City of Shoreline

Stream and Wetland Inventory and Assessment

Appendices

May 2004

Tetra Tech/KCM, Inc.
1917 First Avenue, Seattle, WA 98101-1027

Stream and Wetland Inventory and Assessment

Appendices

May 2004

Prepared for:
City of Shoreline
Shoreline, WA

Prepared by:

Tetra Tech/KCM, Inc.
1917 First Avenue
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(206) 443-5300

Project #3320005

Stream and Wetland Inventory and Assessment
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APPENDIX A.
STREAM INVENTORY AND ASSESSMENT

City of Shoreline

Stream Inventory and Assessment

May 2004

Tetra Tech/KCM, Inc.
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City of Shoreline
Stream Inventory and Assessment

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Project #2090051

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1. INTRODUCTION

The City of Shoreline has undertaken an effort to characterize the streams within its jurisdiction. Tetra Tech/KCM was contracted to conduct a stream inventory and assessment of streams within the City limits and covering the nine drainage basins:

- Boeing Creek Basin
- Thornton Creek Basin
- McAleer Creek Basin
- Lyon Creek Basin
- Middle Puget Sound Basin North
- Middle Puget Sound Basin South
- Bitter Lake Basin
- West Lake Washington Basin
- Seattle Golf Course Basin.

The inventory and assessment were conducted to provide information for four basin characteristic reports. Basins, which are combined into a single basin characterization report because of their small size within the City boundaries, include (a) Bitter Lake and Seattle Golf Course with Middle Puget Sound; (b) West Lake Washington with Thornton Creek; and (c) Lyon Creek with McAleer Creek. Boeing Creek Basin is a single report. All the streams are within the greater Lake Washington Watershed (WRIA 8) and ultimately empty into either Puget Sound or Lake Washington (Figures 1 through 4).

This report documents aquatic and riparian habitat conditions in relation to salmonid use as observed in April/May and August of 2001 and evaluates fish passage at that time. A more detailed evaluation of salmonid utilization and fish passage is addressed in *Fish Utilization in City of Shoreline Streams* (Daley 2004). Additional observations were made on August 28, 2003 and March 30, 2004.

Snohomish County

City of Shoreline

N 205TH ST

N 200TH ST

N195TH ST

N192ND ST

N 185TH ST

N 175TH ST

N 155TH ST

N 145TH ST

15TH AV NW

12TH AV NW

8TH AV NW

6TH AV NW

3RD AV NW

1ST AV NW

GREENWOOD AV N

DAYTON AV N

FREMONT AV N

LINDON AV N

AURORA AV N

ASHWORTH AV N

GREENWOOD AV N

WESTMINSTER WY N

NW INNIS ARDEN WY

CARLYLE HALL RD

Echo Lake

Hillwood Park

Crista Pond

Pan Terra Pond

North Pond

Hidden Lake

Shoreview Park

Steel-Pile Dam

M1 Dam

Darnell Park

BC1A

BC1

BC2

BC3

BC4

BC5

BC6

BC7

BC8

BC9

BC10

BC11

BC12

WL-A

WL-B

Legend

- Open Water Course
- Piped Water Course
- Wetlands
- Parks
- WL-A Wetland ID
- BC4 Reach ID
- Reach Start Points
- Fish Passage Barrier
- Detention Pond
- Boeing Creek Basin
- Waterbodies
- Shoreline City Limits
- Interstate
- State Route
- Principal Arterial
- Minor Arterial
- Collector Arterial
- Residential Street

N

1,200 600 0 1,200 Feet

No warranties of any sort accompany this product or are implied including accuracy, fitness, or merchantibility.

For regulatory purposes, segments within a reach are classified on a site-specific basis.
The mapping in this document provides a general guide to classification.

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Boeing Creek Basin Characterization Report

Figure 1

Stream Reaches, Wetlands and Fish Passage Barriers

Legend

- Open Water Course
- Piped Water Course
- Stream Outside City Limits
- Wetlands
- WL-S Wetland ID
- MC1 Reach ID
- Reach Start Point
- Fish Passage Barrier
- Detention Pond
- Parks
- Lyon Creek Basin
- McAleer Creek Basin
- Waterbodies
- Shoreline City Limits
- Interstate
- State Route
- Principal Arterial
- Minor Arterial
- Collector Arterial
- Residential Street

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N

1,200 600 0 1,200 Feet

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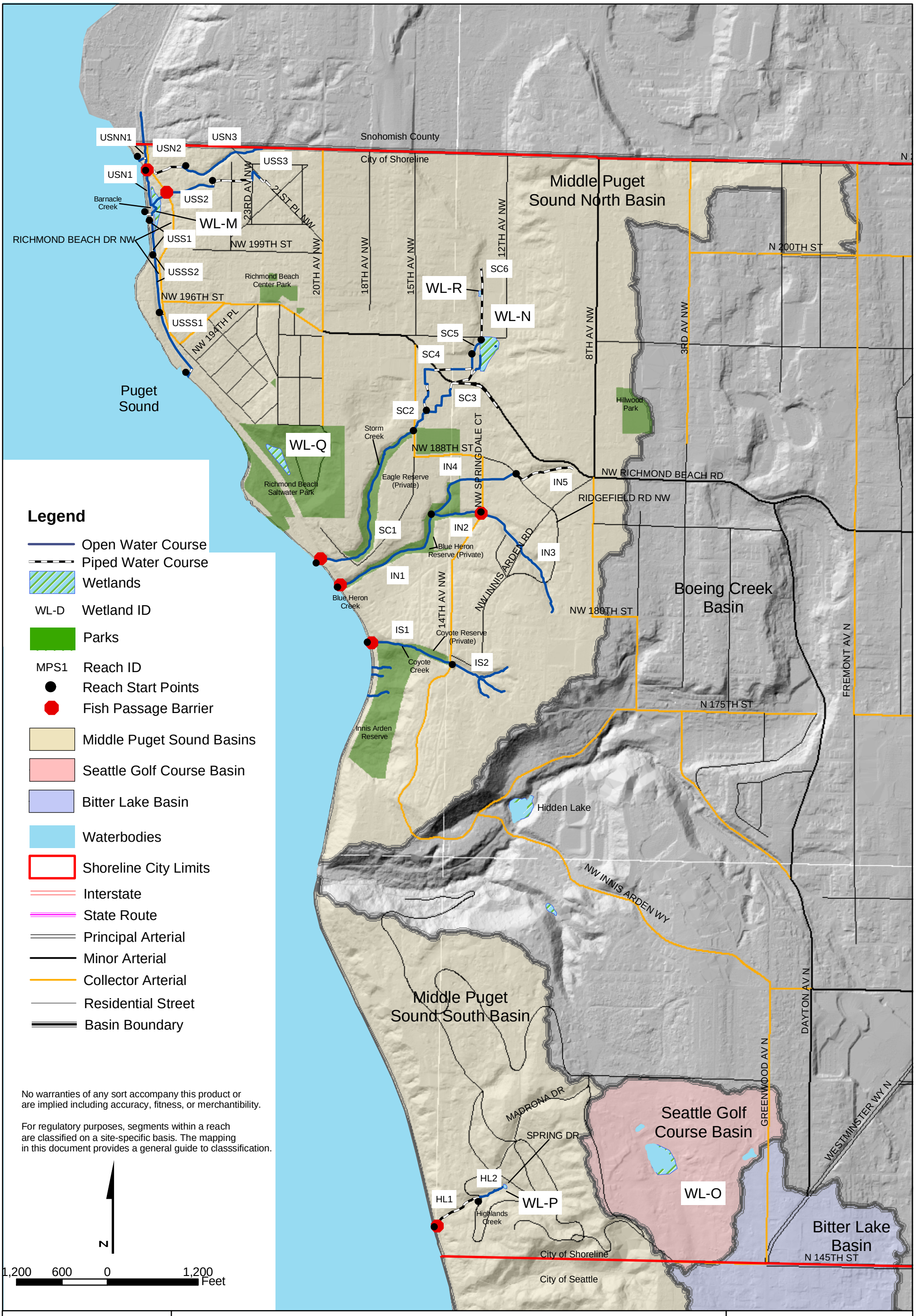
McAleer and Lyon Creek Basin Characterization Report

Figure 4
Stream Reaches, Wetlands and Fish Passage Barriers



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Middle Puget Sound Basins Characterization Report

Figure 3

Stream Reaches, Wetlands and Fish Passage Barriers

Legend

- Open Water Course
- Piped Water Course
- Wetlands
- WL-C Wetland ID
- Parks
- TC1 Reach ID
- Reach Starting Point
- Fish Passage Barrier
- Thornton Creek Basin
- W. Lake Washington Basin
- Waterbodies
- Shoreline City Limits
- Interstate
- State Route
- Principal Arterial
- Minor Arterial
- Collector Arterial

N

1,200 600 0 1,200 Feet

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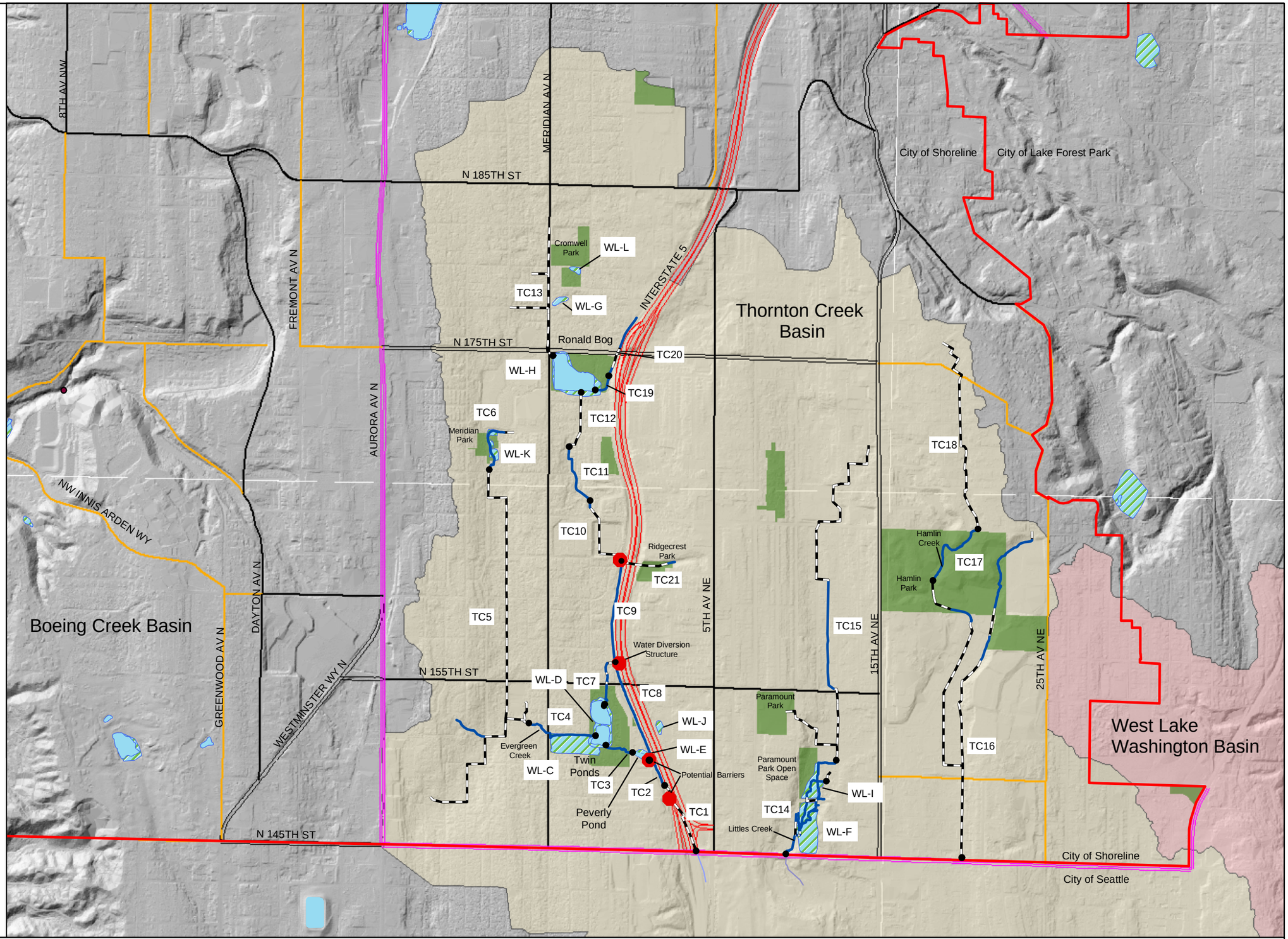

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Thornton Creek Basin Characterization Report

Figure 2
Stream Reaches, Wetlands and Fish Passage Barriers

2. METHODOLOGY

TRI-COUNTY URBAN STREAM BASELINE EVALUATION METHOD

The Tri-County Urban Stream Baseline Evaluation Method (USBEM; R2 Resource Consultants 2000) was adapted for this stream reconnaissance. The USBEM provides a protocol for determining a stream's suitability as habitat for a selected salmonid species. Time and cost precluded utilizing the full protocol. The first phase of the USBEM is to assess the physical characteristics of the stream's watershed using stream system maps, aerial photography, topographic maps and the local knowledge of resource managers. This phase is completed prior to conducting fieldwork. The second phase involves *in situ* measurements to determine and rate actual watershed conditions.

The USBEM is used to assign a salmonid habitat rating of good, fair, or poor to each stream reach, and then to determine potential restoration approaches based on those ratings. The two phases of the USBEM are described below. Chapter 4 includes a description of the stream reaches evaluated within the City of Shoreline..

The stream reaches mapped based on GIS data were refined using information gathered in the stream reconnaissance. During the reconnaissance, the preliminary stream reaches were verified for predominantly homogenous characteristics. Each stream segment, referred to as "open water course" in the map legends, was designated as a reach. Some reaches were not entirely homogenous; a reach designated as an open water course, for example, may have small sections that are piped (piped water course. Reaches which were a combination of open water courses and piped were mapped based on the predominant characteristic within their reach boundaries.

Phase I

Phase I consists of five steps that provide a preliminary score for each stream reach. This initial rating eliminates from further evaluation reaches that are obviously unsuitable for salmonid habitat including piped water courses.

Step 1: Define Channel Network

The channel network consists of the water courses in the project area, including open water courses and piped water courses. Most stream systems in the City are a combination of the two types.

Step 2: Identify Channel Types

Channel types for each stream segment are defined by the segment's gradient and sinuosity, as follows:

- Estuarine (tidal zone between freshwater stream and marine water)
- Palustrine (wetland channels or sloughs)
- Floodplain (low-gradient depositional channels)

- Large contained (low- to moderate-gradient channels that are moderately to deeply incised)
- Moderate gradient mixed control (transport-dominated channel with moderate to high stream power)
- Alluvial fan (moderate-gradient depositional channel in the transitional area between steep slopes and valley floodplains)
- Moderate gradient contained (transport-dominated channel with moderate to high stream power)
- High gradient contained (moderately to deeply incised channel with high stream power)
- Piped water courses

Species of concern are selected by determining the salmonid species known to occur in the watershed and considered at risk by the National Marine Fisheries Service. Each channel type has a predefined level of suitability for supporting the species of concern, as follows:

1. Highly suitable to support the species of concern
2. Secondary habitat use
3. Negligible; habitat unlikely to be used by the species of concern due to geomorphic constraints or natural barriers.

Step 3: Delineate Channel Reaches

Stream reaches are delineated into measurable units based on slope and uniformity of habitat characteristics. Channel typing also assists in the delineation of uniform reaches.

Step 4: Overlay Fish Distributions

Known fish distributions are determined using previous studies and data to assist in determining where fish populations are known to occur in the watershed.

Step 5: Identify Large Scale Watershed and Channel Alterations

The level of alteration of the channel or watershed is determined based on four parameters: the estimated total impervious area; the extent of channel or flow modifications (such as culverts, bank armoring, straightening, etc.); the number of breaks in the riparian zone; and the number of 303(d) listings.

Habitat ratings based on channel type under the guidelines of the USBEM do not take into account the level of alteration to the stream or watershed. The USBEM rating based on channel type indicates only the potential for suitable habitat, based on channel slope and sinuosity. It does not account for actual conditions. For example, the headwater reaches of Boeing Creek fall into channel types that are considered highly suitable for salmonid use based on their slope and sinuosity; however, these reaches are actually very poor for salmonid use because they are currently contained in pipes or grass- or rock- lined ditches .

To address this, the final determination in Phase I is a ranking score reflecting the potential species-specific use by channel type (Step 2) and the level of channel or watershed alteration (Step 5). Figure 5, from the USBEM, shows the decision box for ranking scores. For streams with habitat ratings of secondary or negligible based on channel type, the rating does not change with level of alteration. For streams with habitat ratings of highly suitable based on channel type, however, the rating is reduced to secondary if the level of alteration is moderate or high.

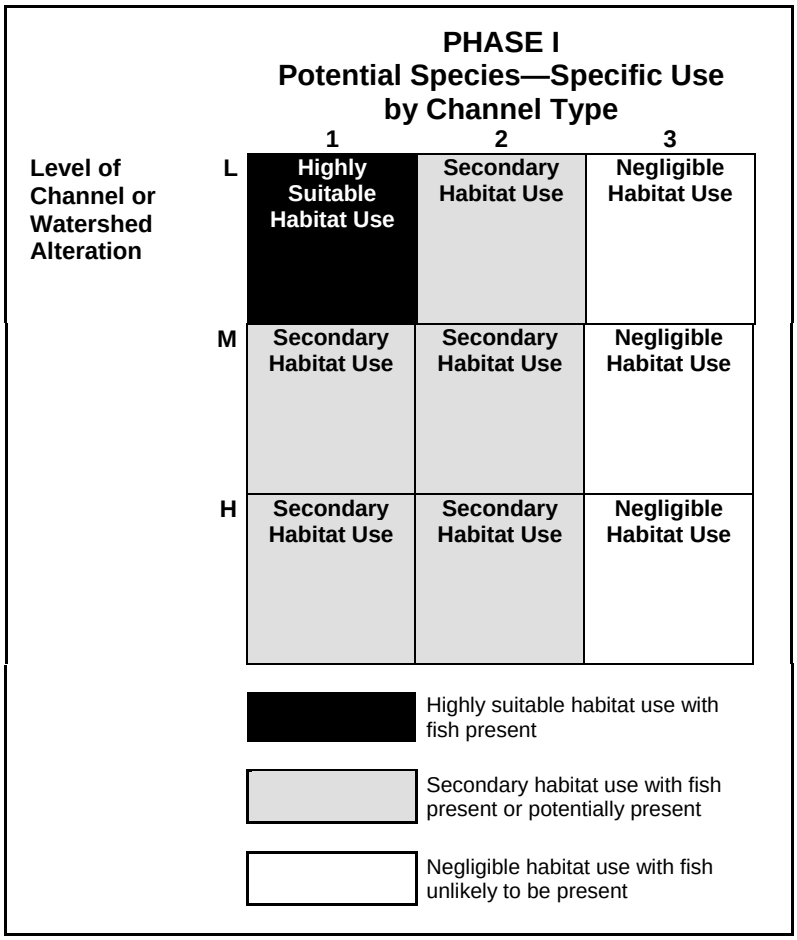

Figure 5. Phase I Decision Box (R2 Resource Consultants 2000)

Under the USBEM, Phase I is intended to reduce the number of stream reaches for which field reconnaissance is performed. The USBEM assumes that highly suitable habitat use areas need not be physically surveyed in Phase II, since fish are likely using the habitat without constraints, and that negligible habitat areas need not be physically surveyed since fish are not likely to use those areas. It recommends surveying only the areas determined to be of secondary habitat use. However, for this study, each stream reach identified by the City was surveyed, regardless of preliminary habitat use designations, in order to provide a more detailed inventory of all waterways in the City.

