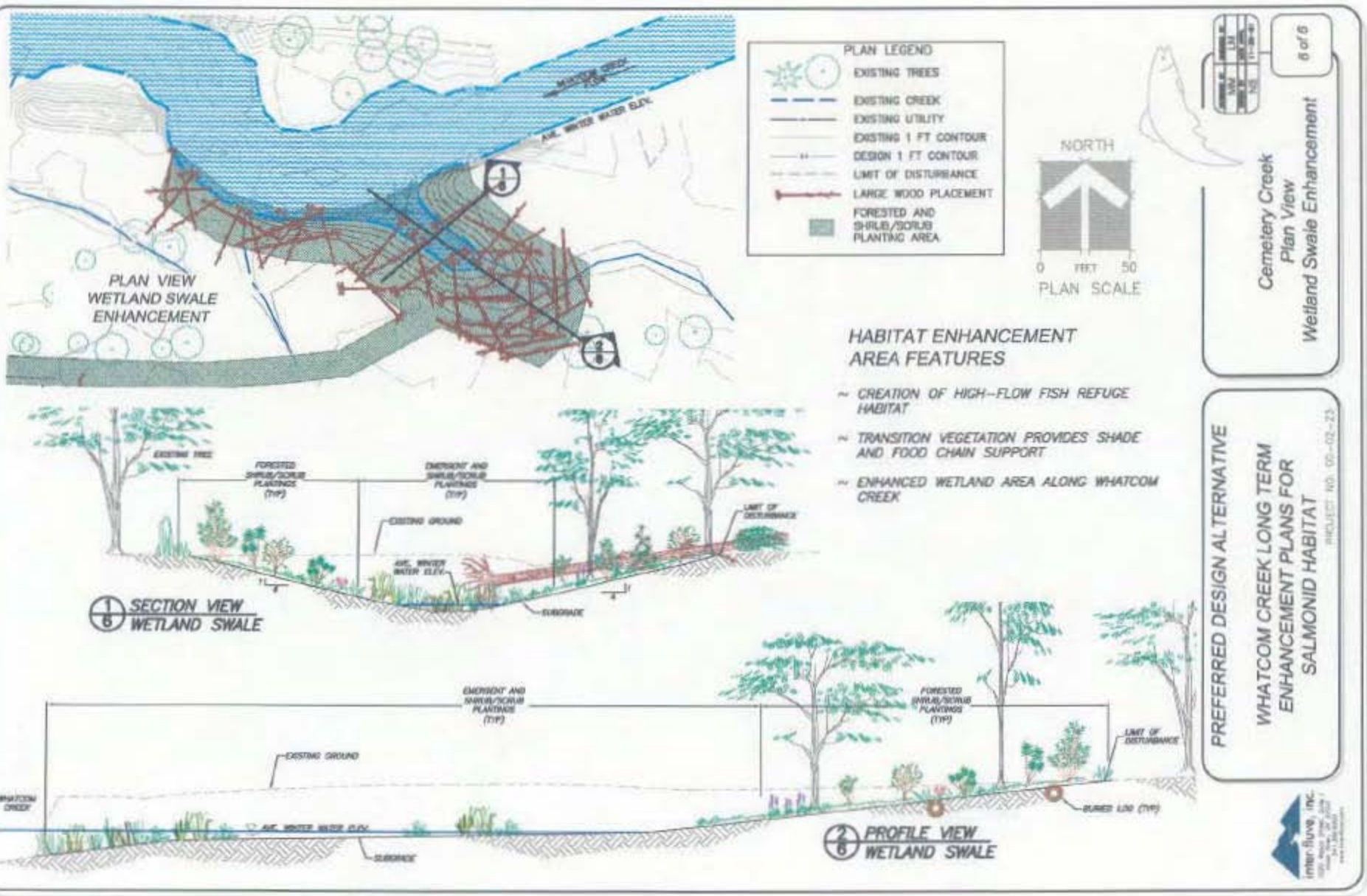
PROJECT NO: 00-02-23

CEMETERY CREEK TYPICAL CHANNEL DETAILS

DESIGNED BY	DRAWN BY
MM	LM
CHECKED BY	DATE ISSUED
NS	11-30-01

5 of 6

inter-fluve, inc.


PLAN LEGEND
EXISTING TREES
EXISTING CREEK
EXISTING UTILITY
EXISTING 1 FT CONTOUR
DESIGN 1 FT CONTOUR
LIMIT OF DISTURBANCE
LARGE WOOD PLACEMENT
FORESTED AND SHRUB/SCRUB PLANTING AREA
NORTH
0 FEET 50
PLAN SCALE
PLAN VIEW
WETLAND SWALE
ENHANCEMENT
HABITAT ENHANCEMENT
AREA FEATURES
~ CREATION OF HIGH--FLOW FISH REFUGE HABITAT
~ TRANSITION VEGETATION PROVIDES SHADE AND FOOD CHAIN SUPPORT
~ ENHANCED WETLAND AREA ALONG WHATCOM CREEK
EXISTING TREE
FORESTED SHRUB/SCRUB PLANTINGS (TYP)
EMERGENT AND SHRUB/SCRUB PLANTINGS (TYP)
EXISTING GROUND
LIMIT OF DISTURBANCE
AVG. WINTER WATER ELEV.
SUBGRADE
1/6 SECTION VIEW
WETLAND SWALE
EMERGENT AND SHRUB/SCRUB PLANTINGS (TYP)
FORESTED SHRUB/SCRUB PLANTINGS (TYP)
EXISTING GROUND
LIMIT OF DISTURBANCE
BURIED LOG (TYP)
AVG. WINTER WATER ELEV.
SUBGRADE
2/6 PROFILE VIEW
WETLAND SWALE
6 of 6
Cemetery Creek
Plan View
Wetland Swale Enhancement
PREFERRED DESIGN ALTERNATIVE
WHATCOM CREEK LONG TERM
ENHANCEMENT PLANS FOR
SALMONID HABITAT
PROJECT NO. 05-02-23
inter-fluve, inc.

