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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and
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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

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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

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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 (*Ardea 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.