Phase II

Phase II consists of collecting field data and using the data to classify stream reaches as good, fair, or poor for supporting the species of concern, based on the following criteria:

- Riparian condition
- Substrate composition
- Substrate embeddedness
- Bank condition
- Benthic invertebrate community
- Fish passage barriers
- Pool frequency
- Channel pattern and connectivity
- Water temperature
- Large wood (LW).

The USBEM recommends that best professional judgment be used to classify the habitat after all parameters have been measured. For example, if the habitat is determined to be good according to parameters, but fish access is limited or impossible due to one or more natural or artificial barriers, professional judgment would determine that the habitat should be classified as fair or poor for fish species under current conditions. This classification would be changed with removal of the barriers.

Once the habitat condition has been determined for each reach, the ratings are combined with the level of alteration (Step 5 of Phase I) and a potential recovery option is identified. Recovery options, as determined using the USBEM, include preservation and acquisition of good habitat and areas with little alteration, enhancement of fair areas with medium or high levels of alteration, and no action for areas with poor habitat conditions and medium or high levels of alteration.

METHODS

Phase I

The City provided channel network maps and all streams were assessed during Phase I to determine channel type, reach delineations and level of alteration. Gradient was calculated using contour maps provided by the City; gradient was the primary criterion for determining the channel type of each stream reach. The area of impervious surface was included for the subbasin in which the reach occurs. The extent of modifications and riparian breaks along the reaches were estimated using aerial photography and land use maps. Water quality 303(d) listings were found at the Washington State Department of Ecology web site (1998). Limited data on fish presence were available. *Fish Utilization in City of Shoreline Watercourses* (Daley 2004) addresses fish presence in more detail.

Phase II

The Phase II criteria were evaluated as follows:

- Riparian condition—The size, density, and species composition of vegetation along the stream corridor were assessed to qualitatively assign ratings of good, fair, or poor.
- Substrate composition—Substrate was qualitatively assessed for the percent presence of each size class of substrate material. In addition, several pebble counts were conducted to determine the ratios of substrate size classes (Wolman 1954).
- Substrate embeddedness—A visual estimation was made of percent of fines in riffles and pool tailout areas.
- Bank condition—Condition was visually estimated based on the extent of artificial hardening, visible signs of erosion and perennial vegetation.
- Benthic invertebrate community—Samples were collected at all suitable locations. Suitable locations were considered areas of coarse substrates or areas with small gravel or larger material with less than 20 percent fines. Benthic invertebrate samples were collected by kick net, which requires disturbing the substrate of a square meter area and capturing dislodged specimens in the net. Samples were preserved in the field and analyzed in the laboratory using Aquatic Biology Associates' (1996) protocol for benthic invertebrate bioassay.
- Fish passage barriers—Many potential fish passage barriers were recorded including weirs, perched culverts, undersized culverts, low flows, etc.
- Channel pattern and connectivity—Channels were categorized according to sinuosity, connection to side-channels, channel definition and bedform.
- Water temperature—Temperatures were recorded in August; an average of three temperatures taken on the same day were used to calculate the rating of good, fair, or poor.
- LW—Sizes of LW pieces were estimated and categorized based on size and frequency.

Fish Passage Barriers

The Washington Department of Fish and Wildlife (1998) has a protocol for determining whether an impediment in a stream is a barrier to fish migration. This protocol involves measuring current velocity, grade, distance and depth of water over and immediately downstream of the impediment. Unless the structure is an obvious barrier such as a dam, observations without using the protocol are judgment calls; experts can disagree as to accessibility. This study did not use the WDFW protocols in assessing whether a reach is accessible. A comprehensive barrier assessment would require a full year of flow measurements. Both WDFW and the National Marine Fisheries Service have other specific considerations when considering a barrier for

regulatory purposes. This study used best professional judgment when assessing whether a barrier presented an impediment to fish passage.

3. RESULTS

PHASE I

The channel network includes the streams (open water courses) and reaches shown on Figures 1 through 4. Piped water courses are also shown. Five channel types were identified: palustrine, floodplain, estuarine, moderate gradient contained, and high gradient contained. All streams drain to either Lake Washington or Puget Sound for which the primary species of concern are chinook and coho salmon, respectively. Potential species-specific use was determined for each reach based on the channel typing and fish species selected. Table 1 summarizes the data compiled in Phase I.

Chinook have been found in the lower reaches of Thornton and McAleer Creeks and need to be used to rank these streams according to USBEM protocol. Coho is used for ranking the other streams. It is recognized that it is unlikely that chinook would access the upper reaches of these streams including those in the City of Shoreline. LFPSF (2001) notes that chinook salmon have been found as far upstream as the flood control facility and fish ladder at NE 196th Street between Forest Park Drive NE and 15th Avenue NE. This facility is just within the City of Shoreline boundary.

Using the USBEM Phase I decision box (Figure 5), reaches found to be of highly suitable habitat use were evaluated for channel or watershed alteration to determine whether their habitat rating should be reduced due to moderate or high levels of alteration. All areas that were found to be of highly suitable habitat use based on channel type were also found to have moderate or high levels of alteration, so their habitat ratings were reduced. As a result, all reaches studied were classified as secondary or negligible habitat use. Thornton, McAleer and Lyon Creeks are listed on the 303(d) list as water quality impaired for fecal coliform.

PHASE II

Field assessments were conducted for all reaches between April 30 and May 3, 2001 and between August 20 and 24, 2001. Additional assessments were conducted on August 28, 2003 and March 30, 2004. Water temperature data were collected during the August surveys, since temperatures are most limiting during summer, when seasonal low flows and high temperatures are most likely. Seven-day average maximum values for water temperatures were not available in the literature. Many reaches had no flow at the time of surveying and no water temperature data were collected for those reaches.

Scores of 1, 2 or 3 (equivalent to a rating of good, fair, or poor, respectively) were given for each field criterion (see Table 2). The USBEM does not recommend an approach for combining criteria scores into a final score. For the purpose of rating and prioritizing reaches, we selected an averaging approach, taking the mean of the scores for each criterion. For average scores between 2 and 3, best professional judgment was used to give a final score. For example, if the overall score was a 2.43, a relatively fair score, but the majority of ratings (e.g., four out of seven) for parameters in that reach were poor, the reach was given an overall poor rating. Other adjustments in overall rating occurred in cases where the average score indicated a fair rating, but fish passage

barriers would cause the reach to be rated poor. Areas with no fish accessibility within the reach must be considered poor habitat for coho and chinook. Table 3 lists the location and type of potential fish barriers which occur furthermost downstream. *Fish Utilization in City of Shoreline Watercourses* (Daley 2004) provides additional information and photographs of some of these barriers. Under the USBEM protocol, three reaches were rated fair (two on Boeing Creek and one on Thornton Creek), and the remainder were rated poor.

TABLE 1.
PHASE I DATA.

Reach[d]	Channel Type	Slope (%)	Fish Used for Ranking	Phase I Ranking	Impervious Area[a]	Modifications to Channel or Flow[b]	Riparian Breaks[b]	Section 303(d) listings[b]	Overall Level of Alteration[b]	Phase I Adjusted Ranking[c]
BC1	MGC	5.2	coho	Secondary	15	M	L	—	Moderate	Secondary
BC1A	E	2.0	coho	Secondary	15	M	L	—	Moderate	Secondary
BC2	HGC	7.1	coho	Negligible	23	H	L	—	High	Negligible
BC3	HGC	12.8	coho	Negligible	23	M	L	—	Moderate	Negligible
BC4	HGC	24.2	coho	Negligible	23	H	H	—	High	Negligible
BC5	HGC	11.4	coho	Negligible	23	H	H	__	High	Negligible
BC6	MGC	4.4	coho	Secondary	51	H	H	—	High	Secondary
BC7	MGC	4.3	coho	Secondary	51	H	M	—	High	Secondary
BC8	MGC	5.3	coho	Secondary	51	H	M	—	High	Secondary
BC9	HGC	2.7	coho	Negligible	51	H	L	__	High	Negligible
BC10	Piped									
BC11	Piped									
BC12	Piped									
TC1	Piped									
TC2	MGC	1.7	chinook	Secondary	48	L	L	L	Moderate	Secondary
TC3	PAL	0.8	chinook	Secondary	45	H	H	L	High	Secondary
TC4	PAL	0.8	chinook	Secondary	45	H	H	L	High	Secondary
TC5	Piped									
TC6	MGC	0.5	chinook	Secondary	46	H	H	L	High	Secondary
TC7	MGC	2.5	chinook	Secondary	45	H	H	L	High	Secondary
TC8	MGC	1.5	chinook	Secondary	45	M	M	L	Moderate	Secondary
TC9	MGC	1.7	chinook	Secondary	46	M	M	L	Moderate	Secondary
TC10	Piped									

a. Impervious surface area determined for subbasin.
b. Determined during Phase I, Step 5.
c. Based on Figure 2. Phase I decision box.
d. Refer to Figures 1,2,3, and 4.
PAL = palustrine, FLP = floodplain, E = estuarine, MGC = moderate gradient contained, HGC = high gradient contained; H = high, M = moderate, L = low;

TABLE 1 (continued).
PHASE I DATA.

Reach[d]	Channel Type	Slope (%)	Fish Used for Ranking	Phase I Ranking	Impervious Area[a]	Modifications to	Riparian Breaks[b]	Section 303(d) listings[b]	Overall Level of Alteration[b]	Phase I Adjusted Ranking[c]
TC11	FLP	1.3	chinook	Secondary	46	H	H	L	High	Secondary
TC12	Piped									
TC13	Piped									
TC14	PAL	1.0	chinook	Secondary	45	H	H	L	High	Secondary
TC15	Piped									
TC16	Piped									
TC17	MGC	4.0	chinook	Secondary	37	H	H	L	High	Secondary
TC18	Piped									
TC19	MGC	1.0	chinook	Secondary	43	H	H	L	High	Secondary
TC20	MGC	1.7	chinook	Negligible	47	H	H	L	High	Negligible
TC21	Piped									
HL1	Piped									
HL2	HGC	17.4	coho	Negligible	20	H	M	—	High	Negligible
IS1	HGC	17.6	coho	Negligible	27	H	M	—	High	Negligible
IS2	HGC	16.2	coho	Negligible	27	H	H	—	High	Negligible
IN1	HGC	7.4	coho	Negligible	32	M	M	—	Moderate	Negligible
IN2	HGC	7.4	coho	Negligible	32	H	H	—	High	Negligible
IN3	HGC	8.3	coho	Negligible	32	H	H	—	High	Negligible
IN4	HGC	9.0	coho	Negligible	32	H	H	—	High	Negligible
IN5	Piped									
SC1	HGC	8.1	coho	Negligible	36	M	M	—	Moderate	Negligible
SC2	MGC	2.2	coho	Secondary	36	H	H	—	High	Secondary
SC3	MGC	0.8	coho	Negligible	36	H	H	__	High	Negligible
SC4	MGC	1.9	coho	Negligible	36	H	H	__	High	Negligible
SC5	MGC	2.0	coho	Secondary	36	H	H	—	High	Secondary
SC6	Piped									
USSS1	MGC	1.0	coho	Negligible	40	H	H	__	High	Negligible

a. Impervious surface area determined for subbasin.
b. Determined during Phase I, Step 5.
c. Based on Figure 2. Phase I decision box.
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PAL = palustrine, FLP = floodplain, E = estuarine, MGC = moderate gradient contained, HGC = high gradient contained; H = high, M = moderate, L = low;

TABLE 1 (continued).
PHASE I DATA.

Reach[d]	Channel Type	Slope (%)	Fish Used for Ranking	Phase I Ranking	Impervious Area[a]	Modifications to	Riparian Breaks[b]	Section 303(d) listings[b]	Overall Level of Alteration[b]	Phase I Adjusted Ranking[c]
USSS2	MGC	0.4	coho	Negligible	40	H	H	—	High	Negligible
USS1	MGC	0.9	coho	Negligible	36	H	H	—	High	Negligible
USS2	HGC	13.6	coho	Negligible	36	H	H	—	High	Negligible
USS3	Piped									
USNN1	MGC	0.3	coho	Negligible	39	H	H	—	High	Negligible
USN1	HGC	10.0	coho	Negligible	36	H	H	—	High	Negligible
USN2	Piped									
USN3	FLP	2.9	coho	Secondary	36	H	H	—	High	Secondary
MC1	MGC	3.5	chinook	Secondary	49	H	H	L	High	Secondary
MC2	MGC	3.0	chinook	Secondary	49	H	H	L	High	Secondary
MC3	Piped									
MT1	HGC	7.1	chinook	Negligible	42	H	H	L	High	Negligible
MT2	HGC	8.2	chinook	Negligible	42	H	H	L	High	Negligible
MT3	HGC	8.4	chinook	Negligible	42	H	H	L	High	Negligible
MT4	HGC	5.0	chinook	Negligible	42	H	H	L	High	Negligible
MT5	PAL	0.6	chinook	Negligible	42	H	H	L	High	Negligible
MT6	HGC	11.6	chinook	Negligible	42	H	H	L	High	Negligible
MT7	HGC	7.5	chinook	Negligible	42	H	H	L	High	Negligible
MT8	Piped									
EL1	Piped									
EL2	Piped									
BA1	Piped									
BA2	MGC	2.8	chinook	Secondary	47	H	H	L	High	Secondary
BA3	MGC	1.8	chinook	Secondary	47	H	H	L	High	Secondary
BA4	MGC	2.8	chinook	Secondary	47	H	H	L	High	Secondary
BA5	Piped									

a. Impervious surface area determined for subbasin.
b. Determined during Phase I, Step 5.
c. Based on Figure 2. Phase I decision box.
d. Refer to Figures 1,2,3 and 4.
PAL = palustrine, FLP = floodplain, E = estuarine, MGC = moderate gradient contained, HGC = high gradient contained; H = high, M = moderate, L = low;

TABLE 2.
PHASE II DATA.

Reach[d]	Temp (°C)	Bank-full Width (feet)	Riparian Condition	Embeddedness	Substrate	Bank Condition	Channel Pattern and Connectivity	LW	Pool Frequency	Passage Barriers	Benthic Invertebrate	Total Score	Average Score	Habitat Assessment
BC1	13	30	2	2	2	1	3	1	3	2	3	19	2.11	Fair
BC1A	13	30	2	2	2	2	3	2	3	2	—	19	2.25	Fair
BC2	13	33	2	NI	3	3	3	2	3	3	3	19	2.75	Poor
BC3	13	9	2	NI	3	1	3	3	3	2	NI	17	2.43	Poor
BC4	a	b	2	NI	3	3	3	3	3	3	NI	20	2.86	Poor
BC5	—	4	3	NI	3	3	3	3	3	3	NI	21	3.00	Poor
BC6	14	37	2	3	2	2	3	3	3	2	3	23	2.56	Poor
BC7	13	22	3	2	2	3	2	3	3	3	3	24	2.67	Poor
BC8	14	25	2	2	2	1	3	2	3	2	3	20	2.22	Fair
BC9	a	15	2	NI	3	2	3	2	3	3	NI	18	2.57	Poor
BC10	—	—	—	—	—	—	—	—	—	—	—	—	—	—
BC11	—	—	—	—	—	—	—	—	—	—	—	—	—	—
BC12	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC2	10	6	2	3	3	2	2	2	2	3	NI	19	2.38	Poor
TC3	18	15	3	3	3	1	1	3	3	2	[c]	19	2.38	Poor
TC4	16	8	3	NI	NI	3	3	NI	NI	2	NI	11	2.75	Poor
TC5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC6	—	6	2	3	3	2	2	3	3	2	—	19	2.50	Poor
TC7	18	12	3	3	3	3	3	3	3	2	3	25	2.78	Poor
TC8	9	8	2	3	3	2	2	2	3	3	NI	20	2.50	Poor
TC9	10	20	2	3	3	3	3	2	3	3	NI	22	2.75	Poor
TC10	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC11	19	14	3	3	3	3	3	3	3	2	3	23	2.89	Poor
TC12	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. Temperature not taken because no water present when sampled.
b. Bank-full width not recorded for creeks with no clear indicators of the ordinary high water mark.
c. Benthic invertebrate sampling protocol indicated that stream conditions were not suitable for sampling.
d. Refer to Figures 1, 2, 3 and 4.
NI = not included in data set because criterion is not appropriate for channel type, LW = large wood; 1 = good, 2 = fair, and
3 = poor.

TABLE 2 (continued).
PHASE II DATA.

Reach[d]	Temp (°C)	Bank-full Width (feet)	Riparian Condition	Embeddedness	Substrate	Bank Condition	Channel Pattern and Connectivity	LW	Pool Frequency	Passage Barriers	Benthic Invertebrate	Total Score	Average Score	Habitat Assessment
TC13	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC14	15	12	2	2	2	1	2	2	1	2	3	7	1.89	Fair
TC15	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC16	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC17	*a*	*b*	1	NI	3	3	3	2	3	NI	*c*	15	2.50	Poor
TC18	—	—	—	—	—	—	—	—	—	—	—	—	—	—
TC19	—	40	2	3	3	2	2	3	3	2	—	20	2.50	Poor
TC20	—	5-11	3	3	3	3	3	3	3	3	NI	24	3.00	Poor
TC21	—	—	—	—	—	—	—	—	—	—	—	—	—	—
HL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
HL2	*a*	*b*	3	NI	3	1	3	3	3	3	NI	19	2.71	Poor
IS1	*a*	15	3	NI	3	2	3	3	3	2	NI	19	2.71	Poor
IS2	*a*	35	3	NI	3	1	3	3	3	3	NI	19	2.71	Poor
IN1	*a*	10	3	NI	3	3	3	3	3	2	NI	20	2.86	Poor
IN2	14	6	3	NI	3	2	3	3	3	3	NI	20	2.86	Poor
IN3	19	4	2	NI	3	2	3	3	3	2	NI	18	2.57	Poor
IN4	19	4	2	NI	3	2	3	3	3	2	NI	18	2.57	Poor
IN5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SC1	17	12	3	2	2	3	3	3	3	3	3	20	2.78	Poor
SC2	18	9	3	2	2	3	3	3	3	2	3	24	2.67	Poor
SC3	__	3	3	3	3	3	3	3	3	3	NI	24	3.00	Poor
SC4	10	4	3	3	3	3	3	3	3	3	NI	24	3.00	Poor
SC5	18	5	3	3	3	3	2	3	3	2	3	25	2.78	Poor
SC6	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. Temperature not taken because no water present when sampled.
b. Bank-full width not recorded for creeks with no clear indicators of the ordinary high water mark.
c. Benthic invertebrate sampling protocol indicated that stream conditions were not suitable for sampling.
d. Refer to Figures 1,2,3, and 4.
NI = not included in data set because criterion is not appropriate for channel type, LW = large wood; 1 = good, 2 = fair, and
3 = poor.