11.0 Figures and Photographs

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Figure 16 – Davis, WDOE
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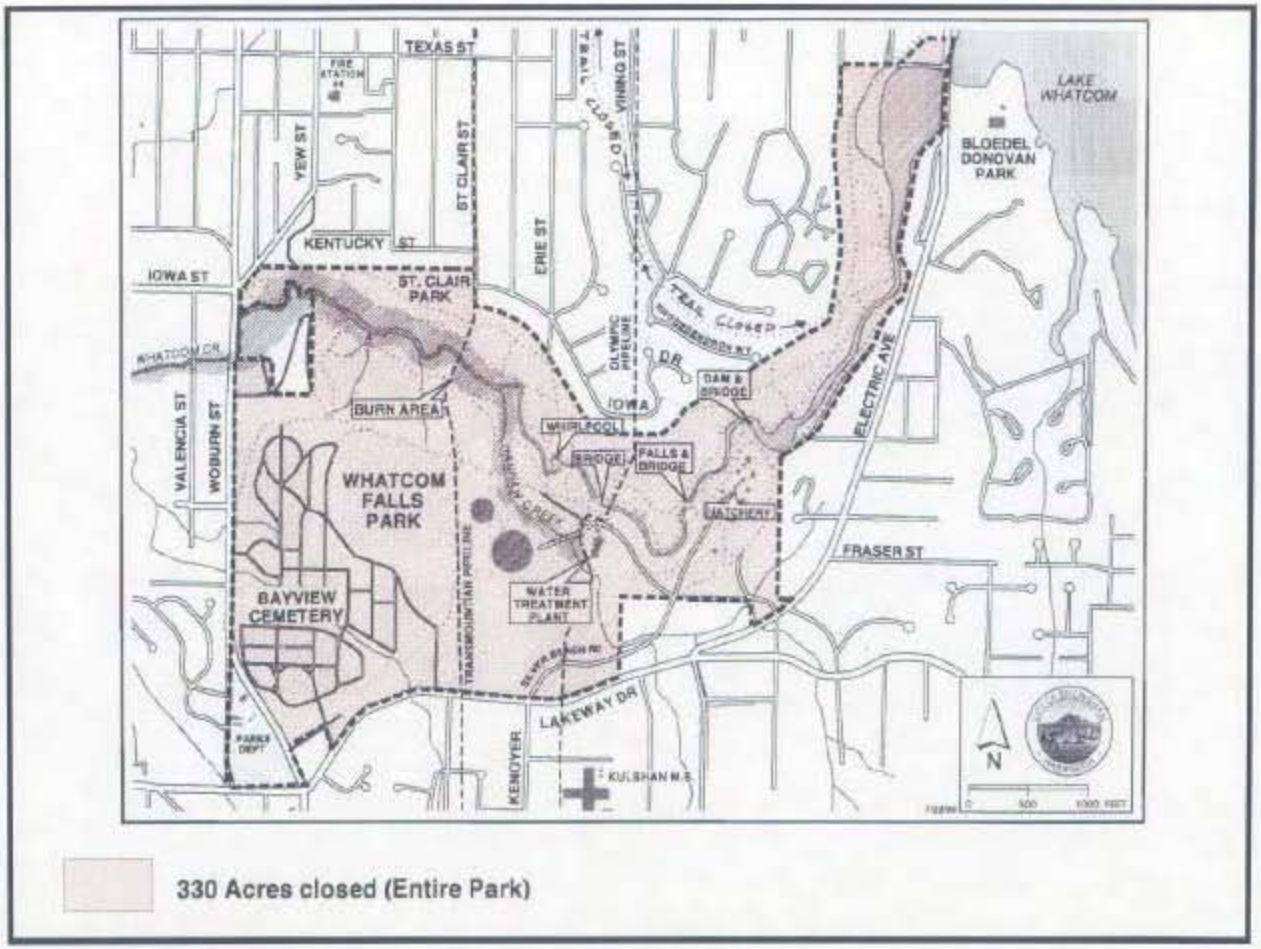
11.0 Figures and Photographs

Figure 1: Incident Location

Figure 2: Break Site

Figure 3: Excavation of Pipe



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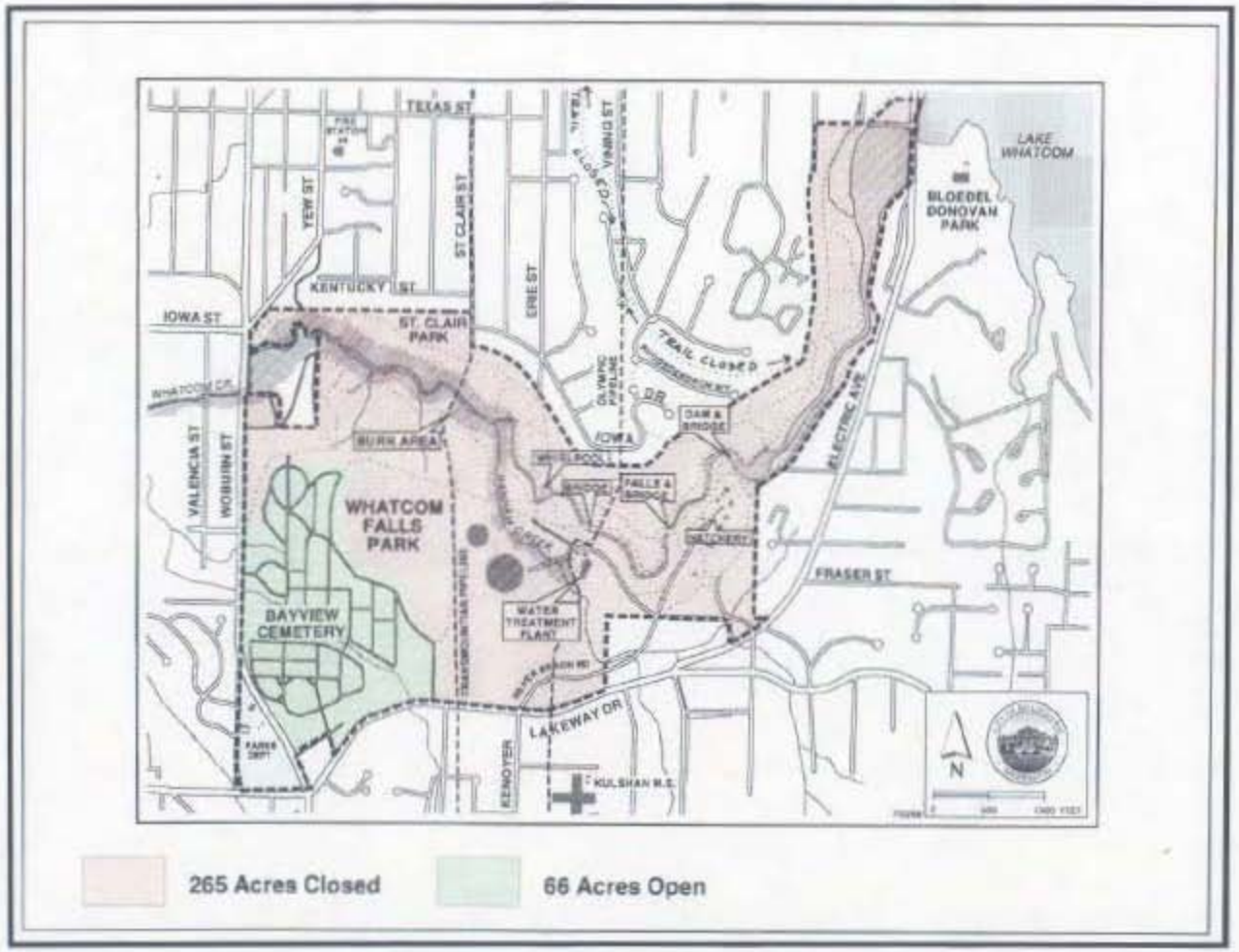
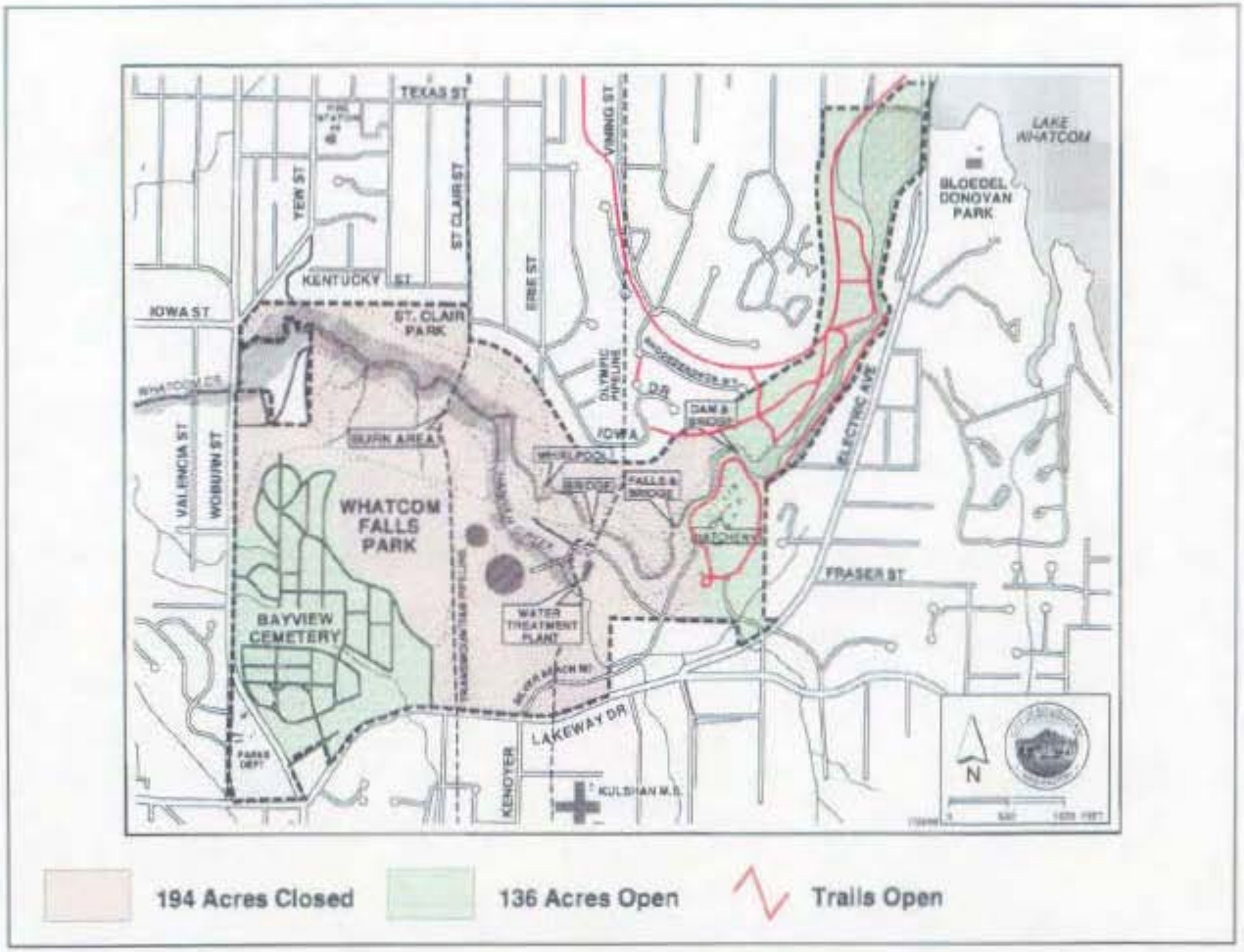