TABLE 2 (continued).
PHASE II DATA

Reach[d]	Temp (°C)	Bank-full Width (feet)	Riparian Condition	Embeddedness	Substrate	Bank Condition	Channel Pattern and Connectivity	LW	Pool Frequency	Passage Barriers	Benthic Invertebrate	Total Score	Average Score	Habitat Assessment
USSS1	—	3	3	3	3	3	3	3	3	3	NI	24	3	Poor
USSS2	—	3	3	3	3	3	3	3	3	3	NI	24	3	Poor
USS1	12	6	3	3	3	3	3	3	3	3	NI	24	3	Poor
USS2	a	6	3	NI	3	2	3	3	3	2	NI	19	2.38	Poor
USS3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
USNN1	12	6	3	3	3	3	3	3	3	3	NI	24	3	Poor
USN1	14	13	3	NI	3	3	3	3	3	3	NI	21	3.00	Poor
USN2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
USN3	14	7	2	3	3	2	2	3	3	2	c	20	2.50	Poor
MC1	19	18	3	1	2	3	2	3	3	2	3	22	2.44	Poor
MC2	a	3	3	3	3	3	3	3	3	3	NI	24	3.00	Poor
MC3	—	4	3	3	3	3	3	3	3	3	NI	24	3.00	Poor
MT1	13	5	3	2	2	3	3	3	3	2	c	21	2.63	Poor
MT2	13	5	3	NI	3	3	3	3	3	2	NI	20	2.86	Poor
MT3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MT4	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MT5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MT6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MT7	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MT8	—	—	—	—	—	—	—	—	—	—	—	—	—	—
EL1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
EL2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
BA1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
BA2	16	10	3	3	3	3	3	3	3	2	3	26	2.89	Poor
BA3	a	4	3	3	3	3	3	3	3	3	3	24	3.00	Poor
BA4	16	8	3	3	2	2	3	3	3	2	c	21	2.62	Poor
BA5	—	—	—	—	—	—	—	—	—	—	—	—	—	—

a. Temperature not taken because no water present when sampled.
b. Bank-full width not recorded for creeks with no clear indicators of the ordinary high water mark.
c. Benthic invertebrate sampling protocol indicated that stream conditions were not suitable for sampling.
d. Refer to Figures 1,2,3, and 4.
NI = not included in data set because criterion is not appropriate for channel type, LW = large wood; 1 = good, 2 = fair, and
3 = poor.

TABLE 3.
FISH BARRIERS WITHIN CITY OF SHORELINE DRAINAGES [a].

Creek	Barrier [b]	Water depth	Description
Boeing BC1 BC1A	Culverts, Dam, High Gradients	<4" through RR culvert, <1" across beach	Steel sheet pile dam completely impassable, railroad culvert at beach seasonally or tidally impassable. Landslides and LW may periodically prevent passage.
Boeing BC2	Culvert	<1’	Gradient and velocity of culvert at NW Innis Arden Way prevents fish passage
Boeing BC6	Dam	<1’	Earthen dam creating Hidden Lake prevents upstream passage at all flows.
Boeing BC7	Detention Pond	<6”	North pond and a perched culvert at NW 175th prevent fish passage. Piped reaches upstream.
Boeing BC8	M1 Dam	<6”	M1 dam prevents fish passage between reaches BC8 and BC9.
Thornton TC1	Culverts, Piped	<1” through culvert under I-5	Culvert under Interstate 5 barrier to juvenile and most salmonid passage. Passage upstream of Twin Ponds could be impeded by intermittent and low flows.
Thornton TC2	Weir	>1’	Weir at Peverly Pond impedes juvenile and most salmonid fish passage upstream.
Thornton TC7	Diversion Structure	<1’	The water diversion structure at the junction of TC7, TC8, and TC9 is a fish passage barrier.
Thornton TC10	Low Flows Piped	<6”	Long pipe length and low flows could impede fish passage.
Highlands HL1	Ravine with High Gradients	<1" in various spots	Steep ravine adjacent to beach and within Highlands neighborhood (>15%). High velocities barrier to juvenile passage. Ornamental landscaping, pipe contained portions, and rock lined ditches may limit adult and juvenile passage.
Innis Arden South IS1	Low Flows	1" spring flows	RR culvert at mouth may be seasonally or tidally impassable, steep gradients may prevent juvenile or adult passage.
Innis Arden North IN2	Culvert	<1” various locations	Perched culvert at NW Springdale Court prevents fish passage.
Innis Arden North IN1	Low Flows	2" spring flows	RR culvert at mouth may be seasonally or tidally impassable, steep gradients may prevent juvenile or adult passage.
Storm SC1	Weirs, Culverts, Ravine	<4" in various locations	Steep gradients and high velocities may prevent juvenile or adult passage. Seasonal low flows or low tides may prevent entry or passage.
Upper Puget Sound South USS2	High gradient, Low Flows	<1" in various locations	Low flows and steep gradients may prevent adult and juvenile passage.
Upper Puget Sound North USN2	High gradient, Low Flows	<1" in various locations	Low flows, extremely steep gradients, and the Richmond Beach culvert may prevent adult and juvenile passage.

McAleer MC1	Low Flows, Culverts	<4" in various locations	MC1 culverts are passable and not velocity barriers.

TABLE 3 (continued).
FISH BARRIERS WITHIN CITY OF SHORELINE DRAINAGES [a].

Creek	Barrier [b]	Water depth	Description
Cedarbrook MT7	Low Flows, Piped, Culverts	<4" in various locations	Seasonally dry with very low flows year-round. Many culverts and piped portions.
Echo Lake EL1	Culvert, Piped	<1" through culvert	Passage limited by long pipes, culverts, rock-lined ditches, and only seasonal or storm event flows.
Ballinger BA4	Seasonal Low Flows, Culverts	<1”	Passage through BA4 is limited at upper end of Bruggers Bog by water <1" deep and minimum jumping height of 30 inches at three concrete culverts.

a. Barriers which primarily occur furthermost downstream.
b. Low flows barriers may depend on life cycle and season utilization. For more information on specific fish barriers see *Fish Utilization in City of Shoreline Watercourses* (Daley 2004).

Fourteen benthic invertebrate samples were collected at suitable locations along Boeing Creek, Storm Creek, Thornton Creek and McAleer Creek. All samples collected had a density of less than 150 organisms per square meter made up of only 3 to 5 taxa, most of which were tolerant to environmental stress and unstable habitats (Tables 4 and 5). The dominant taxon in each sample made up at least 40 percent of the total number of organisms, indicating poor diversity. All samples were rated poor relative to bio-integrity based on the low diversity of species and dominance by more tolerant species.

Phase II physical site surveys confirmed that reaches rated as highly suitable habitat in Phase I based solely on channel type are heavily developed and, in fact, poor habitat for salmonids. These areas may have provided viable fish habitat in the past, but, due to extremely modified and developed watersheds, are no longer suitable.

TABLE 4.
DATA SUMMARY FOR BENTHIC INVERTEBRATE SAMPLING

Reach	Total No. of Organisms	Total No. of Taxa	EPT No.[a]	Benthic Invertebrate Bioassessment[b]
BC1	46	4	2	34
BC2	51	4	1	29
BC6	54	6	2	41
BC7	111	4	2	41
BC8a[c]	20	2	1	41
BC8b[c]	37	4	1	38
TC7	103	4	1	38
TC11	84	4	1	38
TC14	133	5	1	42
SC1	107	4	1	43
SC2	122	4	1	34
SC5	82	5	2	39
MC1	101	4	1	39
BA2	32	3	1	36

a. Number of taxa present in sample that are in the orders of Ephemeroptera, Plecoptera, and Tricoptera, or preferred salmon prey species.
b. Biomonitoring protocol for assessing benthic invertebrate communities developed by Aquatic Biology Associates, Inc. (March 1996). Rankings are as follows:
   - 90-100 Very High—Very high habitat complexity, biotic integrity, taxa richness, percent of cool adapted fauna, number of more specific microhabitat related taxa; low number of tolerant taxa
   - 80-89 High—High as above, low number of tolerant taxa
   - 60-79 Moderate—Moderate as above, some habitat limitations
   - 40-59 Low—Low as above, significant habitat and water quality limitations
   - <40 Severe—Severe departure from ideal conditions.
c. Two samples were taken in this reach of Boeing Creek.

TABLE 5.
NUMBER OF INDIVIDUALS AND PERCENT OF TOTAL BENTHIC INVERTEBRATE TAXA.

	Oligochaeta Annelida	Isopoda Asellidae	Amphipoda Gammaridae	Ephemeroptera Baetidae	Trichoptera Hydropsychidae	Trichoptera Limnephilidae	Trichoptera Leptoceridae	Trichoptera Rhyacophilidae	Coleoptera Dytiscidae	Diptera Chironomidae	**Total Number of Organisms**
BC1											
Number	6	—	—	10	1	—	—	—	—	29	**46**
% of Total	13.0			21.7	2.2					63.0	
BC2											
Number	4	—	5	—	—	2	—	—	—	40	**51**
% of Total	7.8		9.8			3.9				78.4	
BC6											
Number	5	—	9	13	—	—	1	—	1	25	**54**
% of Total	9.3		16.7	24.1			1.9		1.9	46.3	
BC7											
Number	—	—	5	23	—	—	2	—	—	81	**111**
% of Total			4.5	20.7			1.8			72.9	
BC8a											
Number	—	—	—	5	—	—	—	—	—	15	**20**
% of Total				25						75.0	
BC8b											
Number	1	—	1	1	—	—	—	—	—	34	**37**
% of Total	2.7		2.7	2.7						91.9	
TC7											
Number	4	—	27	6	—	—	—	—	—	66	**103**
% of Total	3.9		26.2	5.8						64.1	
TC11											
Number	2	—	7	9	—	—	—	—	—	66	**84**
% of Total	2.4		8.3	10.7						78.6	
TC14											
Number	2	—	76	13	—	—	—	—	2	40	**133**
% of Total	1.5		57.1	9.8					1.5	30.1	
SC1											
Number	10	—	31	45	—	—	—	—	—	21	**107**
% of Total	9.3		28.9	42.1						19.6	
SC2											
Number	8	—	17	39	—	—	—	—	—	58	**122**
% of Total	6.6		13.9	32.0						47.5	
SC5											
Number	11	—	3	11	—	—	—	3	—	54	**82**
% of Total	13.4		3.7	13.4				3.7		65.9	
MC1											
Number	—	1	3	18	—	—	—	—	—	79	**101**
% of Total		1.0	3.0	17.8						78.2	
BA2											
Number	2	—	—	—	—	3	—	—	—	27	**32**
% of Total	6.3					9.4				84.4	

USBEM FINDINGS AND RECOMMENDATIONS

The USBEM method calls for a comparison of the level of channel or watershed alteration determined during Phase I, Step 5, and the habitat condition outcome determined in Phase II (Figure 6). In Phase I, it was found that all stream reaches had experienced a moderate to high level of alteration. Phase II outcomes indicate that habitat conditions range from fair to poor. Therefore, according to the USBEM, the recovery options are limited for all but three reaches in the City of Shoreline. For those reaches that were rated fair (BC1, BC8 and TC14), enhancement is recommended.

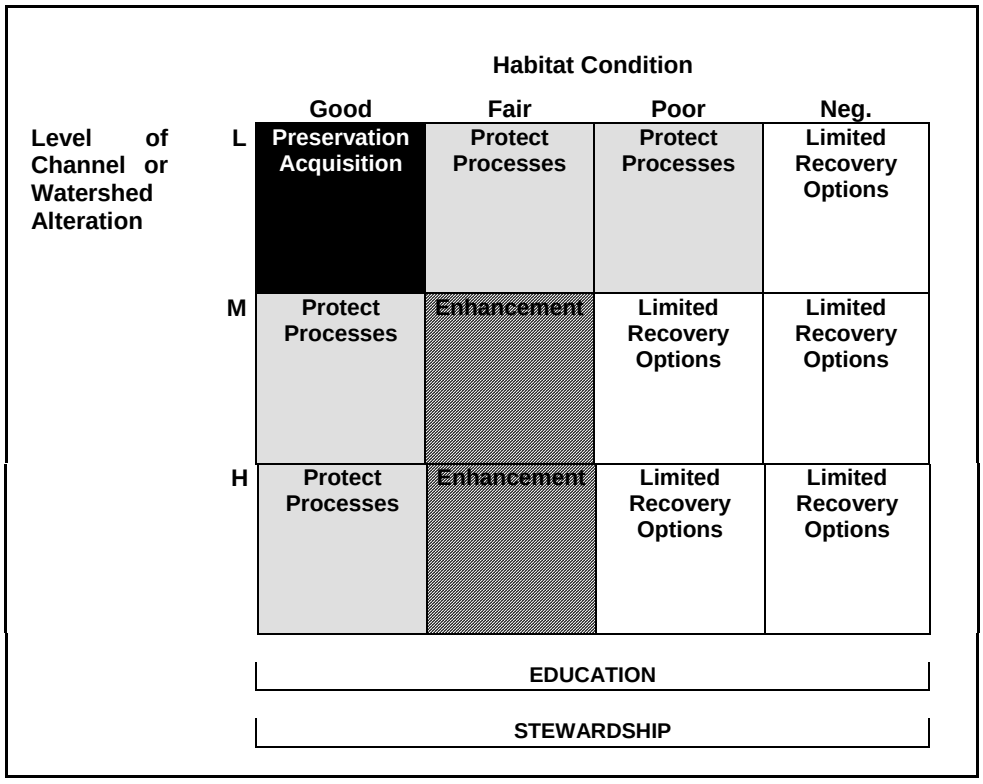

Figure 6. Potential Recovery Options for City of Shoreline Streams

Taking the results directly from the USBEM, the foremost option for recovery within the Shoreline area is enhancement of the BC1, BC8 and TC14 reaches. In these areas, there are several site-specific enhancement options to address poor or fair conditions and improve the overall habitat conditions.

The primary goal for protection of BC1 is stabilization of the banks. Landslides here must be reduced to more natural levels to reduce sediment loading into the stream. Reduction of stormwater flow down steep slopes is a primary method to provide stabilization. All fair reaches would benefit from planting of native riparian vegetation and underplanting of native conifers and deciduous trees, as well as eradication of invasive plants, such as Himalayan blackberry and Japanese knotweed. At TC14, an infestation of Japanese knotweed near the south end of Paramount Park could be addressed to prevent further loss of native vegetation. At all sites, pieces of LW should be placed to facilitate development of pools and provide cover for the species of concern.

4. WATER COURSE REACH DESCRIPTIONS

A narrative description and summary of field data findings and potential fish passage barriers are presented below for each reach. Benthic invertebrate data are not further detailed, since all reach values were low for that parameter.

BOEING CREEK BASIN

Reach BC1

Description

Boeing Creek Reach 1 (BC1) extends from the upstream end of Reach BC1A to the steel-pile dam behind the property at the end of NW 166th Street. The dam prevents fish access to upstream reaches. Riparian condition along this open water course was good, with a large, dense growth of native hardwoods with a medium potential for recruitment of large wood (LW). Bank conditions were good due to little exposed soil or artificial hardening. However, erosion and slumping were evident on the steeper ravine banks. LW abundance was good, although most wood was smaller than key piece size (20 inches in diameter). Embeddedness was fair. Embeddedness can be described quantitatively or qualitatively. For this report, embeddedness is a qualitative measure of the amount of fine material clogging stream gravels and reduces spawning suitability. Substrate composition was dominated by gravel or cobble in the upper portion of the reach; downstream, sand or silt became the dominant substrate type. Much of the reach consisted of step cascades and small, shallow pools, which indicates poor frequency of pools suitably sized for salmonid habitat.

A small seep enters the creek from the north approximately 750 feet upstream of the mouth. Its primary flow appears to originate from stormwater runoff created by the streets and residences above the slope (NW 167th Street).

The lower portion of this reach (approximately 70 feet) is inundated by high tides and is discussed below as Boeing Creek Reach 1A (BC1A).

Reach BC1A

Description

Boeing Creek Reach 1A (BC1A) extends about 70 feet upstream from the creek's mouth at Puget Sound. This open water course flows through a box culvert under the Burlington Northern Santa Fe (BNSF) railroad that was constructed in 1995 to improve fish access. The south half of the culvert provides a low flow channel and fish access. The north half provides overflow capacity and pedestrian access. Older twin culverts to the south that previously carried all of the creek flow also accommodate high flows.

High tides can sweep into the lower portions of this reach, influencing stream depth over the length of this reach. The lack of estuarine vegetation in this reach suggests

that the saline influence of the high tides is of a short duration. Bank restoration has improved the aquatic and riparian habitat in portions of this area. The riprap along the bank, however, does not enhance habitat.

Reach BC2

Description

Boeing Creek Reach 2 (BC2) is a 680-foot reach between the steel-pile dam and Innis Arden Road. It is directly behind several privately owned parcels. The mix of native conifers and hardwoods along this reach is low and sparse, with moderate potential for LW recruitment. Riparian condition and LW abundance are fair. The remainder of the conditions were rated poor. Landslides are common, sand and silt dominate the substrate, a cascade bedform is dominant, and pool frequency is low as a result of filling from landslides.

This reach includes two consecutive weirs upstream of the steel-pile dam. Incision is severe downstream of the weirs. A culvert under NW Innis Arden Way and the Hidden Lake outlet are velocity barriers to adult and juvenile fish.

A small seep enters this reach just above the steel-pile dam. Its primary flow appears to originate from stormwater runoff created by the streets and residences above the slope along Beach Drive.

Reach BC3

Description

Boeing Creek Reach 3 (BC3) is the lower segment of a tributary that enters the main stem of Boeing Creek on the left bank above the sheet-pile dam on BC1. It is an intermittent stream that runs through a steep ravine in the lower reaches. Only its bank conditions warrant a good rating; vegetation exists along the majority of both banks and a minimal length of the bank is artificially hardened. Poor ratings are given for the sand/silt dominant substrate, poorly formed pool-riffle stream morphology, and lack of pools and LW. Riparian conditions were rated fair, owing to the immature but native composition of conifers and hardwoods. Fish passage may be limited by seasonally dry or low-flow conditions.

Reach BC4

Description

Boeing Creek Reach 4 (BC4) is a small intermittent tributary which drains a portion of Innis Arden. It discharges to BC1 approximately 800 feet downstream of the steel-pile dam on the north bank. It has a steep slope in a stair-step pattern. It's overall habitat assessment was rated as poor due to eroding and incised banks and low amounts of large wood. Riparian vegetation including salmonberry, thimbleberry, ocean spray and small alders provides dense cover.

Reach BC5

Boeing Creek Reach 5 (BC5) extends along NW Innis Arden Way from just east of NW 166th Street to east of 6th Avenue NW. This reach is piped or in a grass-lined or rock-lined channel without natural substrate. There was flow in this open water course, approximately 1-inch in depth, only in the portion near the junction with the main stem and originated from the bottom of the ditch. It is likely that there are a number of seeps along the adjacent hillside. The only riparian vegetation was from the side away from the road consisting of saplings growing on the slope of the hillside. Substrate was dominated by silt with quarry spalls spread the length.

Reach BC6

Description

Boeing Creek Reach 6 (BC6) is a highly modified segment of open water course between NW Innis Arden Way and the confluence of BC7 and BC 8 that includes Hidden Lake. The right bank is private property and much of the area has hiking trails. Although riparian condition is similar to that of Reach BC2 (fair), the amount of shading and LW is minimal. Sand and silt are dominant in the substrate and embeddedness or percentage of fines is more than 40 percent in riffles and pools. A moderate amount of riprap bank stabilization has been placed in this reach to stabilize landslides. Several small springs are present on the left bank, but they do not form defined channels.

Large slope failures occur in this area due to sandy soils and high peak flows. Mountain beavers burrowing into the banks create a point of erosion during storm events that likely contributes additional sand into the creek, although their impact is minor in comparison to the high peak flows. In addition, young people using the area for recreation have constructed tunnels in the sandy ravine slope above the creek channel and exposed significant areas to erosion.

Two concrete weirs, 12 and 30 inches high, are present in this reach upstream of Hidden Lake. The weirs may be fish passage barriers during low flows.

Hidden Lake is at the downstream end of this reach. Approximately 2.1 acres, this lake was built in 1924 by constructing an earthen dam across the creek upstream of NW Innis Arden Way. It currently contains an engineered sediment trap. A 24-inch culvert on the left bank of the main channel just upstream of Hidden Lake acts as a bypass channel for diverting water beneath a sand berm to the east side of the lake during dredging. The City maintains the trap by dredging every year. There is some concern within the City that dredging degrades the aquatic habitat in the lake.

Reach BC7

Description

Boeing Creek Reach 7 (BC7) is a short open water course reach along the edge of Shoreview Park from the confluence with the main stem to near NW 175th Street and the North Pond. The right bank is bordered by private property and access is limited.

All criteria were rated fair or poor for this reach. Riparian condition is poor, with much of the bank zone dominated by small or sparse native hardwoods and grass. Both banks are artificially hardened with riprap downstream of the North Pond detention basin. Quarry spalls are present in the channel. LW and pools are very low in number and of unsuitable size to provide viable habitat.

The detention basin and three log weirs, with jumping heights between 15 and 30 inches, could impede upstream fish passage, especially at low flows. Removal of the log weirs may improve juvenile fish passage, but would only provide an additional 400 feet of access upstream from the most upstream weir. Weirs may be providing essential erosion control in the channel.

Reach BC8

Description

Boeing Creek Reach 8 (BC8) is a branch of Boeing Creek that enters the main channel from the left bank. This open water course extends between the western edge of Shoreview Park and the M1 dam near the intersection of Carlyle Hall Road NW and NW 172nd Street. Native conifers and hardwoods were present but sparse, providing moderate potential for LW recruitment. LW abundance was at fair levels, with a small number of key pieces, primarily in the upper end of the reach. The reach was sinuous with a poorly defined step-pool bedform and infrequent shallow pools. A compromised score of fair was given for the substrate, since sand and gravel were present in equal proportion.

Bank conditions were typically good, with perennial vegetation along approximately 80 percent of both banks and less than 20 percent of the banks artificially hardened. Large slope failures occur in the reach due to the high peak flows that erode the toe of already unstable slopes with exposed sands and clays. Groundwater seepage probably exacerbates consequent erosion and sedimentation in the reach. This area, along with much of the area in the lower basin, was mapped as a landslide hazard area. A small spring on the right bank contributed a negligible flow to the stream. A rough-skinned newt was observed at this reach. A small spring-fed tributary enters the right bank approximately 800 feet upstream of the confluence of BC7 and BC8. A culvert upstream of the spring-fed tributary is not a fish passage barrier.

The M1 Dam, approximately 50 feet high, at the upstream end of this reach is a passage barrier. No base flow occurs above the dam; groundwater seepage initiates a base flow approximately 600 feet below the dam.

Reach BC9

Description

Boeing Creek Reach 9 (BC9) extends from the M1 Dam at the upper end of Reach 8 through the Shoreline Community College property and ends at the intersection of Greenwood Avenue North and Carlyle Hall Road NW. It is bordered on the right bank by Carlyle Hall Road NW and is primarily a channelized grass-lined open water course with quarry spalls dominating the bottom substrate. A combination dirt and gravel

parking lot on the Shoreline Community College Campus is within 50 feet of the left bank and contributes sediment to this reach which did not contain water on March 31, 2004. There is a dense growth of riparian vegetation on both sides of this reach approximately 30 feet in depth.

Reach BC10

Boeing Creek Reach 10 (BC10) begins at the intersection of Greenwood Avenue North and Carlyle Hall Road NW, extends along the east side of Aurora Avenue North, and ends near North 183rd Street. It is contained primarily in pipes with short sections of open water courses including one through Darnell Park. No natural substrate was present.

Reaches BC11 and BC12

Description

Boeing Creek Reaches 11 and 12 (BC11 and BC12) are primarily piped water courses through developed residential or commercial areas north of North 175th Street.

Reach BC11 has a short portion of an open water course on the Cristwood Community property north of North Richmond Beach Road. On this property, runoff appears to collect in a grass lined swale for approximately 200 feet. South of this area, mapping indicates that the creek runs through another open area, but water was not observed there. Flows may have been obscured by vegetation or the reach may be piped. Access was prohibited by steep ravines and fencing.

BC12 has several short open water course segments including one through Hillwood Park which is approximately 500 feet long and primarily grass-lined.

THORNTON CREEK BASIN

Reach TC1

Thornton Creek Reach 1 (TC1) crosses under Interstate 5 through a 1,500-foot long 72-inch diameter culvert from the city limit to the beginning of Reach TC2 and is completely piped. For this reason, no data were collected.

Reach TC2

Description

Thornton Creek Reach 2 (TC2) is a concrete-lined open water course extending from the outlet of Peverly Pond (WL-E) to a culvert under Interstate 5. It is contiguous with TC8. Peverly Pond and TC3 flow over a concrete sill into the channel which is formed by TC2 and TC8 at their juncture. TC2 possesses dense riparian vegetation including willow, alder, cottonwood and Douglas fir along with a variety of shrubs including blackberry and salmonberry. Although the width of the vegetated banks is relatively narrow (~10-20 feet), it supplies large wood to the open water course which provides cover and insects for fish. The channel bottom is highly silted with no gravels

apparent. Although the reach is concrete lined, the banks consist of soil where grasses and other herbs have taken root. The concrete is not readily observable. There is a thick orange and brown substance several inches thick and one square foot in area on the bank opposite the sill. On March 30, 2004 the depth of water was approximately 12 inches with a temperature of 50 degrees F.

Wetland Resources (2000) documented cutthroat trout, coho salmon and aquarium billfish in this reach during a wetland evaluation of the area. Because there is an impassible barrier under Interstate 5, it is likely that the coho salmon is a plant from a classroom program. City staff observed fish of unknown species on August 28, 2003 and a water depth of 2 feet.

Reach TC3

Description

Beginning at the southeast corner of Twin Ponds (WL-D), Thornton Creek Reach 3 (TC3), an open water course, extends across 1st Avenue NE and ends at the western end of Peverly Pond (WL-E), a pond/wetland area between 1st Avenue NE and Interstate 5. Riparian conditions along this reach were poor due to the low density and young age of the vegetation and a large infestation of Japanese knotweed. However, vegetation was suitable for stabilizing banks, which were rated good. Substrate was muck, embeddedness was rated poor, and no pieces of large wood (LW) or pools were observed. Glide habitat (smooth stretches of flowing water) was dominant. The channel had good sinuosity and connections to side channels and wetlands. A culvert beneath 1st Avenue NE may limit fish passage at low flows. Passage into the south pond of Twin Ponds Park is good.

Reach TC4

Description

From the southwest corner of Twin Ponds, Thornton Creek Reach 4 (TC4, Evergreen Creek) extends to the northwest corner of the Evergreen School property, where it enters a 40-inch culvert. Students constructed a wetland as part of the stream system where the stream enters the culvert under Meridian Avenue and planted riparian vegetation along this segment of stream. The students were recognized by the National Wildlife Federation for this work.

A detention pond that drains to this reach lies just north of the wetland. Between Meridian Avenue and Twin Ponds, the channel is poorly defined. Both the north and south sides of the open space had depressions, which appeared to be wetlands. The north side had more of a defined channel with a mud bottom. No flowing or standing water was present during the surveys. The area was dominated by non-native species and had fair forest cover. The dominant riparian species was reed canarygrass, but several native species were also present, including willow and red alder. Bank condition was rated poor, since much of the bank area was exposed or artificially hardened. Overall, this reach rated poor for habitat quality.

A 36-inch culvert accessible to fish crosses under a trail along the west side of the south pond. Fish passage through the open space is likely limited to high flow events, since low flows appear to disperse into the wetland area.

Reach TC5

Thornton Creek Reach 5 (TC5) begins at the upper end of Reach 4 and may have several branches extending as far as Stone Avenue North. It is primarily a piped water course, with grass-lined and concrete-lined sections. No data were collected for this piped reach.

Reach TC6

Description

Thornton Creek Reach 6 (TC6) flows through Meridian Park as an open water course. It expands into a small wetland (WL-K) in the park prior to being piped under North 167th Street, where Reach TC5 begins. The creek, approximately 3 feet wide in its defined channel, has a muddy substrate and moderately good riparian habitat consisting of willow trees and salmonberry. Patches of sedge and reed canarygrass occur on portions of the banks. A staff gauge has been placed in the creek. The stream exits the wetland complex through a 48-inch culvert under a trail constructed of fill.

Reach TC7

Description

Thornton Creek Reach 7 (TC7) lies between the north inlet of the north pond and a diversion structure adjacent to Interstate 5. Overall, riparian area was given a poor score since immature trees and shrubs were sparse and many non-native plants were present. Substrate consisted of both silt and gravel, but embeddedness was rated poor. Due to bank hardening and sparse bank vegetation, bank condition was also rated poor.

The stream flows through a series of culverts in the park north of the ponds. The northernmost culvert (24 inches in diameter) crosses beneath North 155th Street. Passability is unknown since the upstream end of the culvert could not be accessed. The middle culvert passes beneath a pedestrian trail and consists of three 18-inch pipes. A jumping height of 20 inches and higher downstream flow velocity likely prevents juvenile fish passage. Quarry spalls are present at the downstream end of these rusting culverts. The southernmost culvert, a 40-inch pipe, also passes beneath a pedestrian trail. It has a 6-inch jumping height and a plunge pool that slows downstream velocity; it is not likely to be a fish passage barrier.

The reach continues north, crossing North 155th Street in a pipe, continues for a short stretch as an open water course until piped under a residence, and then flows through the backyard to a pipe extending east to the diversion structure adjacent to Interstate 5. This diversion structure is the juncture and northern terminus for Reach TC7 and Reach TC8, which is a channelized open water course. The stream flows through a constructed concrete-lined pond in the backyard of the residence (SPU

1999). This section of the reach could not be evaluated due to the lack of access to the property.

Both City and WDFW staff observed a steelhead in Reach TC7 on February 4, 2004 in approximately 2 feet of water just north of North 155th Street. The steelhead, approximately 27 inches long, had minor abrasions, but seemed to be in good health. With the heavy January rains, it is likely that the steelhead was able to navigate the long culvert under Interstate 5 and to pass over the angled sill which is approximately 8 feet in height from the creek bottom.

Reach TC8

Description

Thornton Creek Reach 8 (TC8) begins at Peverly Pond west of Interstate 5, runs north along the highway under North 155th Street, and ends at the diversion structure near property at the northeast corner of St. Barnabas Church. TC8 has a thick growth of riparian vegetation, primarily Himalayan blackberry and nightshade with cottonwood, Douglas fir, alder and willow saplings scattered throughout. The woody vegetation is growing along the banks of the channel . Water parsley, cattail and veronica grow in the sediment within the channel. All three plants are obligate wetland plants and require saturated soil for growth. Trees become more abundant and larger as the channel passes behind the Aegis facility.

Several hundred feet south of North 155th Street, the channel contains saturated sediments about 30 inches in depth. An oily sheen was present. The whole area from bank to bank (approximately 5 feet) was wet with one inch of water evident in places, although no significant precipitation has fallen for several months prior to this observation (August 28, 2003). Water temperature was 48 degrees F with an ambient temperature of 56 degrees F. The source of the water is probably a high groundwater table as Twin Ponds was historically mined for peat and the channel bottom is several feet below the bottom of the main stem of Thornton Creek which runs parallel and approximately several hundred yards to the west of TC8. In addition, City staff found during rain events that runoff from Interstate 5, First Avenue NE and areas east of Interstate 5 flow into TC8. No flow was evident at this location because of the thick growth of vegetation in the channel. It became apparent that a diffuse flow was occurring after examining a portion of the channel further to the south. Near the concrete sill, there was several inches of flow occurring over a bank width of 3 feet. It is likely that the flow was more apparent in this section of TC8 because of a more defined channel with terraced banks within the concrete channel. Bottom substrate was covered with silt. Similar to TC2, there is a dense growth of vegetation on each bank.

Based on a 1963 agreement with local property owners, the diversion structure at the north end of TC8 and the channel which comprises both TC8 and TC2, was constructed by the Washington Department of Transportation to divert flows over 17 cubic feet per second from the main stem portion of the stream, which passes through Twin Ponds, and discharge it back to the main stem at Peverly Pond just below the concrete spillway. A flow study conducted by City staff shows diversion into this ditch occurs only at extreme rainfall events.

Reach TC9

Description

Thornton Creek Reach 9 (TC9) begins at the diversion structure north of North 155th Street and, proceeding north, ends at a small pond/wetland area just south of the Metro Bus Barn and north of North 162nd Street. The stream discharges from a 4-foot concrete culvert on the south side of the bus barn into the wetland. The properties at 2320 North 156th Place and 2322 North 158th Street were accessed to view this reach, which has a bank-full width of approximately 20 feet and a 6-inch water depth. Fencing prevented access to much of the channel itself. This open water course was concrete- and/or riprap-lined with a heavily silted bottom. Similar to TC2 and TC8, this reach has developed wetland habitat in places signified by cattails and water parsley. Riparian vegetation, in relatively narrow strips on each bank, consists primarily of blackberries, reed canarygrass and willow and cottonwood saplings.

Reach TC10

Description

Thornton Creek Reach 10 (TC10) is almost entirely piped. TC10 is piped west and north under the bus barn and opens to a short channelized open water course north of the Metro Bus Barn prior to joining TC11. Low flows and the long pipe length could impede fish passage.

Reach TC11

Description

Thornton Creek Reach 11 (TC11), an open water course, extends north through private property, connecting to the piped outlet of Ronald Bog. Non-native species, noxious weeds and artificial armoring are evident along the banks. No LW was present. The substrate consists primarily of fines. No pools are present in this reach. Benthic invertebrate diversity was rated poor.

A 60-inch culvert crossing beneath North 167th Street has no jumping height and is not a velocity barrier. Low flows occurred during surveys (less than 1 inch deep). The low flows, coupled with culverts, are potential barriers to fish passage.

Reach TC12

Description

Thornton Creek Reach 12 (TC12) is a piped segment serving as the outlet to Ronald Bog. Because of a reverse slope and disrepair due to settling, this section backs up flow and causes flooding during heavy rains. Otak (December 2001) recommended constructing an open water course along this reach, which would enable a larger flow to traverse this area and reduce flooding potential. The long outlet pipe and associated catch basin may prevent fish passage.

Reach TC13

Thornton Creek Reach 13 (TC13) is north of Ronald Bog, from North 175th Street to North 180th Street. This piped reach runs through a highly developed area.

Reach TC14

Description

Thornton Creek Reach 14 (TC14) runs as Littles Creek through Paramount Park, where a series of wetlands, ponds and connecting channels occur. Most of the data collected at this palustrine channel indicated ratings of good or fair. Riparian species were immature native conifers or hardwoods, bank condition was good due to sufficient bank vegetation and sparse armoring, and pool frequency was fair. Gravel and quarry spalls were present in the lower end of the reach. Overall, this reach is one of only three reaches in the City given a fair rating.

Paramount Park contains a diverse vegetation community, including watercress in portions of the stream and red elderberry, red osier dogwood, Indian plum, skunk cabbage, hardstem bulrush, slough sedge and a variety of ferns in the wetland and riparian corridor.

Beginning at 12th Avenue NE, the stream flows west out of a pipe, turns south as it enters the eastern edge of Paramount Park Open Space, splits, and flows south in two channels. The east channel, including flow from Wetland WL-I through a short segment of an open water course, crosses beneath a pedestrian trail in a culvert that allows fish passage. It then enters a pond, seeps into a wetland, enters a second pond, and reconnects with the west or main channel (Littles Creek).

The two ponds were constructed by local volunteers to enhance the wetlands under a Water Quality Block Grant awarded by King County Department of Natural Resources. In addition, the volunteers cleared invasive plant species, planted native vegetation, placed large wood in the ponds and along the stream courses and established an interpretive trail emphasizing the importance of water quality and wetlands. These volunteers diverted the flow from an old King County detention facility into a constructed channel to feed the wetland ponds. Small channels connect each pond with both channels.

The west channel, which is Littles Creek proper, flows west through a City-owned drainage tract with landscaping and property improvements on each side. This section is prone to flooding. The west channel then turns south and enters Paramount Park. It enters a wetland and then crosses beneath the pedestrian trail via a culvert. It continues south until it reconnects with the east channel.

Reach TC15

Thornton Creek Reach 15 (TC15) extends from North 150th Street to a detention pond at North 170th Street and 15th Avenue NE. A piped segment drains the Paramount Park playfield. It is alternately piped and ditched. Because the piped portion is longer

than the portion of channelized open water course, this reach was mapped as a piped water course.

Reach TC16

Thornton Creek Reach 16 (TC16) is east of 15th Avenue NE and extends from Hamlin Park past the Shoreline city limit at NE 145th Street and joins the main Thornton Creek system. There is a small portion of channelized open water course along this reach. Because of the preponderance of piping, this reach was mapped as a piped water course.

Reach TC17

Thornton Creek Reach 17 (TC17) flows through Hamlin Park as an intermittent open water course beginning at a pipe on the park's northern boundary (TC18) at NE 165th Street and 18th Avenue NE.

Reach TC18

Thornton Creek Reach 18 (TC18) is a piped reach extending from the northern boundary of Hamlin Park north to NE 177th Street.

Reach TC19

Description

Thornton Creek Reach 19 (TC19) is an open water course which flows into the southeast corner of Ronald Bog after flowing through the park along Interstate 5 as a roadside and channeled open water course (TC20). Riparian cover is fair because of primarily alder trees along the banks; the shrub layer consisted of blackberry. Substrate consisted of mud and sand supporting a thick growth of algae. Oil sheen was common throughout this reach.

Reach TC20

Description

Thornton Creek Reach 20 (TC20) is also a roadside and channeled open water course with a piped portion under North 175th Street that follows the west side of the Interstate 5 off ramp and enters Ronald Bog Park at the northeast corner. The section through the park is heavily vegetated with blackberries. No pools or large wood was evident. North of North 175th the channel bottom was concrete; south of the street the bottom consisted of grass. A small trickle of water was evident.