Figure 5: Map of Whatcom Falls Park. Closures from June 17-July 10, 1999



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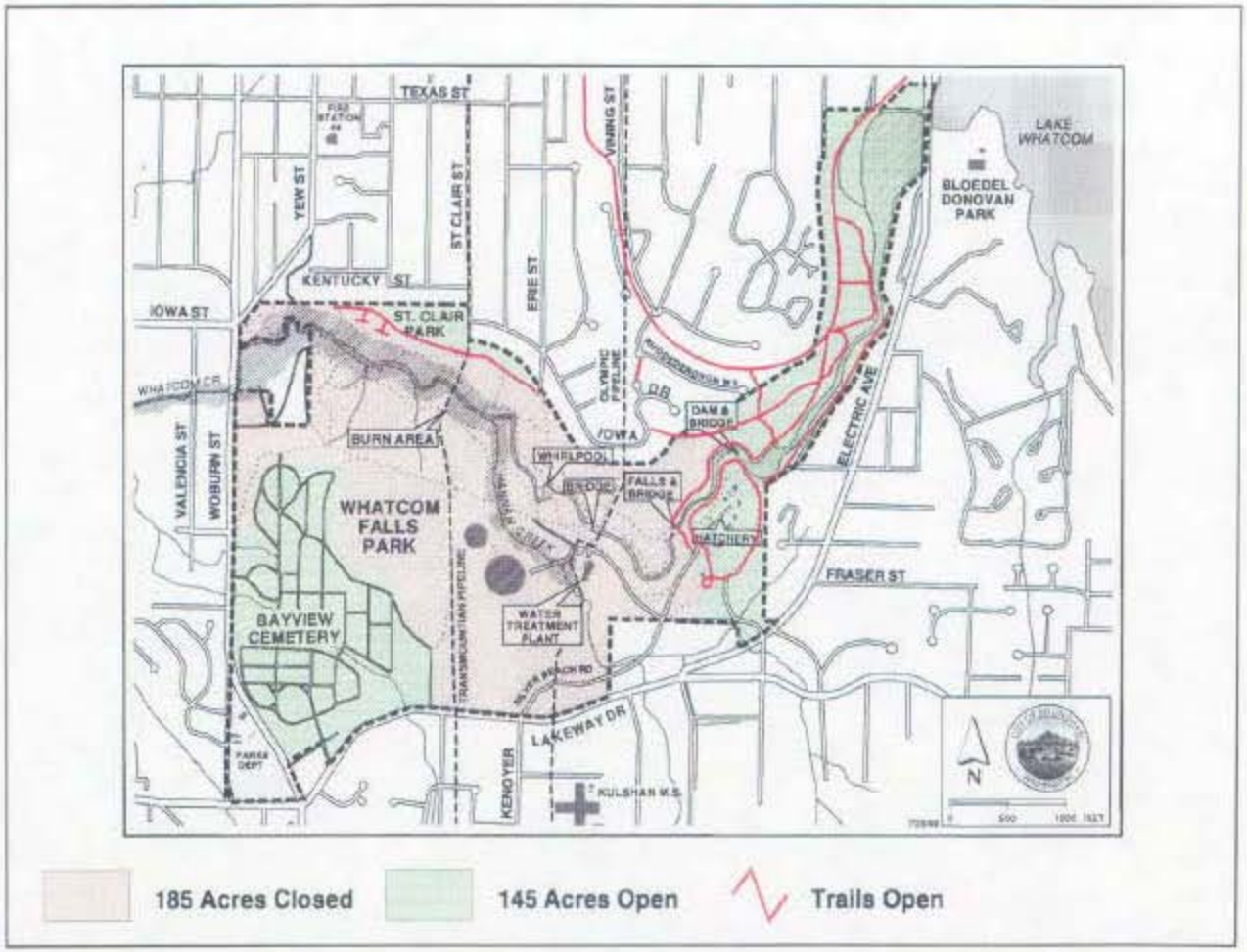