Reach TC21

Thornton Creek Reach 21 (TC21) is primarily a piped reach with a relatively small section of channelized open water course in a small ravine. The piped segment runs through Ridgecrest Park, under Interstate 5 and joins TC9.

MIDDLE PUGET SOUND BASINS

Highlands Creek

Reaches HL1 and HL2

Description

Highlands Creek is a spring-fed stream that consists of two reaches (HL1 and HL2) extending from just west of Spring Drive to Puget Sound. A spring and associated wetland (WL-P) located between Cherry Loop and Spring Drive are the headwaters of Highlands Creek; no flows occur above that location except sheet flow during heavy rain storms. Below the spring, the channel (HL2) is poorly defined. Because of negligible flow, no data were collected for embeddedness or benthic invertebrates. Embeddedness can be described quantitatively or qualitatively. For this report, embeddedness is a qualitative measure of the amount of fine material clogging stream gravels and reduces spawning suitability. No pools were present, resulting in a poor rating for channel form and pool frequency. No pieces of large wood (LW) were observed. Large, dense conifers were present, as well as a number of ornamental and non-native species. For this reason, a fair rating was given for riparian conditions.

At Cherry Loop (HL1), the flow enters pipes, concrete pools and finally a tightline that carries flow to the beach. This reach was mapped as a piped water course.

Innis Arden South Creek

Reach IS1

Description

During late summer of 2001, low flows (less than 1 inch) were present in Innis Arden South Creek Reach 1 (IS1), which extends from the creek's mouth at Puget Sound to 14th Avenue NW. This stream is locally known as Coyote Creek. This reach was found to have poor riparian condition, substrate composition, channel pattern, LW and pool frequency. Bank condition was fair. Embeddedness and benthic invertebrate data were not collected since substrate was primarily fines. The area is dominated by non-native species. Banks show evidence of slumping and eroding along more than 20 percent of the reach, and no pools or LW were observed.

West of 14th Avenue NW, the creek is confined in a deep ravine with no defined channel. Vegetation covered the entire ravine floor; water was not present.

At the lower end of the reach, the flow enters a plastic pipe for approximately 300 feet down an extremely high gradient ravine. Fish passage is not possible due to the piping. Removal of the piping may not result in increased passage, since extreme gradients and intermittent flows would remain. A culvert beneath the railroad may prevent fish entry into the creek during low tides. Another culvert, beneath 14th Avenue NW, could impede fish passage at low flows.

Reach IS2

Description

Innis Arden South Creek Reach 2 (IS2) extends from 14th Avenue NW upstream for approximately 400 feet and then splits into three or more branches. These branches come together at the private property on 1302 NW 175th Street. No water was present in any branch and it is likely that this reach is highly intermittent, having flows only after heavy rains and for a very short time following rain events. No pools or LW were observed in these branches of undefined bedform, although banks were fairly stabilized by thin, immature stands of native hardwoods. On the northern branch, blackberries were the dominant vegetation. For these reasons, the overall rating for this reach was poor.

East of 14th Avenue NW, the creek is confined in a deep ravine with no defined channel. Vegetation covered the entire ravine floor; water was not present.

Innis Arden North Creek

Reach IN1

Description

Innis Arden North Creek Reach 1 (IN1), known locally as Blue Heron Creek, begins at Puget Sound and ends west of 14th Avenue NW. This reach is within the private open spaces of the Blue Heron Reserve east of the BNSF tracks. The stream in this reach is confined in a ravine with no defined bedform and few, shallow pools. Several landslide scars were observed. Ratings for all criteria were poor. The riparian species were primarily hardwoods and non-native species of immature size. The high level of sand and silt indicated poor benthic invertebrate habitat; samples were not taken due to unsuitable substrate.

Flow depth at the time of survey in April of 2001 was less than 2 inches. It likely decreases to no flow during summer months. The gradients recorded for IN1, IN2 and IN3 were 7.4 percent to 8.3 percent, which fish typically are able to ascend. However, given the lack of wood capable of forming step pools, juvenile and adult upstream migration may be hindered. A 36-inch culvert beneath the railroad may prevent passage during low flows or low tides.

Reach IN2

Description

Approximately 1,200 feet upstream of the mouth, this creek splits into two branches: the south branch Innis Arden North Creek containing Reach 2 (IN2) and Reach 3 (IN3) and the north branch Innis Arden North Creek containing Reach 4 (IN4) and Reach 5 (IN5).

Reach IN2 ends at Springdale Court NW and is primarily contained in the Blue Heron Reserve. This reach is confined in a high-gradient channel, is straightened, and has no

pools and lacks channel roughness that large wood can typically provide. The riparian area is dominated by non-native species with sparse growth of native hardwoods and offering little potential for LW recruitment. Substrate was dominated by sand and silt with high levels of embeddedness. All criteria were rated poor at this reach, except bank condition, since more than 50 percent of the bank had some form of vegetation holding it in place. The culvert under Springdale Court NW is perched with a 5-foot drop and is impassable at all flows.

Reach IN3

Description

IN3 extends upstream from NW Springdale Court to approximately NW 180th Street, crossing under NW Innis Arden Road. Like IN2, IN3 flows through a steep channel with few pools and little LW. Substrate was rated poor with high levels of embeddedness. Upstream of NW Innis Arden Road, the channel is poorly defined, experiences only ephemeral flows and passes through residential areas with poor riparian cover. Culverts at Ridgefield Road NW and NW Innis Arden Road could impede fish passage at low flows.

Reach IN4

Description

IN4 extends from the upstream end of reach IN1 to Ridgefield Road NW. No water was present in the reach during the time of survey and many of the in-stream data were not collected. The riparian area consisted of thin, immature stands of native conifers and hardwoods and no LW was observed. The channel was of undefined bedform, had no pools and was confined in a steep ravine for the portion not on private property. A few areas of slumping were evident, although vegetation was present along most of the banks, resulting in a fair rating for bank condition.

Seasonally low and intermittent flows prevent fish passage. Culverts are present beneath Springdale Court NW and Ridgefield Road NW. Since this reach only experiences seasonal flows, removal of any culverts would increase upstream habitat accessibility on a seasonal basis. Removal of the culverts, however, could increase function and value of downstream segments through the addition of allocanthous material. This is material derived from the canopy in the immediate vicinity of a stream, lake or wetland and typically consists of branches, twigs, leafs, pollen and insects.

Reach IN5

IN5 is entirely piped from Ridgefield Road NW to NW Richmond Beach Road.

Storm Creek

Reach SC1

Description

Storm Creek Reach 1 (SC1) begins at the mouth of Storm Creek at Puget Sound and continues to 15th Avenue NW, passing through a private open space called the Eagle Creek Reserve owned by the Innis Arden Club, a neighborhood association. It is confined within a very steep ravine between the mouth and 17th Place NW; this short portion has almost vertical slopes made up of glacial till. It appears to be unstable, with evidence of frequent slides.

Above 17th Place NW, the creek runs through a narrow, undeveloped valley. Erosion is severe throughout this reach. Non-native species such as English ivy, laurel and holly have spread into parts of the preserve from adjoining property. There is a paved portion of the creek approximately 800 feet upstream from the mouth where Ronald Wastewater District repaired a faulty sewer line. This presents a potential fish passage barrier. The reach had many cascades. Riparian vegetation was mixed native and non-native species and the presence of LW was very low, with less than 0.15 key pieces per bank-full width. Silt and gravel were co-dominant substrates and embeddedness was rated fair. Due to landslides, banks were poorly defined in places and bank conditions were rated poor.

Reach SC2

Description
Storm Creek Reach 2 (SC2) begins at 15th Avenue NW and ends just north of NW 191st Street on private property at 19118 15th Avenue NW. Flows were less than 2 inches deep at the time of survey. Riparian areas consisted of non-native species, bank condition was poor due to hardening and no LW was observed. No pools were present and the channel was poorly defined having no pool-riffle complexes. Substrate was dominated by silt, but gravel was present and embeddedness was fair. Two culverts, beneath 15th Avenue NW and NW 191st Street, were inaccessible for observation.

Reaches SC3 and SC4

Description

Storm Creek Reaches 3 and 4 (SC3 and SC4) split from the upper end of Reach SC2, forming two branches. Reach SC3 extends about 400 feet north of NW Richmond Beach Road and ends east of the Meadowbrook Apartment complex near Wetland WL-N. Reach SC4 extends north and then east across NW Richmond Beach Road, then reconnects with SC3.

These reaches are in highly developed areas on each side of NW Richmond Beach Road and are alternately in pipes and open water courses as they run through apartment and residential complexes. Low flows were present during surveys (less than 1 inch deep). No pools or LW were evident. Substrate was primarily silt. Water temperature

was 50 degrees F (March 30, 2004). Riparian species were predominantly non-native, including blackberry and grasses. Both of these channelized reaches were mapped as open water courses..

Reach SC5

Description

Storm Creek Reach 5 (SC5) is a very short reach (300 feet) that begins north of the Meadowbrook Apartment Complex, where Reach SC4 ends. This reach collects flow from stormwater pipes exiting from Syre Elementary School and from NW 195th Street. In addition, this reach collects some flow exiting from Wetland WL-N to the east. Most of this reach was rock-lined by private owners and therefore rated poor for bank condition. No pools were observed. Embeddedness was rated poor and substrate consisted primarily of fines. A few small pieces of LW were present, but of unsuitable size to provide cover.

Fish passage may be constrained in this reach by low flows and by rock weirs constructed on private property. However, Washington Department of Fish and Wildlife (WDFW) staff trapped cutthroat trout in this reach during the summer of 1999 (Hennick 1999). The presence of these fish indicates their resilience to adverse living conditions. Even streams with poor habitat can and do support fish. Removal of fish migration barriers need not be considered pointless when the habitat upstream is ranked as poor.

Reach SC6

Description

Storm Creek Reach 6 (SC6) runs from just south of North 195th Street to the property at 1233 NW 199th Place and is entirely piped. No data were collected here; this reach was mapped as a piped water course.

Upper Puget Sound South Creek

Reach USSS1

Description

South Upper Puget Sound South Creek Reach 1 (USSS1) flows into Puget Sound through a culvert southwest of the intersection of NW 194th Place and Richmond Beach Drive NW. This channelized reach, approximately 3-feet wide, 1-inch deep and with a spall bottom, was mapped as an open water course and flows along the west side of the BNSF railroad tracks. There were no pools or LW. The most common vegetation associated with the reach is reed canarygrass, horsetail and blackberry. The reach extends to the NW 196th Street bridge over the railroad tracks, about 850 feet north of the outlet culvert.

Reach USSS2

Description

South Upper Puget Sound South Creek Reach 2 (USSS2) is a channelized 800-foot stretch of an open water course along the BNSF railroad tracks. Reach USSS2 begins at the NW 196th Street bridge and ends at the subbasin divide between MSN-F and MSN-H at NW 198th Street. Water appears to collect in Reach USSS2 and can flow over either north or south depending on the grade and water surface elevation. No pools or LW were evident; the bottom substrate was a mix of quarry spalls and silt. Again, reed canarygrass, horsetail and blackberry grow on the banks of this reach.

Reach USS1

Description

Upper Puget Sound South Creek Reach 1 (USS1) is an channelized open water course that begins at the divide between Subbasins MSN-F and MSN-H. This reach extends north about 500 feet and flows into Reach USN1 just upstream of the culvert below the BNSF railroad tracks. Like the previous reaches, pools and LW were not evident; the 1-inch depth of water flowed north and eventually into WL-M.

Reach USS2

Description

Upper Puget Sound South Creek Reach 2 (USS2) extends from 25th Avenue NW to Barnacle Creek (Upper Puget Sound North Creek Reach 1). Low flows (less than 1 inch deep) occurred during surveys of this reach, which is confined in steep ravines. Blackberries were the dominant riparian species, followed closely by ornamentals planted on and adjacent to private parcels. The channel was silty and had no pools or LW. While the latter criteria were rated poor, bank condition was rated fair.

Low flows and extreme gradients through the steep ravine are fish passage barriers. The wetland (WL-M) has a poorly defined channel confluence with Barnacle Creek, but under high tidal influence would allow access into the wetland area and the subsequent upstream portion of USS2. Extreme gradients may preclude fish from passing into the upper portion of the reach.

Reach USS3

Description

Upper Puget Sound South Creek Reach 3 (USS3) extends from the upper end of Reach USS2 (25th Avenue NW) to 23rd Place NW. The reach ends about 150 feet northwest of the intersection of 23rd Place NW and 21st Place NW. This reach is entirely piped, with the exception of a small section of open water course between 23rd Avenue NW and 23rd Place NW.

Upper Puget Sound North Creek

Reach USNN1

Description

North Upper Puget Sound North Creek Reach 1 (USNN1) begins in Snohomish County in the vicinity of Point Wells. This reach is a channelized open water course and flows south into Puget Sound through a culvert. The outlet culvert is just north of NW 204th Street. A portion of this reach continues south and connects with the upper portion of Reach USN1. Water depth was 1 inch and an oil sheen was evident. No pools or LW were associated with this reach. Water temperature was 54 degrees F (March 30, 2004). High flows or flows at high tide may drain south into Reach USN1.

Reach USN1

Description

Upper Puget Sound North Creek Reach 1 (USN1), known locally as Barnacle Creek, is west of Richmond Beach Drive NW and is the outlet of the creek into the Puget Sound. The lower section of Barnacle Creek is tidally influenced upstream for a distance of approximately 20 feet. Railroad tracks border the stream for approximately 100 yards, eliminating vegetative cover from the stream bank. Channel substrate is dominated by sand with a gravel component. This narrow channel flows parallel and adjacent to a 0.5- to 1-acre wetland (WL-M) where riparian vegetation provides good cover. Tributaries to this stream run through backyards, where they are highly manipulated into manicured landscape. Trash and debris are present in a portion of the wetland area. Riparian vegetation is mixed, including young and mature coniferous and deciduous trees. Overall, the rating for this area is poor. (See the description of Wetland WL-M for more information.)

A culvert that conveys flow to Puget Sound from east of the railroad was fully submerged during surveys. It does not appear to be a fish passage barrier.

Reach USN2

Description

Upper Puget Sound North Creek Reach 2 (USN2) extends eastward from Richmond Beach Drive NW and discharges to USN1 after passing under Richmond Beach Drive NW. It is entirely piped.

Reach USN3

Description

Upper Puget Sound North Creek Reach 3 (USN3) is an open water course that runs through a steep ravine and is confined by residential development. All ratings for this reach were poor due to the area being highly developed. Vegetation was sparse and non-native vegetation was present. Banks were poorly vegetated and armored. No

pools or LW were observed and substrate was primarily silt. It is likely that flow occurs throughout the year.

A 24-inch concrete culvert beneath NW 204th Street is not a fish passage barrier. A second culvert, upstream of NW 204th Street beneath a private access road, could impede fish passage. However, extreme gradients and low flows likely present a greater fish passage barrier than the presence of culverts. The lack of riparian vegetation precludes the natural process of step pool formation from LW.

McALEER AND LYON CREEK BASINS

McAleer Creek

Reach MC1

Description

McAleer Creek Reach 1 (MC1) extends from NE 196th Street to Forest Park Drive NE. Portions of this reach were lined with a mixture of native and non-native vegetation of unsuitable size to provide shade, cover or large wood (LW) recruitment. However, there were sections with vegetated banks, and considerable riparian cover remains in this reach especially in the area associated with wetland (WL-V). Approximately 58 percent of the 50-foot riparian corridor is forested. Pools were only present as step pools formed by weirs. The channel provided poorly defined pool-riffle complexes. Many private landowners had lined the creek with riprap or other bank hardening materials. In the developed areas of the stream, bank hardening has constricted the stream and resulted in a scoured and incised channel.

Within the channel, gravel or cobble was subdominant; however, it was heavily cemented with sediment. Embeddedness was rated poor. Embeddedness can be quantitative and qualitative. For this report, embeddedness is a qualitative measure of the amount of fine material clogging stream gravels, which reduces spawning suitability. This reach had an overall average score close to fair, but more criteria were given poor ratings. For this reason, the overall rating is poor.

The McAleer Creek Regional Detention Pond is on the north side of NE 196th Street approximately 500 feet east of 15th Avenue NE. The detention facility is controlled by a sluice gate that is typically left open and passable to fish. A large box culvert with a graveled bottom enables the stream to flow under NE 196th Street.

A 48-inch box culvert crossing beneath 15th Avenue NE has no drop but may be a velocity barrier to juvenile fish. KCM (1983) reported that this culvert may be a low-flow barrier for fish passage. A 72-inch diameter culvert beneath Forest Park Drive NE is not likely to be a fish passage barrier. The upstream end of the culvert was not accessible. Daley (2004) found a temporary passage barrier due to improper maintenance. Replacement of the 15th Avenue NE culvert may open access to juvenile salmonids for an additional 2,000 feet upstream.

Upstream of Forest Park Drive NE the creek is open for only 24 feet before it enters a 66-inch culvert under the south cloverleaf on-ramp for I-5. Within the south

cloverleaf, the stream exhibits a scoured trapezoidal form. The average width of the creek in this reach is approximately 10 feet.

Reach MC2

McAleer Creek Reach 2 (MC2) follows along the west side of 6th Avenue NE and turns east along NE 200th Street before passing under Interstate 5. This channelized open water course portion is alternately piped and ditched along roadways. The piped portion runs beneath Interstate 5 and continues east to discharge into MC1 through a 42-inch concrete culvert with wing walls near a wastewater pumping station. This reach did not contain water and had no LW or pools. The open channel is concrete for most of the length with quarry spawl comprising a portion of the channel.

Reach MC3

McAleer Creek Reach 3 (MC3) is a combined piped and channelized open water course reach that passes through the south off-ramp of Interstate 5 at NE 205th Street. The 300-foot open water course portion is a grassy swale in the cloverleaf.

McAleer Creek Tributaries

Reaches MT1 and MT2

Description

McAleer Creek Tributary Reach 1 (MT1), a segment of Whisper Creek, is almost entirely on private property between NE 195th and 16th Avenue NE just west of Lago Place NE. MT2 is just south of Reach MT1, running from 15th Avenue NE to Whisper Creek at the City boundary. Localized springs are the major sources of flow in these reaches.

Both reaches have several road crossings, including 16th and 18th Avenues NE, and are primarily modified natural channels with short open water course and piped water course sections. Flows may contribute significantly to McAleer Creek during the winter. The channels are highly modified, with few natural in-stream formations of pools and riffles. No LW pieces were observed; the majority of riparian species were non-native. Bank condition was rated poor due to extensive bank hardening through private property and piped portions. Gravel was a subdominant substrate, but sand and silt were present in large amounts. Overall, both reaches are rated poor.

Low to no flows and piped and culverted sections may be barriers to fish passage. Culverts are present at the 16th and 18th Avenues NE road crossings. Velocities could not be recorded due to extremely low flows and it is not known whether the culverts pose fish passage problems at higher flows.

Reach MT3

Description

McAleer Creek Tributary Reach 3 (MT3) begins west of 15th Avenue NE and generally flows west and joins Whisper Creek just south of MT2. Localized springs are the major source of this reach, which flows primarily through residential yards.

This tributary is very narrow, with a gravel substrate intermixed with a large amount of sand and silt. Riparian vegetation is minimal over most of this reach. Frequently, lawns were mowed to the stream's edge. Other than artificial pools, streambed structure was poor and extensive glide habitat was present, consisting of smoothly flowing water.