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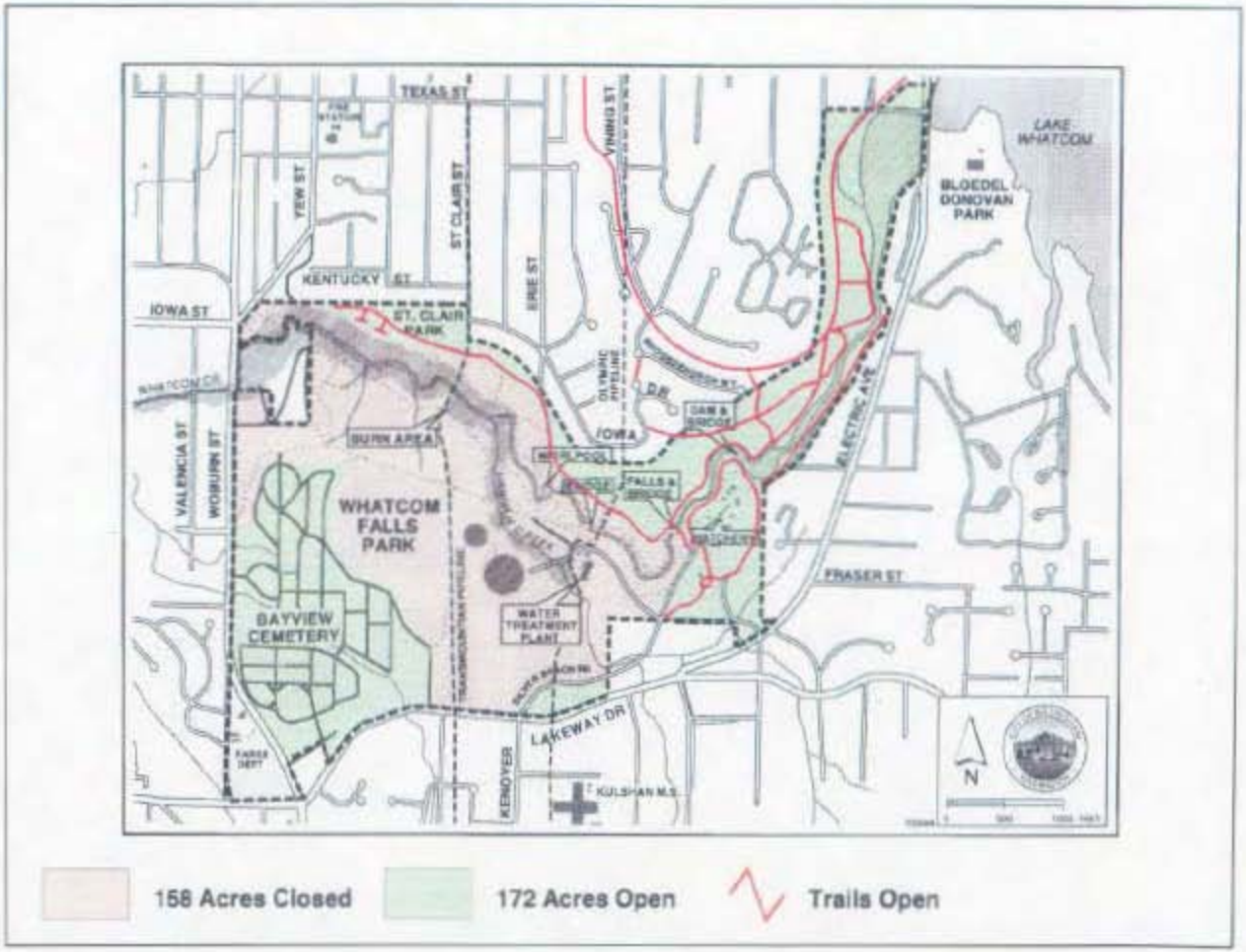

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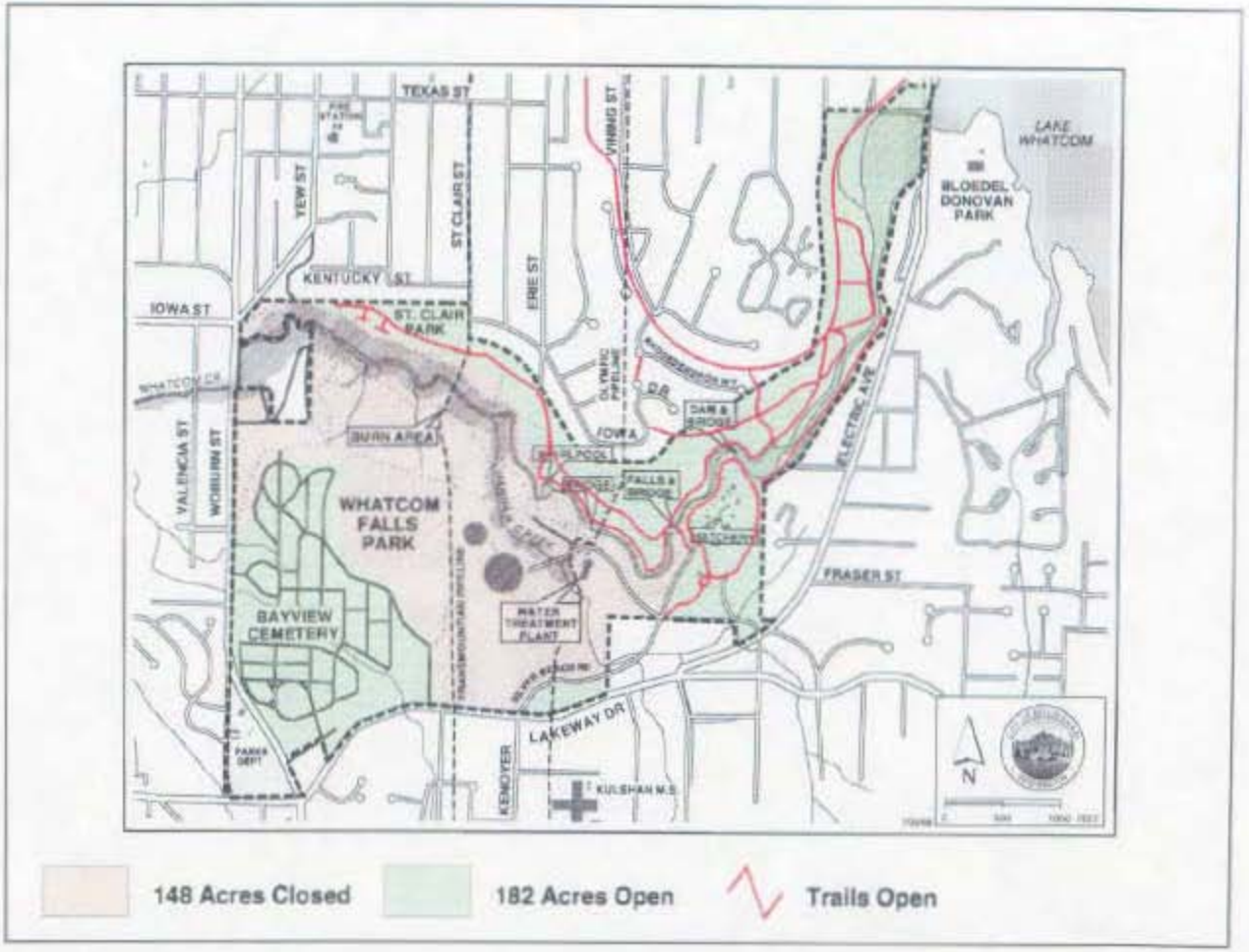

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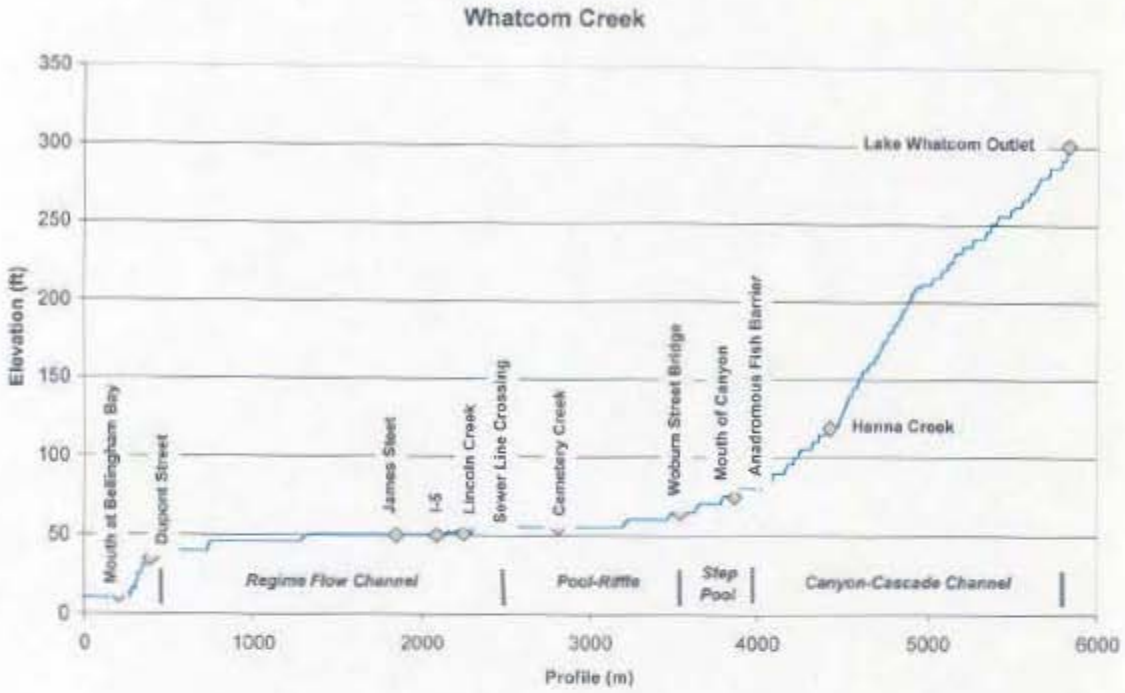

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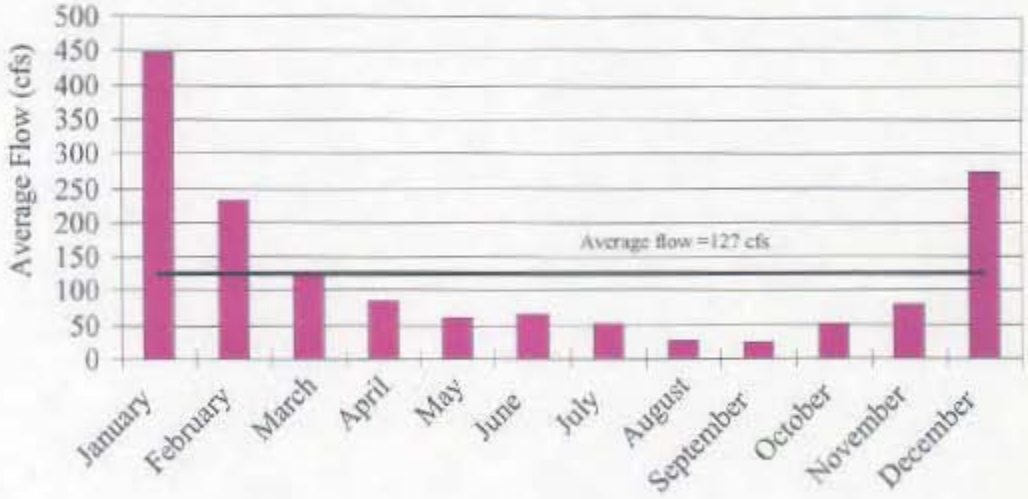

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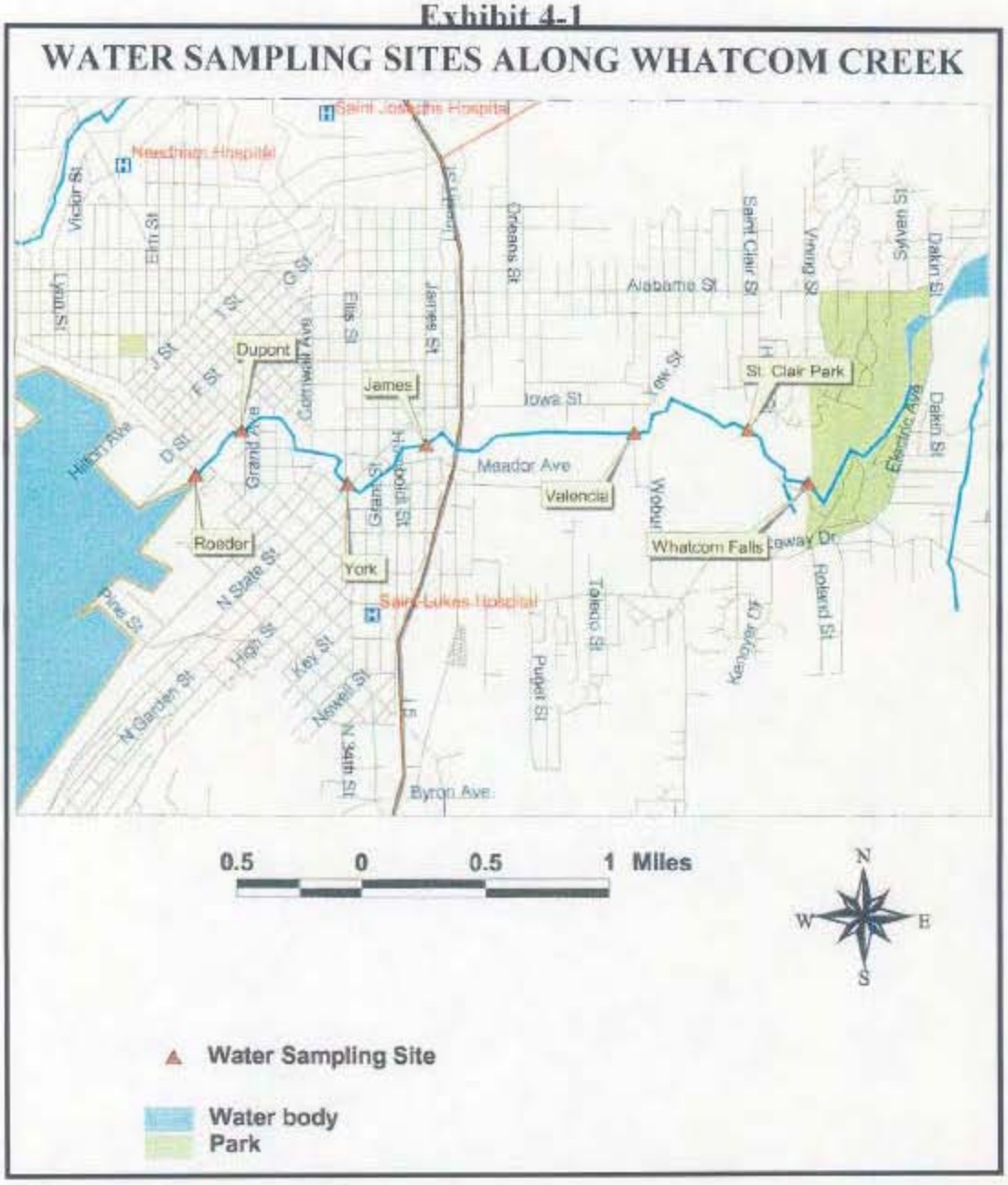