Reach MT4

Description

McAleer Creek Tributary Reach 4 (MT4) originates from springs and flows into Whisper Creek. The northern portion of MT8 discharges to MT4 east of 18th Avenue NE. The reach has a dense growth of riparian vegetation, including alder and willow, which supplies LW and structure to the reach. Substrate is primarily gravel, with a substantial sand component. Bank condition is fair with no apparent hardening.

Reach MT5

Description

McAleer Creek Tributary Reach 5 (MT5), a reach of Whisper Creek west of Lago Place NE, has a dense but narrow riparian corridor providing shade and LW. Channel width is approximately 5 feet. Substrate consists of gravel with a mix of sand and mud.

Reach MT6

Description

McAleer Creek Tributary Reach 6 (MT6) is locally referred to as Sarah's Creek and flows through the City along 23rd Avenue NE for only about 400 feet before discharging to Whisper Creek in the City of Lake Forest Park. Significant riparian vegetation is lacking. The stream bed possesses a good assortment of gravels and little embeddedness. Portions of the banks are hardened.

Reach MT7

Description

McAleer Creek Tributary Reach 7 (MT7), known as Cedarbrook Creek, drains the area around Cedarbrook School and NE Perkins Way. One channeled open water course segment from the south part of Reach MT8 joins with MT7 at the Cedarbrook School playfield, where they are piped to Whisper Creek. MT 7, a perennial stream, lies along the west side of the school, flowing through thickets of primarily blackberries and

laurel that provide dense cover. There are alder and cedar trees scattered along the reach. The substrate is primarily sand and mud with little LW evident. Fishery habitat is poor because of the small size of this stream, no channel complexity and lack of native riparian vegetation.

Reach MT8

Description

McAleer Creek Tributary Reach 8 (MT8) is a matrix of piped and channeled open water course segments, most of which occur along roadways between 16th Avenue NE and Lago Place NE and NE 190th and NE 186th Streets. The northern part of the system discharges to MT4; the southern part discharges to Whisper Creek (MT5) through the pipeline under Cedarbrook School.

Echo Lake Creek

Reach EL1

Description

Echo Lake Creek Reach 1 (EL1) extends from Echo Lake to Lake Ballinger in Snohomish County. It flows through a channeled open water course without natural substrate between North 203rd Street and North 200th Street. The remainder of the reach is piped. No flow was observed during surveys; in-stream data were not collected. The open ditch area is approximately 5 feet wide and riprap-lined with silt substrate and is dominated by non-native species such as blackberries, ivy and grasses. Fish passage is limited by low or intermittent flows, rock-lined portions and extensive piped sections.

Reach EL2

Description

The downstream end of Echo Lake Creek Reach 2 (EL2) is the inlet to Echo Lake. This piped reach extends from the lake to the intersection of North 192nd Street and Aurora. It is piped for its entire length.

Ballinger Creek

Reach BA1

Ballinger Creek Reach 1 (BA1) begins near the City of Shoreline boundary at NE 195th Street and continues to the southeast corner of Bruggers Bog Park. This reach is primarily piped, with a small segment of an open water course at its southern end. Piping beneath 25th Avenue NE does not appear to be a fish passage barrier, but it might hinder access at extremely low flows.

Reach BA2

Description

Ballinger Creek Reach 2 (BA2) passes through Bruggers Bog Park. Based on the numerous old western red cedar stumps with platform notches and the damp soil, it is likely that much of the park was once a wetland that since has been drained and/or filled. All ratings for this reach, except for fish passage, were poor. The riparian area consisted primarily of grass that is regularly mowed and no LW pieces were present. Silt and sand were dominant substrates and embeddedness was poor. Few pools were present. Much of the private portions had artificially hardened banks. A few areas may be suitable for coho or cutthroat spawning, but the large amount of fines in the reach likely would inhibit this activity. This reach is hydraulically connected with the adjacent wetland (WL-T) as it leaves the park.

Ballinger Creek enters the north end of Bruggers Bog Park via three concrete culverts each less than 2 feet in diameter at the downstream end of BA4. The jumping height from the water surface to the bottom edge of these culverts is a minimum of 30 inches, presenting a fish passage constraint. A channeled open water course (BA3) with very low flow drains into BA2 at this point.

The creek runs alongside a parking lot for more than 100 feet. Support material for the fill under the parking lot, which appears to be a crib wall of concrete ecology blocks, constitutes the left bank for long portions of this reach. Two culverts, which drain a parking lot, discharge stormwater into the creek and a small spring-fed tributary enters Ballinger Creek from the left bank. Beyond the parking lot, the creek passes through another culvert (27 inches in diameter) under the access road for Bruggers Bog Park. This culvert has a small jumping height (4 inches) and flow velocities of less than 0.8 feet per second, which is passable for fish.

Reach BA3

Description

Ballinger Creek Reach 3 (BA3) carries drainage from the adjacent hillside and park to the main channel of Ballinger Creek at the northwest corner of Bruggers Bog Park; it flows along the west edge of the park and immediately east of a King County maintenance yard. There is probably a hydraulic connection with the wetland (WL-T) along the south edge of the park, although there was no apparent surface connection. The substrate was organic, and native vegetation such as cattail and water parsley grew in several areas. Standing water exhibited an oil sheen. This reach had probably been dug many years ago to help drain the wetland and receive runoff from the hillside to the west.

Reach BA4

Description

Ballinger Creek Reach 4 (BA4) begins at the northwest corner of Bruggers Bog Park and continues to the north city limit at NE 205th Street. The stream is piped through

the Ballinger Creek Condominiums except for a few short sections of open channel through manicured landscaping; the channel is open from the trash rack at NE 200th Street upstream to the city limit. As addressed under BA2, the three concrete culverts at the downstream end of this reach present an upstream barrier to fish. A small tributary flows from east to west along the north side of NE 200th Street and enters BA4 near the trash rack. City staff noted flow in the summer of 2001 and a wetland fringe adjacent to the stream.

Riparian vegetation consisted mostly of Himalayan blackberries and a few 20- to 30-year-old alders; bank condition was stable. The width of riparian vegetation was approximately 50 feet on both sides near NE 200th Street, but it rapidly decreased upstream, and at NE 203rd Street it was less than 10 feet. Sand and gravel were co-dominant, but embeddedness was poor and riprap was present upstream of NE 200th Street. The reach has no natural meanders and runs between residential homes and beneath road crossings at NE 200th Street and NE 203rd Street.

Reach BA5

Ballinger Creek Reach 5 (BA5) is primarily piped and running south along 25th Avenue NE then turning west as a channeled open water course south of NE 200th Street and discharging into Reach BA2.

5. DISCUSSION AND SUMMARY

The USBEM protocol indicates poor scores (Table 2) for nearly all stream reaches in the City of Shoreline. Generally, this is a result of the highly urbanized and altered condition of the watersheds. Riparian conditions were typically poor or fair in all reaches and many non-native, noxious, and ornamental species were present. Mature riparian vegetation can provide shade to a stream, lowering water temperatures and providing cover to aquatic and terrestrial species. As a result of poor riparian conditions, the recruitment potential for LW is low. LW is necessary for the formation of pools, retention of coarse bedload materials, and to provide cover.

Most channel types were high or moderate gradient contained channels; according to the USBEM methodology, these channels can provide well-formed pool-riffle or step-pool bedforms. These habitats provide spawning, rearing, and staging areas for fish. Streams within the City of Shoreline, however, have no well-defined habitat complexes. Substrates are primarily silt and sand, with few areas of suitable spawning gravels. Embeddedness is typically fair or poor, indicating that gravels are largely filled in with fines and do not provide quality spawning and rearing habitat. Passage barriers are present preventing fish access to many reaches.

The three reaches rated fair—Boeing Creek Reaches 1 and 8 and Thornton Creek Reach 14—have several advantages over other reaches. BC1 had the most mature and dense riparian vegetation and a good number of LW key pieces. The riparian zone was also much larger than that of other reaches because the steep slope of the riparian zone prevented residential development. Stream bank condition was also good in that banks were vegetated and not artificially armored. Substrate was a mixture of gravel and sand dominant areas and embeddedness was poor indicating the gravels were clogged with sand and/or silt reducing spawning suitability. The flume under the railroad likely prevents fish passage only seasonally during low flows. The primary detriment to habitat quality in this reach is the significant amount of sediment from landslides in the ravine. The sediment fills in pools and reduces fish habitat. The landslides are likely due to increased stormwater runoff from developed areas adjacent to Boeing Creek.

Reach BC8 had native conifers, some of significant size and cover. Bank condition was rated good for the same reasons as BC1. Fewer LW key pieces were present than in BC1, but there were many more than in most other reaches. Substrate was a mixture of gravel and sand. Fish passage, although blocked at the upper end of BC8, would not otherwise be impeded in this reach except at low flows.

Reach TC14, the segment of Thornton Creek running through Paramount Park, had high sinuosity and was connected to side channels and wetlands. It had native riparian species and more than 80 percent of its bank area was vegetated, although only immature and sparse conifers and hardwoods were present. No passage barriers were present.

The benthic invertebrate bioassessment revealed that most samples (with index numbers less than 40) contained an invertebrate community composed of a very low

diversity of species. However, the species present in the greatest numbers were those that are typically tolerant of toxic conditions. The creeks sampled were observed to have a very sandy, unstable substrate and a severely stressed habitat as a result of eroding banks and other sediment input caused by high peak flows. It is likely that these conditions prevent a diverse and rich benthic invertebrate community from becoming established. Given the community structure observed, it is likely that other limiting factors are present, such as significant levels of pollutants, which would greatly diminish the ability of Ephemeroptera, Plecoptera, and Tricoptera to survive. This is also an indication that, although habitat conditions are not completely suitable for diverse benthic invertebrates, they have the potential to become suitable with the proper enhancement and protection, if sediments are stabilized.

The USBEM provides a baseline assessment of stream habitat conditions to determine a stream's capacity to support salmonid species of concern. This survey indicates that open water courses in the City of Shoreline have poor to fair habitat with documented anadromous salmon use; it does not reflect the conditions for the many other aquatic and wildlife species present in the area and therefore does not accurately reflect the importance of protecting necessary processes. Resident cutthroat trout habitat could be enhanced regardless of the status of fish passage barriers lower in the watersheds.

Most of the streams in Shoreline are headwater areas, which are most valuable for maintaining low flows and water quality. The State 303(d) list of impaired water bodies includes Thornton, McAleer and Lyon Creeks as streams which exceed the State standard for fecal coliform. Habitats necessary for other aquatic and terrestrial species were present in many of the less developed areas. Boeing Creek, in particular, had a moderately mature riparian zone that was undeveloped for over 200 feet in width in the lowest reach and likely provides habitat for several common native species of birds and small mammals. Evidence of amphibians in BC8 is an indicator that, although habitat use is negligible for salmonids, other species are present and in need of habitat protection and enhancement.

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APPENDIX B.
WETLAND INVENTORY AND CLASSIFICATION

City of Shoreline

Wetland Inventory and Classification

May 2004

Tetra Tech/KCM, Inc.
1917 First Avenue, Seattle, WA 98101-1027

City of Shoreline
Wetland Inventory and Classification

May 2004

Prepared for:
City of Shoreline
Shoreline, WA

Prepared by:
Tetra Tech, Inc.
Seattle, WA

City of Shoreline
Wetland Inventory and Classification
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1. INTRODUCTION

As part of its effort to characterize aquatic resources, the City of Shoreline contracted with Tetra Tech/KCM to conduct an inventory and classification of existing wetlands in the City. Tetra Tech/KCM classified the wetlands according to the *Classification of Wetlands and Deepwater Habitats of the United States*, prepared by the U.S. Fish and Wildlife Service (Cowardin, et al. 1979), which is the classification used in the National Wetlands Inventory (NWI).

Wetlands are an essential part of a properly functioning watershed, benefiting both human and wildlife populations. Wetlands provide fish and wildlife with refuge and cover for nesting, mating, rearing, and foraging. They are also valuable to the surrounding human community for flood mitigation, storm abatement, sediment retention, aquifer recharge, water quality improvement and aesthetic qualities (Mitsch and Gosselink 1986). Shoreline's critical areas code establishes an overall goal of maintaining no net loss of the function, value and acreage of wetlands within the City.

A wetland inventory was conducted in October and November of 2001 to identify significant unmapped wetlands and to classify both previously known and unknown wetlands within the City boundaries. This wetland inventory was not exhaustive, but addressed wetlands that were known from the City's GIS wetland layer (primarily wetlands identified from the National Wetland Inventory), wetlands that were subjects of development reports supplied by the City and wetlands readily identified from aerial photography. Each of these areas was visited and ground-truthed to determine whether it qualifies as a wetland. Areas that were determined to be wetlands were visually assessed for classification. This report describes major wetlands and those wetlands for which the City had development reports and classifies them according to the federal system. Figures 1 through 4 in Appendix A shows the location of these wetlands within the various drainage basins within the City of Shoreline.

This report does not address small previously unmapped wetlands associated with stream reaches inventoried in the *City of Shoreline Stream Inventory and Assessment* (Tetra Tech 2004). There are many small wetland areas in the riparian zone of most streams. However, previously mapped wetlands along streams in the City were visited and classified.

2. METHODS

Data collected for wetland classification for this report included the estimated size of the wetland, wetland vegetation classes present, and estimated area of open water. Wetland size was estimated based on vegetation and soil indicators. Plants were identified using Hitchcock and Cronquist (1973). Wetland delineations were not conducted; therefore the actual size and boundary of most of the wetlands are not precisely known. Wetland classes were determined using the U.S. Fish and Wildlife Service report (Cowardin, et al. 1979) based on visual estimation of dominant vegetation species and vegetation cover. Area of open water was also estimated visually. All field surveys were conducted in October 2001. The USFWS Cowardin classification system, which has no regulatory status, is described below.

U.S. FISH AND WILDLIFE SERVICE CLASSIFICATION SYSTEM

The U.S. Fish and Wildlife Service classification (Cowardin et. al 1979) places the wetland into a system category first, and then subcategorizes the wetland into a class based on the vegetation present. All wetlands that were identified in this study fall under the system category, "palustrine," which is defined as follows:

- Water regime not influenced by oceanic tides
- Persistent emergents, trees, shrubs, or emergent mosses covering 30 percent or more of the area.

Identified Shoreline wetlands were classified in the following classes based on vegetation:

- Aquatic Bed: Vegetation composed predominantly of plants that grow principally on or below the surface of the water for most of the growing season in most years
- Emergent Wetland: Vegetation composed predominantly of emergent, vascular species
- Forested Wetland: Vegetation composed predominantly of trees or shrubs that are 20 feet or taller
- Scrub-Shrub Wetland: Vegetation composed predominantly of trees or shrubs that are less than 20 feet tall.

3. RESULTS

Twenty-four previously unmapped areas were identified as potential wetlands: nine in the Boeing Creek watershed, six in the Middle Puget Sound watersheds (North and South), two in the McAleer Creek watershed, and seven in the Thornton Creek watershed. Based on field visits, four of the 24 were found to be wetlands. In addition, 17 previously mapped wetland areas were verified for size, location and classification.

The majority of wetlands in the City are palustrine wetlands under the federal classification, since they have 30 percent or greater vegetation cover. A description of each wetland and its federal classification is presented below and summarized in Table 1.

BOEING CREEK BASIN

Wetlands

Wetland A, Hidden Lake

Description

Existing mapping for Hidden Lake, located in Reach BC6, shows that wetlands are present along the majority of the lake boundary. Although the lake was artificially created when a dam was constructed, the wetlands have formed naturally under these conditions. Originally this area consisted of a small pond surrounded by a series of wetlands. In 1920, this area was dredged and enlarged to create a fishing pond. Both forested and emergent wetland classes are present around the periphery of the lake. King County (October 1994) described Hidden Lake as associated with three palustrine wetlands: scrub-shrub (0.16 acre); emergent/scrub-shrub (0.07 acre); and forested (1.29 acres).

TABLE 1.
WETLAND CLASSIFICATIONS.

Site	Location	Size (acres)	Wetland Classes Present (Cowardin, et al. 1979)
Boeing Creek Basins			
A	Hidden Lake	1.5	Palustrine Forested Palustrine Scrub-Shrub Palustrine Emergent
B	Boeing Creek Reach 3	<0.5	Palustrine Forested
Thornton Creek Basin			
C	Meridian Avenue	4	Palustrine Forested
D	Twin Ponds	2.4	Palustrine Forested Palustrine Emergent
E	Peverly Pond	1-2	Palustrine Forested Palustrine Scrub-Shrub Palustrine Emergent
F	Paramount Park	6.9	Palustrine Forested Palustrine Scrub-Shrub Palustrine Emergent
G	Thornton Creek Reach 13	0.4	Palustrine Forested
H	Ronald Bog	1	Palustrine Forested Palustrine Scrub-Shrub Paulstrine Emergent
I	Kim Wetland (Part of Paramount Park Wetland)	0.4	Palustrine Forest Palustrine Scrub-Shrub
J	Interstate 5 and North 152nd Street	0.4	Palustrine Scrub-Shrub Palustrine Emergent
K	Meridian Park	1.1	Palustrine Forested Palustrine Scrub-Shrub
L	Cromwell Park	0.3	Palustrine Forested Palustrine Scrub-Shrub
Middle Puget Sound Basins			
M	Upper Puget Sound	0.5-1	Palustrine Forested
N	NW 195th Street and 12th Avenue NW	1-2	Palustrine Forested Palustrine Scrub-Shrub
O	Seattle Golf Course	2.1	Palustrine Emergent Aquatic Bed
P	Highlands Creek	0.5	Palustrine Emergent
Q	Richmond Beach Park	1	Palustrine Forested Palustrine Emergent
R	19620 14th Avenue NW	>1	Palustrine Forested
McAleer and Lyon Creek Basins			
S	Echo Lake	0.2	Palustrine Scrub-Shrub Palustrine Emergent Palustrine Aquatic Bed
T	Bruggers Bog	<0.5	Palustrine Scrub-Shrub Palustrine Emergent
U	McAleer Creek Reach 1	1	Palustrine Forested Palustrine Scrub-Shrub

Wetland B, Boeing Creek Reach 3

Description

Previous mapping of this wetland indicated that it was adjacent to, but off-line from, Reach BC3 of Boeing Creek; the wetland was found to be directly adjacent to the creek. No flow was present in the creek at the time of survey, but soil was saturated and there were small pockets of standing water. The dominant species are red alder and cedar trees, with lesser coverage of salmonberry, elderberry, youth-on-age and bracken fern. The wetland's area is less than 0.5 acres. The wetland class is palustrine forested.

THORNTON CREEK BASIN

Wetlands

Wetland C, Meridian Avenue

Description

This previously unmapped wetland (WL-C) is in Twin Ponds Park and is part of a large wetland system including Twin Ponds (WL-D). A bike and pedestrian trail and Reach TC4 pass through the open space. Stream, riparian and upland habitats combine with the lower wetland areas to create a habitat mosaic. The wetland makes up approximately 60 percent of the habitat for the entire area. The area is entirely forested and provides habitat for a diverse community of wildlife, including river otter, great blue heron, turtles and various species of hawks (personal communication, Janet Way, December 27, 2001). Dominant tree species include red alder, willow, cedar and cottonwood. Other abundant species included salmonberry, Himalayan blackberry, morning glory and creeping buttercup. The total size is approximately 4 acres. This wetland is a palustrine forested wetland.