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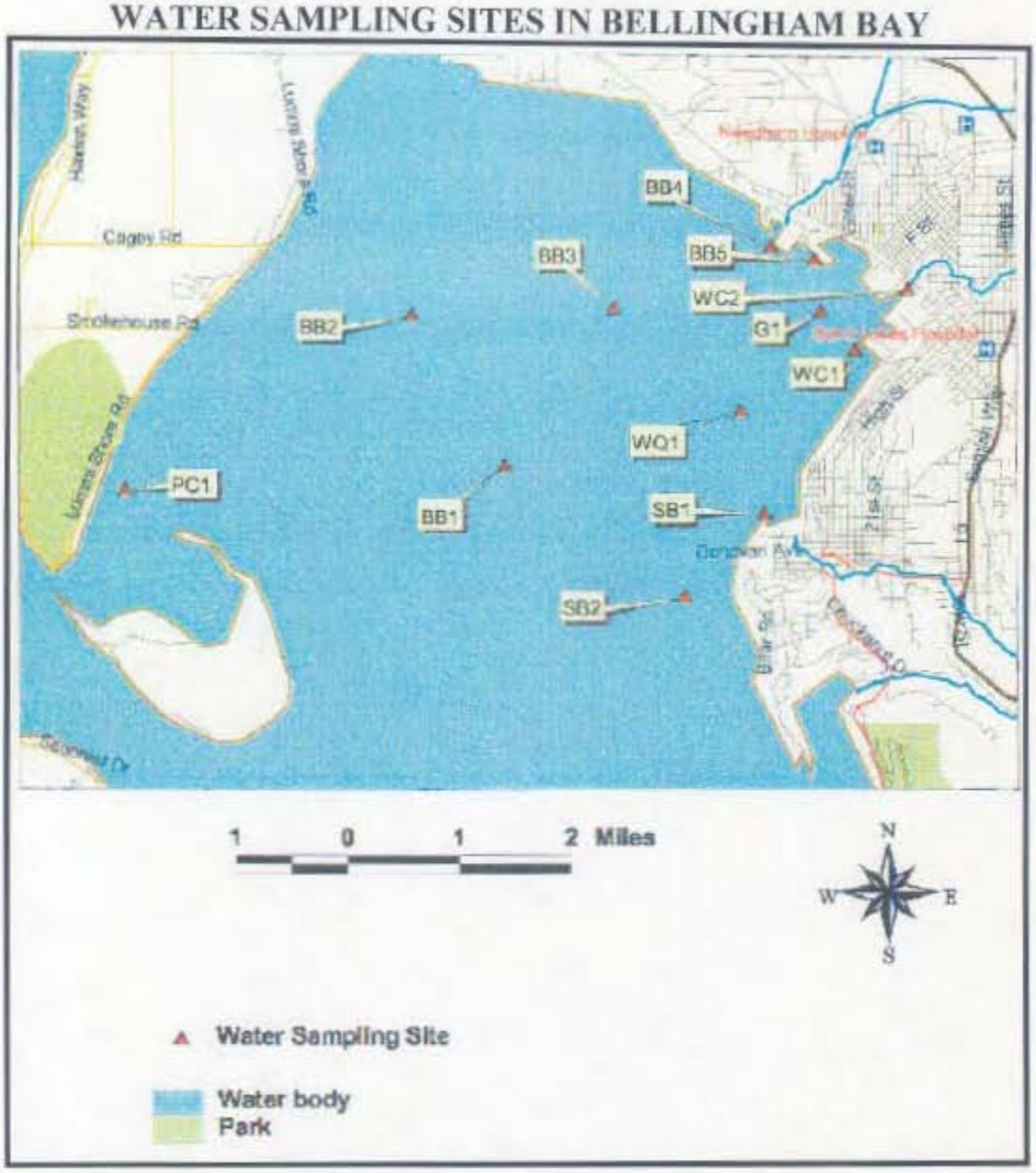

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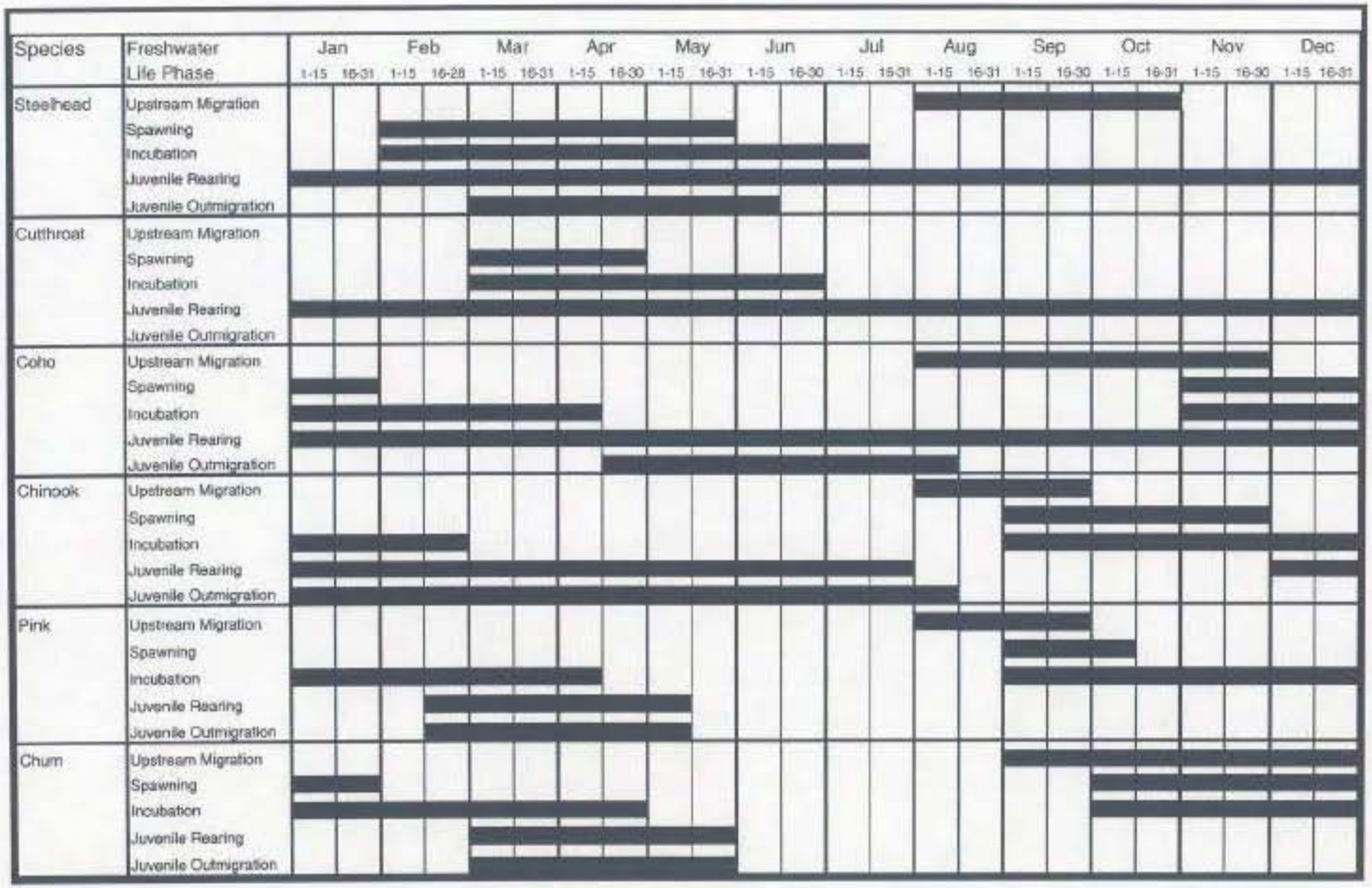

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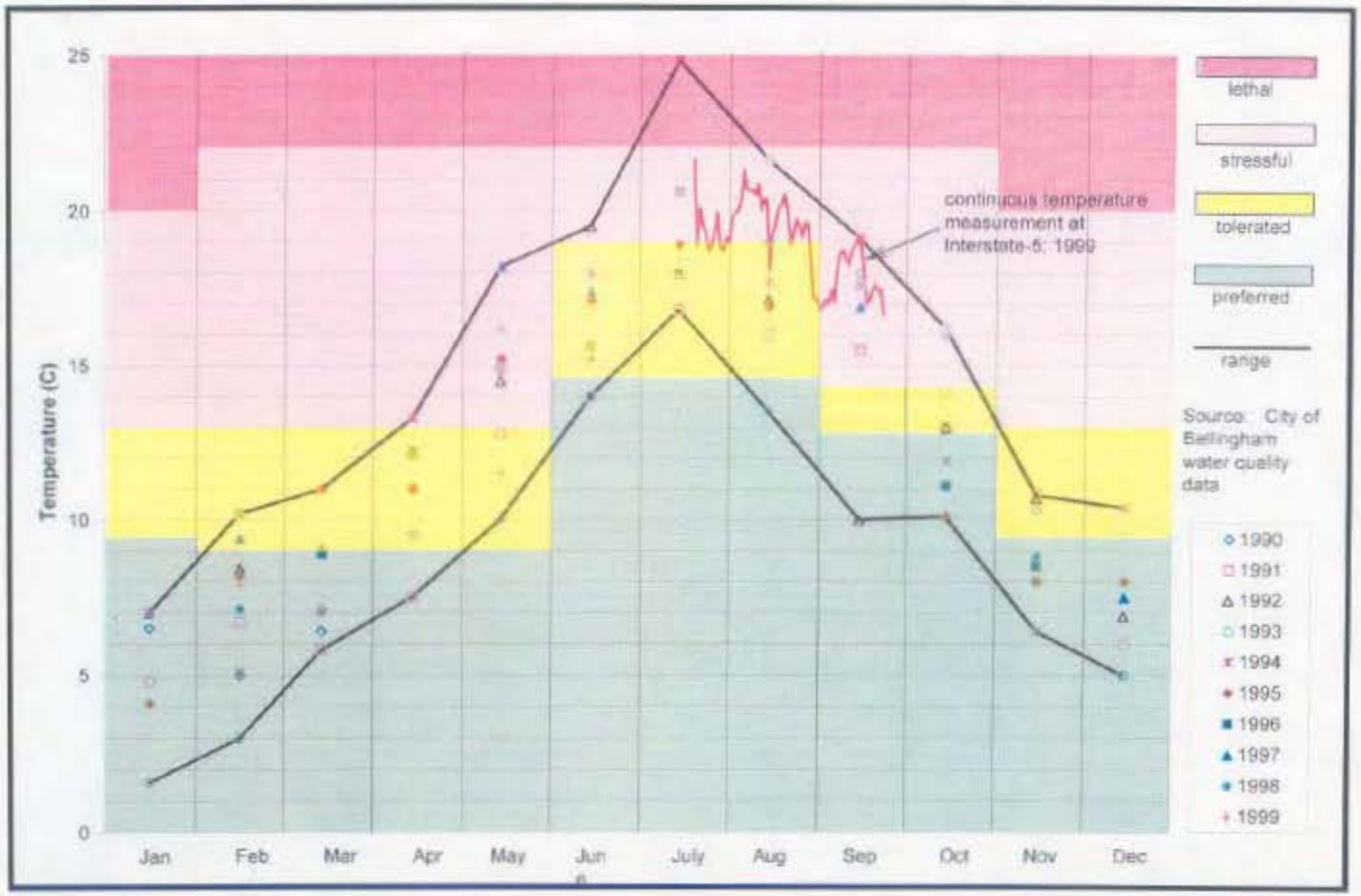

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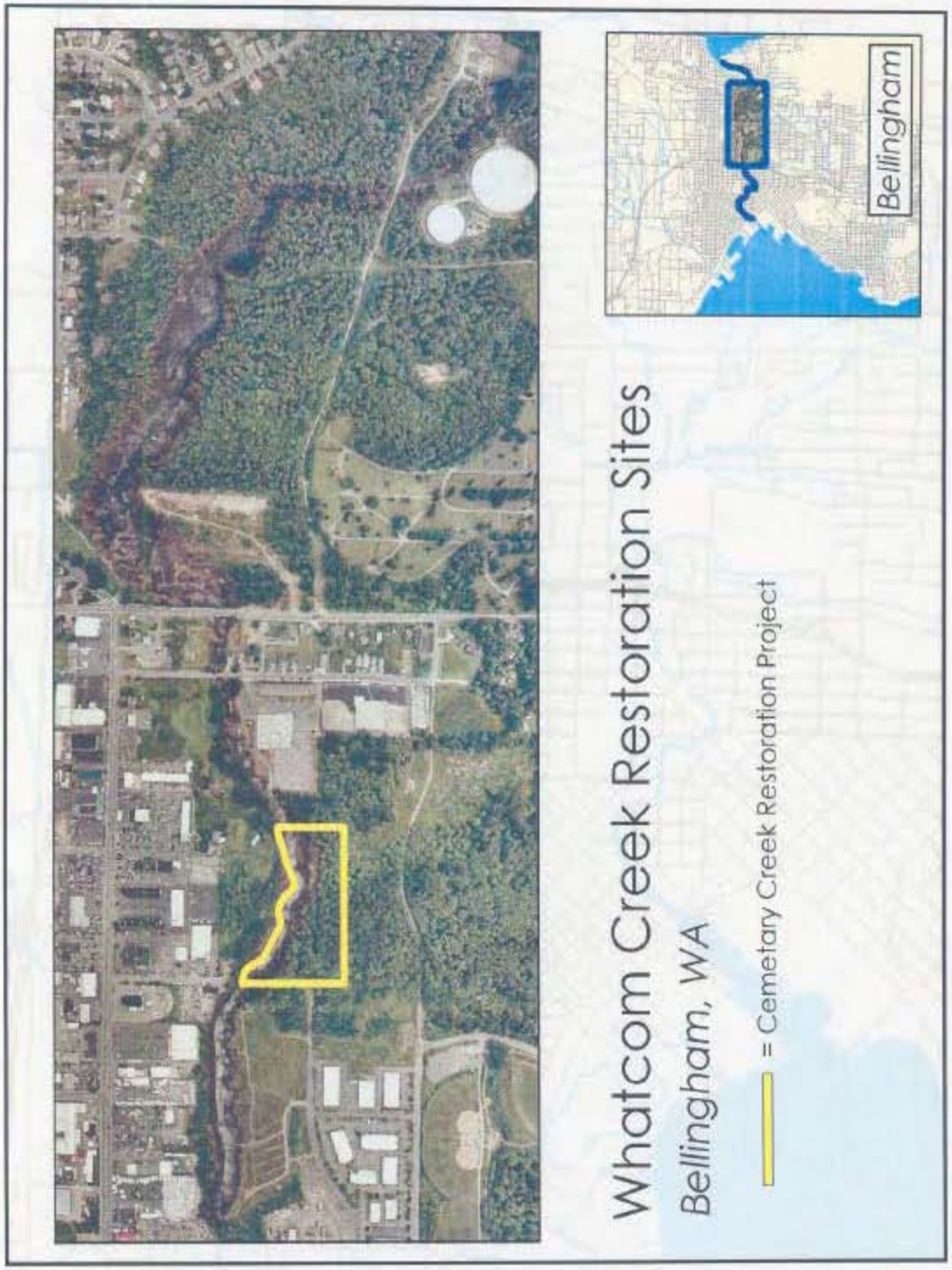