Wetland D, Twin Ponds

Description

Previous mapping indicated wetlands only on the east side of both ponds at this location (WL-D). Wetlands occur along the entire circumference of both lakes for a width of 5 to 10 feet and are protected, for the most part, by riparian vegetation. However, the riparian corridor on the east that separates the ponds from the playfields is narrow and does not buffer this wetland from playfield activities. John Dixon, a Shoreline resident, has an ongoing program of enhancing the riparian vegetation around Twin Ponds. A larger area of forested wetland occurs at the southernmost end of the ponds. Overall, the area has two wetland classes present: forested and emergent. Forested wetlands are dominated by Pacific and Sitka willow, red alder and cottonwood; the shrub layer includes stinging nettle, red-osier dogwood and salmon berry; emergent areas are dominated by cattail, skunk cabbage and water parsley. John Dixon, a Shoreline resident, along with other volunteers, has an ongoing program of enhancing the riparian vegetation around Twin Ponds. Of the entire 5.4 open water/wetland complex, approximately 2.4 acres are wetlands.

Wetland E, Peverly Pond

Description

This previously mapped wetland (WL-E) lies between Thornton Creek Reaches TC2 and TC3. It covers approximately 1 to 2 acres between 1st Avenue NE and Interstate 5. Three wetland classes are present. Forested wetland is dominated by willow and cottonwood and emergent wetland is dominated by cattail. A third class, aquatic bed wetland, occurs in the open water portion where yellow pond lily is present. Several non-native species have become established here, including reed canarygrass, blackberries and scotch broom. A development project is under construction in the area east of 1st Avenue NE and includes mitigation for buffer impacts. Wetland Resources (2000) addressed this wetland in more detail and documented its size as exceeding one acre.

Wetland F, Paramount Park

Description

This previously mapped wetland (WL-F) is in Paramount Park between 10th Avenue NE and 12th Avenue NE, just north of NE 145th Street. It is one of the larger wetlands in the City, at approximately 6.9 acres. This wetland is associated with Thornton Creek Reach TC14, known as Littles Creek, where a series of wetlands, ponds and connecting channels are present. Local volunteers have completed several wetland enhancement projects, including removing fill and planting native vegetation in the vicinity of the ponds and planting trees in a detention facility constructed by King County. Three wetland classes are present: forested, scrub-shrub and emergent.

Wetland G, Thornton Creek Reach 13

Description

This previously mapped wetland (WL-G) is adjacent to Thornton Creek Reach TC13 near North 179th Street and 21st Avenue North. During surveys for the stream inventory, this reach was not found to have water or natural substrate. However, on October 26, 2001, the area in the northeast corner of the N 178th Street and N Meridian Avenue intersection was found to have small pockets of standing water. The area is forested with sparse herbaceous or shrub cover. Dominant trees included red alder, willow, and cedar. Spiraea, salmonberry, lady fern, horsetail and creeping buttercup were also present. The total area is approximately 0.4 acres. This wetland is a palustrine forested wetland. It is confined on all sides by roads or homes and is very small.

Jones and Stokes (1990) described and delineated this wetland in 1990. They described stormwater as entering the site through a 12-inch corrugated metal culvert at the southeast corner of the site and exiting the wetland through another culvert at the corner of North 178th Street and Meridian Avenue.

Wetland H, Ronald Bog

Description

Ronald Bog (WL-H) is a open water/wetland complex occupying approximately 7.7 acres. The wetland portion around the edge occupies 1 acre. Otak (December 2001) conducted a detailed wetland study of Ronald Bog and addressed the individual wetland types. The following descriptions are from the Otak report:

> "Wetland 1 is a palustrine forested wetland of approximately 0.8 acres in size, located along the inflow corridor that enters Ronald Bog from the northeast. The open water course flows due south, carrying stormwater discharge from 175th Street. The riparian corridor is dominated by red alder (*Alnus rubra*) trees, with a mixed shrub component of non-native Himalayan blackberry (*Rubus procerus*) and salmonberry (*Rubus spectabilis*). Where the ditch widens, the stream drops its bed load and a non-vegetated mud flat is present. The forest in this area is red alder and black cottonwood (*Populus balsamifera*) with some willow (*Salix spp.*) in the understory. Groundcover is sparsely vegetated with giant horsetail (*Equisetum telmateia*), creeping buttercup (*Ranunculus repens*) and reed canarygrass (*Phalaris arundinacea*). Flows from this ditch enter the pond of Ronald Bog along its east margin, in the tangle of red alder and willows that fringe the pond margins in the southeast corner.
>
> Wetland 2 is a small area of palustrine emergent vegetation, approximately 0.14 acres in size, located along the west shore of the pond. The dominant vegetation is soft rush (*Juncus effusus*), common velvet grass (*Holcus lanatus*), and a few young red alder. The area appears to be regularly maintained as a part of the park maintenance or right-of-way maintenance along Meridian Avenue.
>
> Wetland 3 is a palustrine scrub-shrub wetland located in the northeast corner of the pond of Ronald Bog. It is a long, narrow channel approximately 0.07 acres in size that may have been a former inlet to the pond. The channel is lined with red alder saplings and young trees, with spirea (*Spiraea douglasii*) present along the edge."

Wetland I, Kim Wetland

Description

This wetland (WL-I) near the intersection of NE 148th Street and 11th Avenue NE contains palustrine forested and scrub-shrub vegetation occupying approximately 0.4 acres. It is part of the larger lower Paramount Park wetland system (WL-F), which drains into Littles Creek. It is considered separately here because of a past enhancement evaluation (Tetra Tech/KCM June 2001). Pacific willow, red alder and salmonberry are dominant woody species. Herbaceous species include small-fruited bulrush, common horsetail, giant horsetail and spirea. Skunk cabbage and water parsley were also in evidence.

Wetland J, Interstate 5 and North 152nd Street

Description

This disturbed wetland (WL-J) is bordered by Interstate 5 on the west and residences on the east. On the southern edge, a large amount of fill for a community center parking lot appears to have altered the topography. An open ditch between properties provides surface water to this wetland. The wetland, approximately 0.4 acre in area, is drained by another open ditch that runs parallel to Interstate 5. Vegetation consists of red alder, poplar saplings, sedge and reed canarygrass. In most places the grass is mown to the wetland edge.

Wetland K, Meridian Park

This wetland (WL-K), approximately 1.1 acre in size, lies within Meridian Park and is immediately south of the Cordell Hull playfields. Thornton Creek Reach TC6 flows south through the wetland and creates a habitat mosaic. This forested wetland contains willow, red alder and western red cedar, along with a thick growth of salmonberry. Reed canarygrass, sedges and buttercup comprise the winter groundcover. A trail constructed of earthen fill material separates portions of the wetland.

Wetland L, Cromwell Park

Description

Otak (December 2001) studied the approximately 0.3 acre Cromwell Park wetlands; the following description is from the Otak report:

> "There is an existing palustrine forested wetland community (WL-L) in the northeast corner of this southern portion of the park. It is dominated on the north by four large black cottonwood trees (each approximately 24-30 inches in diameter). The main portion of the wetland is a standing water swamp; mature native willows are present around the margins and within the main body of the wetland area. A dense sub-canopy of willows is present below the larger trees and they provide an excellent physical barrier to domestic animals or people gaining access to the open water within the wetland. This large wetland is a highly functioning wetland. The very nature of the mixture of standing water and dense woodland provides excellent habitat to many more elusive and human-sensitive birds and mammals. The dense canopy provides excellent shading for the water, and the steep sided basin provides good storage functions."

MIDDLE PUGET SOUND BASINS

Wetlands

Wetland M, Upper Puget Sound

Description

It is unclear whether this wetland was previously mapped. Current mapping shows a wetland adjacent to the beach, but west of the railroad tracks. Wetland M is west of Richmond Beach Drive NW, east of the railroad tracks from NW 202nd Street to NW 199th Street and immediately west of the Richmond Beach Pump Station. It is a palustrine forested wetland less than one acre in size and is associated with the Upper Puget Sound North and South Creeks. Barnacle Creek (Reach USN1) meanders through the wetland where residents have created an informal boardwalk with construction debris laid across the creek in several places and over the wetland. In addition to willow, salmonberry and blackberry, watercress and water parsley occur throughout the area. The size of this wetland is estimated to be a half-acre or larger.

Wetland N, NW 195th Street and 12th Avenue NW

Description

This wetland is south of NW 195th Street and west of 12th Avenue NW near NW Richmond Beach Road. It is between 1 and 2 acres in size. Two wetland classes are present—forested and scrub-shrub. Because of illegal clearing, the wetland occupies the periphery of the site. Willow, red alder, big leaf maple, and western red cedar are present in forested areas; other species present include salmonberry, Himalayan blackberry, nettles, reed canarygrass and Canadian thistle. The wetland is associated with Storm Creek and is located east of Reach 5. Due to illegal clearing, the area has been invaded by reed canarygrass and blackberries and contains numerous pieces of debris such as tires, plywood and trash. This wetland has both palustrine forested and palustrine scrub-shrub wetland types.

Wetland O, Seattle Golf Course

Description

This wetland is around the margins of a lake on the Seattle Golf Course. Access to the golf course was not obtained. However, previous studies have reported that the wetland covers 2.1 acres.

Wetland P, Highlands Creek

Description

This palustrine emergent wetland is the headwaters of Highlands Creek and occurs in an area heavily modified with ornamental ponds and fountains. The wetland is approximately half an acre large in size.

Wetland Q, Richmond Beach Park

Description

This previously unmapped wetland was found near Richmond Beach Park on the east side of the railroad. The total area of the wetland is approximately 1 acre. Two wetland classes are present: forested and emergent. Alders and willows dominate the forested wetland areas, while emergent areas are dominated by cattails. Other abundant species present include Himalayan blackberries and horsetail. Soils were saturated, but there was less than 40 percent open water present. A small seep with buttercup growing in the wet soil exits the hillside several hundred feet up slope and east of the wetland and flows into the southern portion.

Wetland R, 19620 14th Avenue NW

Description

This previously unmapped wetland is bordered by M.G. Syre Elementary school to the east and the residence at 19620 14th Avenue NW on the west. There is an approximate 30 to 40 percent slope between the residence and the wetland. Wetland R was probably associated with the adjacent historical channel of Storm Creek that is partially piped at present. Surface water accumulates within this former channel and flows on top of and parallel to the piped portion. Originally delineated for the residence, the wetland extends further northwest and southeast of the parcel, making it difficult to determine its total size. However, it is larger than an acre. This palustrine forested and broad-leaved deciduous wetland community is dominated by red alder and salmonberry.

McALEER AND LYON CREEK BASINS

Wetlands

Wetland S, Echo Lake

Description

Previous mapping indicating wetlands along the southwest fringe of Echo Lake appears to be accurate and the boundaries have not changed. Wetland fringe consists of three wetland classes: aquatic bed, emergent, and scrub-shrub. Aquatic bed wetlands were present where yellow pond-lily has become established. Reeds were dominant in emergent wetlands, and willows and Douglas spirea dominated the scrub-shrub wetlands. The total area of this wetland is estimated to be approximately 0.2 acres located primarily in the southwest portion of the 13 acre lake.

Wetland T, Bruggers Bog

Description

Bruggers Bog historically was a bog with acidic soils. Plants that survive under these conditions include sphagnum moss, cranberry and Labrador tea. Such plants are not currently present in Bruggers Bog. Surface waters accumulate from single- and multi-

family residences in the surrounding area, flow southeast and contribute to Ballinger Creek, which runs through Bruggers Bog Park. Wetland T is a narrow and linear wetland on the south edge of the park adjacent to a King County Maintenance Facility. Vegetation includes small willow trees and shrubs, cottonwoods, and red alders, along with cattails, sedge and water parsley in the very wet areas. This wetland is less than 0.5 acres in size.

Wetland U, McAleer Reach 1

Description

Wetland U is associated with and adjacent to McAleer Creek, west of 15th Avenue Northeast. This wetland extends linearly south of NE 200th Court and on both the east and west sides of McAleer Creek. It was originally delineated for an apartment complex bordering the wetland on the northeast (Land-Tek Wetland Services 2001). The size within the parcel was calculated to be 0.68 acres, however it extends off-site both north and south and is estimated to be approximately 1 acre or more. It is one of the few surviving forested/scrub-shrub wetlands of significant size in the City. Approximately 20 large cedar trees (20- to 30-inch in diameter) provide cover for this wetland.

4. SUMMARY AND DISCUSSION

This study identified and classified 21 wetlands; 17 had been previously mapped and four had not. All wetlands were classified palustrine according to Cowardin et al. (1979).

This study did not include functional assessment or wetland delineations. Wetland areas are estimations based on visual observation of soil, hydrology and vegetation indicators. In some cases, observations indicated that previous mapping of existing wetlands was incorrect. NWI mapping is typically based on aerial photography and documentation, and may not be ground-truthed for accuracy in the Shoreline area. For example, most of Paramount Park is wetland; yet the NWI mapping outlines only a small portion of the park as wetland. Ground-truthed estimations of wetland area are likely more accurate than NWI mapping. However, complete wetland delineations are necessary for the most accurate assessment of size.

NWI mapping indicates that wetlands occur along the shoreline of the Puget Sound. However, according to the City code, these are considered "Shorelines of the State" and do not fall into a wetland category. According to Cowardin et al. (1979), these areas are classified as marine wetlands. Marine wetlands likely occur along much of the Puget Sound shoreline, but have not been included in this study.

Opportunities for improvement of habitat exist at many of these wetlands as described in this report. In addition, enlarging existing wetlands or restoring historical wetlands contribute to stormwater management and increasing base flow to streams. In general, it is recommended that wetland habitat be expanded in areas that are not otherwise confined and that the wetlands be reviewed for buffer requirements. Excavation of additional low areas and revegetation would be necessary for expanding wetland habitat. Because of soil and hydrology issues, it is far preferable to restore degraded or historic wetlands than excavating adjacent land to expand existing wetlands or create new wetlands. In addition, several locations have become infested with non-native species, including blackberries, reed canary grass, and Japanese knotweed. Removal of non-native species aids in the emergence of native species and better supports native wildlife. Additional plantings, maintaining the areas free of invasive species and monitoring success of each is crucial to successful restoration.

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APPENDIX C.
FISH UTILIZATION IN CITY OF SHORELINE STREAMS

City of Shoreline

Fish Utilization in City of Shoreline Streams

May 2004

Tetra Tech/KCM, Inc.

In Association With
Daley Design

City of Shoreline
Fish Utilization in City of Shoreline Streams
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1. INTRODUCTION

SCOPE OF WORK

As a subconsultant to Tetra Tech/KCM (Tt/KCM), Daley Design assessed the fisheries issues and activities associated with the watersheds within the City of Shoreline. The City of Shoreline has identified a need to evaluate the fisheries utilization of the watersheds within the City boundaries and in particular the presence of salmonids (resident trout or anadromous salmon). Some of these watersheds involve only a small portion of major streams that flow into Lake Washington while other watersheds include the entire basin as it flows to Puget Sound.

The scope of work involved the following tasks:

- **Task 1. Data Collection**—In conjunction with the Tt/KCM staff, relevant data collected by the City, County and Washington Department of Fish and Wildlife (WDFW) have been reviewed. Information that non-profit groups in the area collected was also included in the data review. This information assisted in the final on-site assessments that were completed. Information reviewed included fish observations, barriers to fish access, and site maps.
- **Task 2. Onsite Evaluation**—A preliminary stream walk of critical sites was conducted to determine best methods for evaluation of the fish presence or absence. Sites for collection of fish with net traps were determined. Trapping at these sites was conducted using a fike net.

  Potential fish passage barriers were evaluated and a preliminary determination of corrective actions was undertaken. Protocol for the evaluation by Daley Design was based on on-site evaluation of the stream conditions, including summer low flow and observed stream bank erosion defining ordinary high water during the adult migration periods and smolt migration in the late winter and early spring. Definition of habitat quality and potential fish passage barriers by Daley Design was based on previous experience in watershed assessment and utilization of habitat by salmonids and other fish species.
- **Task 3. Report Preparation**—Daley Design assisted Tt/KCM in the preparation of the fisheries report. This effort included documentation of existing fisheries issues and data collection. Photographs of stream features are contained at the end of this report.

CITY DRAINAGE BASINS

The City of Shoreline includes five major basins including Boeing Creek, Thornton Creek, McAleer Creek, Middle Puget Sound North and Middle Puget Sound South (see Figures 1 through 4 in *Appendix A; Stream Inventory and Assessment)*. The Boeing Creek, Thornton Creek and McAleer Creek Basins have established salmonid populations. Adult salmon have been observed in Boeing Creek (personal communication, Ed Barnes, Shoreline Resident 2001); however, there are impassable barriers on this system within the city limits. Adult salmon have been reported in Thornton and McAleer Creeks downstream of the city limits (Vanderhoof, et. al 2000) and in McAleer Creek at the detention pond on NE

196th Street (LFPSF 2001). The author observed cutthroat trout in Thornton and McAleer Creeks within the city limits.

Figure 1 summarizes life cycle timing for fish in Shoreline drainages and when certain species are in residence. Coho salmon and searun cutthroat trout spend their first year rearing in creeks prior to outmigration. Resident cutthroat trout reside in the stream throughout their life cycle (Behnke 1992). Chinook salmon fry usually remain in the streams for three months after emerging from the gravels and migrate seaward from early March through early July (Groot and Margolis 1995; Healey 1991).