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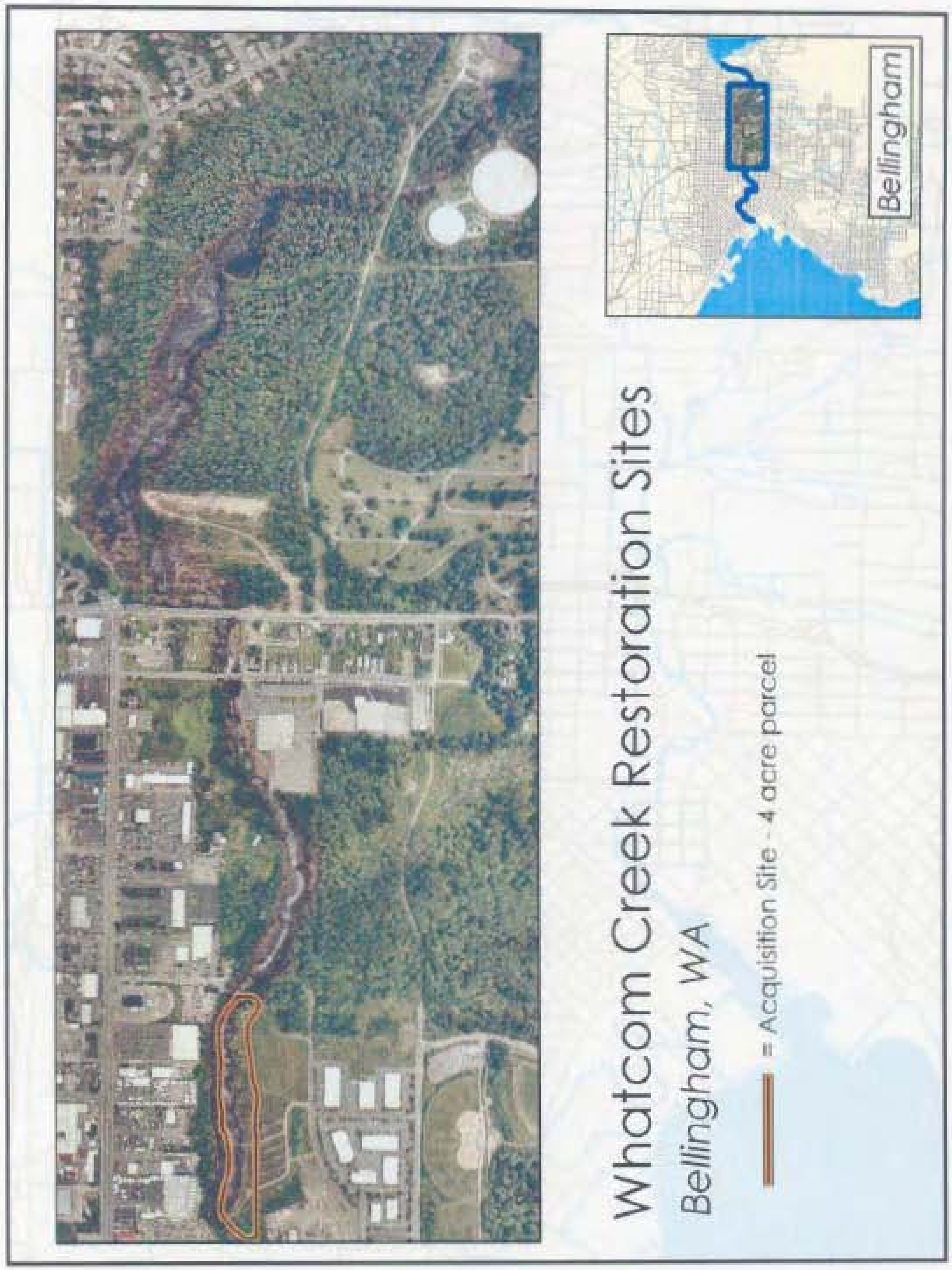

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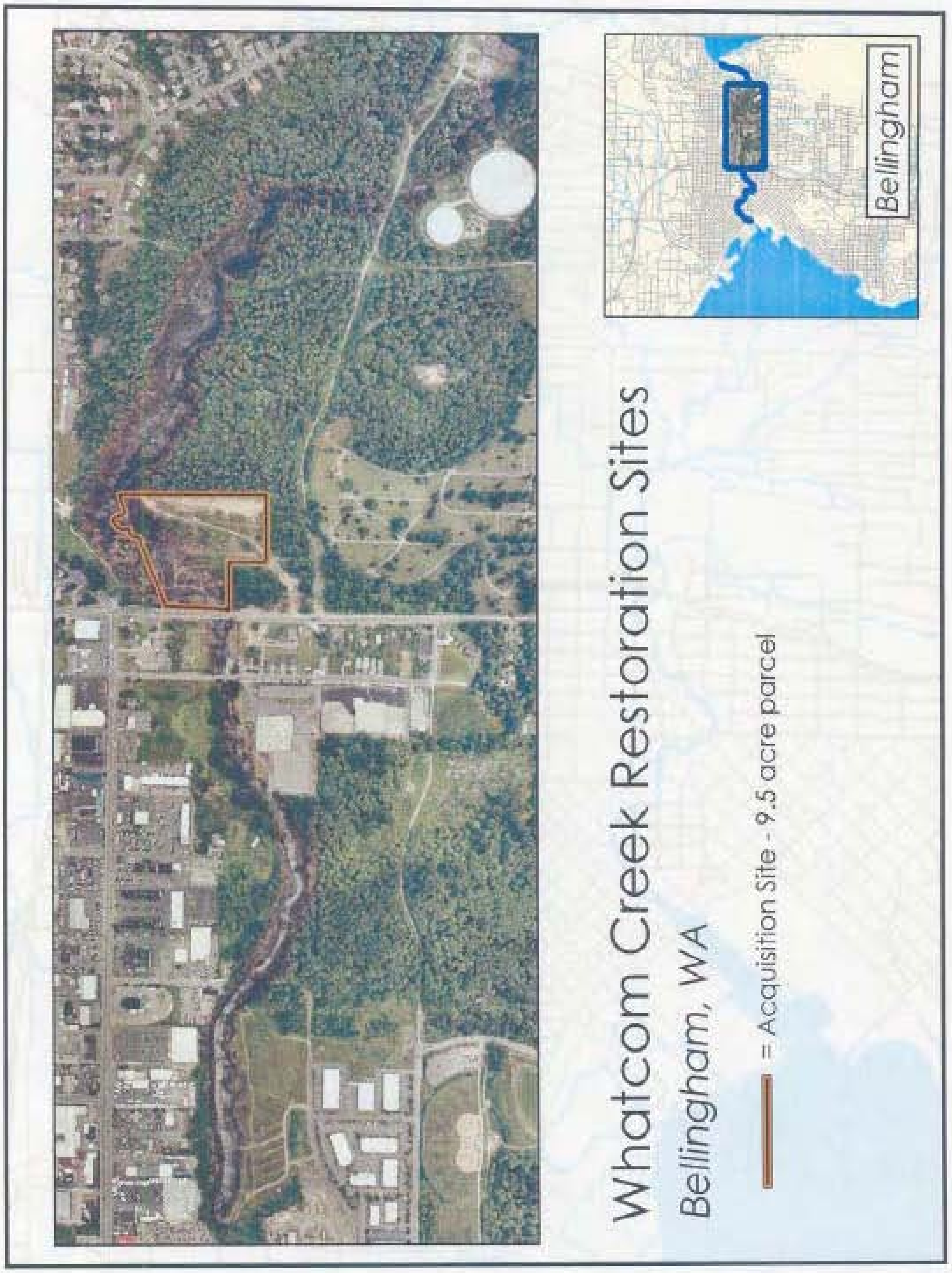

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