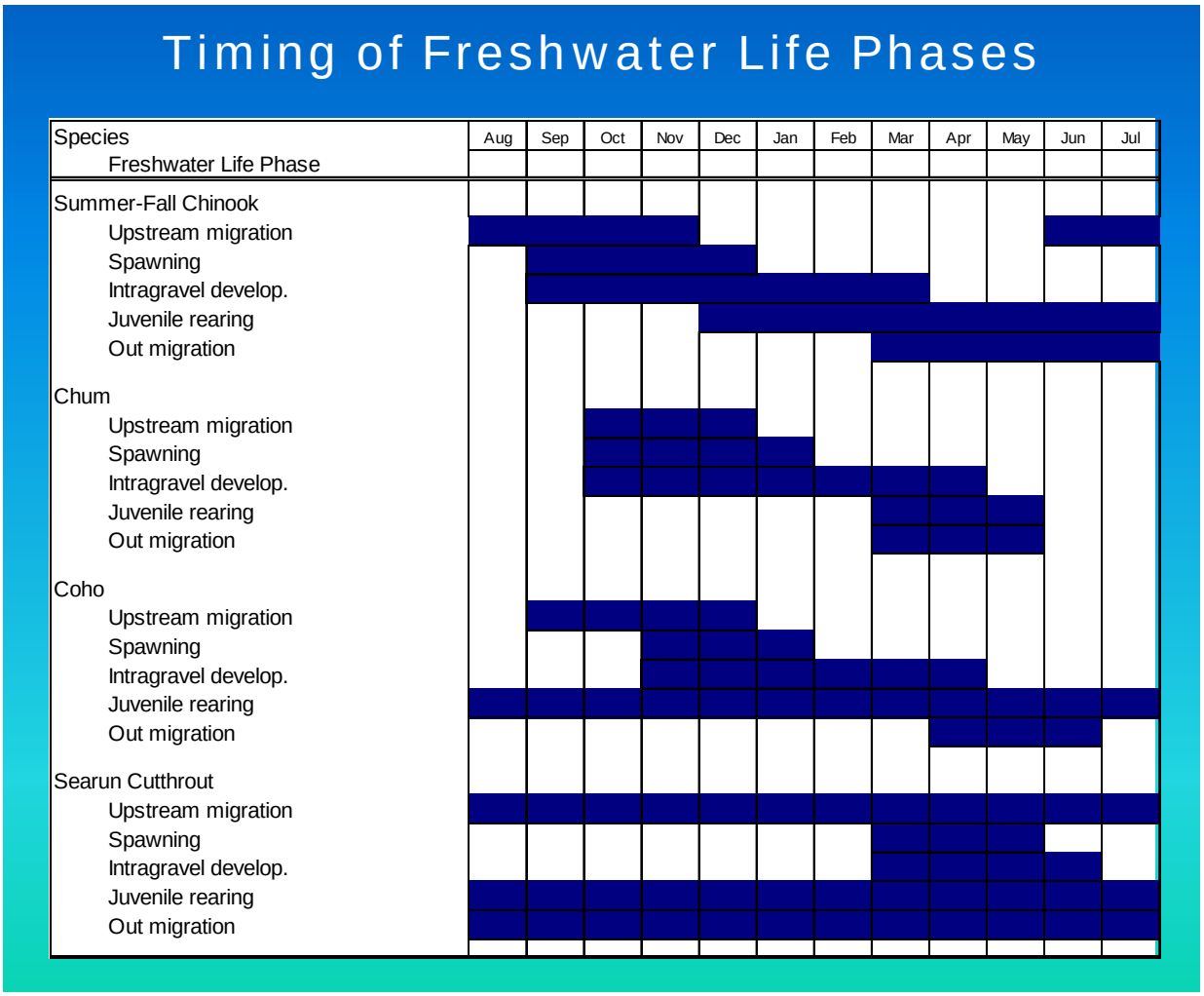

Figure 1. Life Cycle Timing for Fish in Shoreline Drainages (Adapted from Williams 1975)

In addition to the evaluation of all Shoreline basins (Figure 1-4 in Appendix A) for salmonid utilization, the major basins were assessed for fish use by other species, including the marine shoreline areas of Boeing Creek, Storm Creek, Innis Arden Creeks and the Middle Puget Sound North Basin. Published sources were also reviewed (Groot et al 1995; Chapman 1996). Of particular importance is King County's recent *Reconnaissance Assessment of the Nearshore Ecosystem: Eastern Shore of Central Puget Sound* (Brennan 2001). This document provides references to past and recent survey data that identify

significant shoreline and intertidal use by critical forage species for adult and juvenile salmon, including herring, surfsmelt, Pacific sand lance, eulachon and longfin smelt. Significant areas include Edwards Point, Point Wells, Richmond Beach and the Boeing Creek Delta; these areas are used for feeding, migration, spawning and rearing (Brennan 2001).

FISH PASSAGE BARRIERS

Fish passage barriers prevent the movement of fish through a stream. Barriers can be man-made such as culverts, or natural, such as a steep gradient. Some barriers primarily impede upstream access; others impede upstream and downstream access equally. In Shoreline, upstream impediments generally don't prevent downstream access. Barriers can be seasonal, affected by the level of flow in a reach. They can also be species and age-class specific. Adult coho and steelhead are more adept at accessing reaches with shallow water depths or swift flow than adult chum or chinook. Adult fish in general can navigate blockages more effectively than juvenile fish. Barriers can impede up and downstream migration of anadromous species such as salmon, but can also block access to additional stream reaches for resident cutthroat trout and other non-salmonid species of fish such as sculpin and dace. Fish passage barriers in each basin are discussed in Chapter 2.

The Washington Department of Fish and Wildlife (1998) has a protocol for determining whether an impediment in a stream is a barrier to fish migration. This protocol involves measuring current velocity, grade, distance and depth of water over and immediately downstream of the impediment. Unless the structure is an obvious barrier such as a dam, observations without using the protocol are judgment calls; experts can disagree as to accessibility. This study did not use the WDFW protocols in assessing whether a reach is accessible. A comprehensive barrier assessment would require a full year of flow measurements. For this study, barriers were assessed using best professional judgment.

2. SURVEY FINDINGS

Stream walks were conducted on City of Shoreline streams in February, May and October of 2001. Observations were completed at Twin Ponds, Echo Lake, Bruggers Bog, a small tributary to McAleer Creek called Cedarbrook Creek behind the abandoned Cedar Heights Elementary School, and Thornton Creek below Jackson Golf Course. In addition, a site walk was conducted on October 5, 2001 to verify shoreline conditions and reassess culvert crossings under the railroad tracks.

BOEING CREEK BASIN

Juvenile coho were observed in a pool just upstream of the footbridge east of the Burlington Northern Santa Fe (BNSF) railroad tracks (Photos 1 to 3). The coho appeared to be recent swim-up fry from natural spawning in the creek. A significant amount of large wood (LW) pieces is present in most of the lower reaches of Boeing Creek and to a limited extent in the creek above Hidden Lake. The lower creek was traversed from the mouth to a steel-pile dam that was used in the past for water diversion to the Seattle Golf Club. The dam blocks the upstream passage of adult and juvenile fish at all flows (Photo 4).

In May, a stream walk of the reach above Hidden Lake identified a potential source of sand that is prevalent in the creek. Large slope failures occur in this area, exposing the underlying sandy material. Mountain beaver are burrowing into the banks and creating a point of erosion during storm events that is likely contributing additional sand into the creek, although this impact is minor in comparison to high peak flows (Photo 6). In addition, children playing in the area have constructed tunnels into the sandy ravine slope and exposed significant areas for erosion into the creek. The stream is in good condition in this area with the exception of sand in the pools (Photos 7 to 9).

According to Mr. Ed Barnes (personal communication, September 2001), a Shoreline resident involved in salmon enhancement activities, salmon use lower Boeing Creek extensively. Mr. Barnes indicated that he has observed more than 100 adult chum salmon in addition to large numbers of adult coho salmon spawning in the reach below the steel-pile dam. Mr. Barnes has also observed chinook salmon and searun cutthroat trout in the lower reaches of Boeing Creek. He found a spawned-out chinook carcass during the fall of 2001. It is likely that many of these fish are the result of the "Salmon in the Classroom" program that is facilitated by a variety of local educators, including Dr. Matt Loper, an instructor at Shoreline Community College. City staff observed cutthroat redds in BC1 approximately 400 feet downstream of the dam on March 22, 2004.

Evidence was also found of salmonids in Hidden Lake (Photo 10). During the field investigation, a fish feeding in the lake was identified as a juvenile salmonid. Based on the reported activities of the Environmental Department of Shoreline Community College and the Salmon in the Classroom Project, this fish was probably a coho salmon that was migrating downstream to Puget Sound.

Definite barriers were identified at five locations including the Hidden Lake and M1 Dams. Potential fish barriers have been identified at four locations on Boeing Creek. Table 1 summarizes definite and potential fish passage barriers identified in the Boeing Creek Basin.

TABLE 1.
BOEING CREEK BASIN FISH PASSAGE BARRIERS

Reach	Barrier	Description
Definite Barriers		
BC1	Steel-Pile Dam	The dam prevents fish passage upstream at all flows
BC2	Culvert	Gradient and velocity of culvert at NW Innis Arden Way prevents fish passage
BC6	Dam	Earthen dam creating Hidden Lake prevents upstream passage at all flows
BC7	Detention Pond	North Pond and a perched culvert at NW 175th prevent fish passage. Piped reaches upstream
BC8	M1 Dam	M1 Dam prevents fish passage between reaches BC8 and BC9
Potential Barriers		
BC1A	Railroad Culvert	The culvert below the BNSF railroad at the beach may prevent fish passage at low flows and low tides
BC2	Weirs	Two weirs used for grade control could pose seasonal blockage
BC6	Weirs	Two weirs used for bed control may pose barriers at low flows
BC7	Weirs	Three log weirs may be height barriers to juvenile fish

THORNTON CREEK BASIN

Definite barriers originally identified include the Interstate 5 culvert (TC1), Peverly Pond weir (TC2) and the diversion structure at the upstream end of TC7. Potential fish passage barriers have been identified at five locations (TC3, TC7, TC10, TC11 and TC12). Subsequent to the original assessment, an adult steelhead was found in TC7 (February 4, 2004). Consequently, this report considers the Interstate 5 culvert and Peverly Pond weir as potential barriers to adult salmonids, but definite barriers to juveniles. Table 2 summarizes fish passage barriers identified in the Thornton Creek Basin.

As documented by WDFW (1998), the Salmon Watchers Program and the Seattle Public Utilities report *Thornton Creek Watershed Characterization Report* (Seattle Public Utilities 2000), Thornton Creek supports a limited population of coho salmon. Sockeye have been observed in the lower reaches, as well as adult and juvenile chinook salmon (Weitkamp & Ruggerone 2000).

Chinook salmon prefer larger streams (Healey 1991; Weitkamp and Ruggefone 2000); adult chinook observed near the mouth of Thornton Creek may have been fish searching for their home stream. There is no documented evidence of chinook spawning in the creek. Juvenile chinook that have been observed in the stream may be fish that were planted as part of the Washington Department of Fish and Wildlife "Salmon in the Classroom" program. The size of the juvenile chinook indicates these fish may be 2-year old fish. Washington Trout staff who have conducted surveys in the Puget Sound area indicate they have observed 2-year old chinook in several watersheds in Western Washington. Within the City of Shoreline, the

presence of juvenile migratory salmon, including coho and chinook, is likely the result of releases by students.

Non-anadromous salmonid species have been observed in the creek. During a field investigation, a 10-inch cutthroat trout was seen near where the stream crosses NE 155th Street. In addition, Seattle Public Utilities (2000) indicates the presence of cutthroat trout throughout Thornton Creek.

To determine whether juvenile salmonids were using Twin Ponds, a minnow trap baited with salmon eggs was placed in Twin Ponds in May and fished for 48 hours. No fish were captured. It is likely, however, that cutthroat trout inhabit Twin Ponds. Observation of the aquatic benthos in the creek as it enters the upper pond revealed mayfly and stonefly nymphs. In addition, gammarid shrimp were found in the pond. These are all excellent sources of food for juvenile and adult salmonids (Chapman and Bjornn 1969).

The general quality of Thornton Creek is well documented in the SPU study; the following summarizes the basic condition of the creek in relation to its use by fish and wildlife:

- "Like most urban streams, Thornton Creek does not offer prime habitat for fish. Significant problems affecting fish survival include high storm flows, channelized banks, sedimentation, lack of food, poor water quality, high temperatures, low dissolved oxygen levels, barriers to passage, inadequate in-stream wood and rock structures, and lack of refuge, spawning and rearing areas."

A stream walk of Thornton Creek downstream of the Shoreline city limit was undertaken on October 5, 2001. The walk included the stream through the southern portion of the Jackson Golf Course and downstream. Significant numbers of juvenile coho or cutthroat were observed. A large freshwater pond supplied with well water discharges into Thornton Creek. Large trout in the pond system are confined by a screened outlet. Flow was low above the pond; there appeared to be several blockages to juvenile fish migration in this area of the golf course. These blockages may not be a problem for adults during the winter, as water volume increases.

Wetland Resources Incorporated (2000) documented cutthroat trout, juvenile coho salmon and aquarium billfish in Reach TC2 during a wetland evaluation of the area. Because the culvert under I-5 is a definite impassible barrier to juvenile salmonids, it is likely that the coho salmon was from the Salmon in the Classroom program.

Seattle Public Utilities (2000) summarized various fish sampling efforts dating from 1981. Chinook, coho and chum salmon and steelhead have all been documented, primarily in the lower portions of the stream and outside the Shoreline city limits. Chinook fry and rainbow trout were documented near Twin Ponds. The study notes that the chinook fry were probably released into the system. Carp and sunfish were found in Ronald Bog. City of Shoreline staff observed largemouth bass in Ronald Bog during late spring of 2001.

TABLE 2.
THORNTON CREEK BASIN
FISH PASSAGE BARRIERS

Reach	Barrier	Description
Definite Barriers		
TC7	Diversion Structure	The water diversion structure at the junction of TC7, TC8 and TC9 is a fish passage barrier.
Potential Barriers		
TC1	Culvert	Culvert under Interstate 5 is a barrier to juvenile fish and most salmonids.
TC2	Weir	Weir at Peverly Pond is a barrier to juvenile fish and most salmonids.
TC3	Culvert	A culvert beneath 1st Avenue NE may limit fish passage at low flows.
TC7	Culvert	Three culverts at a pedestrian trail at Twin Ponds Park have a hydraulic drop of 20 inches, which likely prevents juvenile fish passage.
TC10	Pipe and Low flows	Long pipe length and low flows could impede fish passage.
TC11	Culverts and Low Flows	Several culverts may prevent fish passage at low flows.
TC12	Pipe and Catch Basin	The long piped section and catch basin at the Ronald Bog outlet may prevent fish passage.

MIDDLE PUGET SOUND BASINS

Unlike Boeing Creek, the Middle Puget Sound Basins have natural barriers to saltwater migration (Photos 14 and 15). The BNSF railroad causes problems for fish access due to the configuration of the culvert outfalls (Photos 16 to 19). However, some areas of these basins support resident cutthroat trout; city personnel have received calls about cutthroat trout observations from local residents. Hennick (1999) reports trapping cutthroat trout in Storm Creek (SC5) during the summer of 1999. Barnacle Creek (USN1) and possibly Coyote Creek (IS1) do allow access to short sections of stream.

In addition, the intertidal reach of Boeing Creek (BC1A) and the culvert crossing at the extreme northern boundary of the city limits (USN1) provide areas of habitat that can be utilized by juvenile salmonids that have moved into the saltwater and are foraging along the shallow beach areas during high tides. Forage species of fish and other organisms of importance as food for juvenile salmonids utilize these intertidal areas. The flow of freshwater into the shallow tidal areas and the recruitment of sands and gravel to the beaches is an important nearshore process influencing habitat in these areas.

In September 1995, two King County staff biologists examined Storm Creek Reach 1 (SC1) and Innis Arden North Creek Reach 1 (IN1) for fish presence and access barriers. Electrofishing did not produce any fish species. They indicated that both streams have barriers to upstream passage of adult salmonids at their mouths and lower reaches and did not have any spawning habitat (Hartley 1995).

Definite barriers were identified at the mouth of each stream in both basins, primarily associated with the BNSF railroad tracks. Reach USN1 (Barnacle Creek) is accessible for a

short segment during high tide. The culvert under Richmond Beach Drive NW prevents further fish access. Table 3 summarizes definite and potential fish passage barriers identified in the Middle Puget Sound Basins.

TABLE 3.
MIDDLE PUGET SOUND BASINS FISH PASSAGE BARRIERS

Reach	Barrier	Description
Definite Barriers		
HL1	Gradient	Pipe and steep channel gradient prevents fish passage from Puget Sound
IS1	Gradient	Fish passage is prevented due to piping and steep channel gradient
IN1	Gradient	Steep channel gradient prevents fish passage from Puget Sound
IN2	Culvert	Perched culvert at NW Springdale Court prevent fish passage
SC1	Gradient	Fish passage is prevented due to steep channel gradient
USS2	Gradient	Steep channel gradient prevents fish passage from Puget Sound
USN2	Gradient	Steep channel gradient and a culvert under Richmond Beach Drive prevents fish passage from Puget Sound
Potential Barriers		
IN1	Culvert	Culvert at 14th Avenue NW may prevent fish passage
IN3	Culvert	Culverts at Innis Arden and Ridgefield Roads may prevent fish passage
IN4	Culvert and Low Flows	Culverts at NW Springdale Court and Ridgefield Road NW may prevent fish passage
SC1	Pipe Repair	Concrete repair and gabion installation over sewer pipeline may prevent fish passage
SC3	Weirs	Rock weirs may prevent fish passage at low flows
SC4	Weirs	Rock weirs may prevent fish passage at low flows
USN3	Culvert	Culvert upstream of NW 204th Street may prevent fish passage

MCALEER CREEK

Inspection of McAleer Creek downstream of I-5 revealed a temporary barrier to fish passage in the culvert under Forest Park Drive NE immediately south of Northeast 205th (Photos 11 to 13). The barrier is temporary and due to improper culvert maintenance; both adult and juvenile fish could navigate this culvert with proper maintenance.

McAleer Creek supports anadromous fish as far upstream as Lake Ballinger. LFPSF (2001) notes that chinook salmon have been found as far upstream as the flood control system and fish ladder at NE 196th Street between Forest Park Drive NE and 15th Avenue NE. Field observations in May 2001 and observations by Mr. Ed Barnes (personal communication September 2001) confirm cutthroat trout and coho salmon using this system. Ned Orr, who lives adjacent to Reach MT2 on 16th Avenue NE, has observed cutthroat trout and coho in this reach (personal communication March 2001). Sockeye have been reported in the lower reaches of this system outside the Shoreline City limits (SPU November 2000). LFPSF (2001) documents that a steelhead trout carcass was found in Lyon Creek in 1998 and also cites stream use by coho and cutthroat trout. City staff found a steelhead and 3 adult

cutthroat trout spawning in MC1 just south of the Interstate 5 cloverleaf on March 11, 2004.

The Echo Lake drainage, which is part of the headwaters of McAleer Creek, flows north into Lake Ballinger. A culvert at the Echo Lake outlet has created a definite impassable barrier to movement of adult and juvenile fish between the two lakes. Echo Lake has supported a population of rainbow trout (Walcott 1965) and supports resident cutthroat trout, large mouth bass and sunfish populations. It is likely that urban development and the associated stormwater runoff into the lake have significantly lowered the water quality of the lake with increased temperatures and chemical contamination.

Definite barriers are present on Reaches BA4 and EL1. Potential barriers have been identified at a number of locations within the McAleer and Lyon Creeks Basins. Table 4 summarizes fish passage barriers identified in the McAleer Creek Basin.

TABLE 4.
McALEER AND LYON CREEK BASINS FISH PASSAGE BARRIERS

Reach	Barrier	Description
Definite Barriers		
BA4	Culverts	Three concrete culverts upstream of Bruggers Bog have minimum jumping heights of 30 inches
EL1	Culvert	Perched culvert at Echo Lake outlet is too high for access
Potential Barriers		
MC1	Culvert	Culvert under Forest Park Drive at NE 205th Street may prevent fish passage
MC1	Culvert	Culvert beneath 15th Avenue NW may prevent fish passage
MT1	Culvert	Culverts under 16th and 18th Avenues NE may prevent fish passage
MT2	Culvert	Culverts under 16th and 18th Avenues NE may prevent fish passage
MT3	Culvert	Culverts under 16th and 18th Avenues may prevent fish passage
MT5	Pipe	The long pipe under the Cedarbrook School playfield may prevent fish passage

3. SPECIES UTILIZATION

Determination of salmonid utilization has been accomplished by reviewing existing documentation, on-site observations and telephone interviews with local salmon enhancement volunteers. The individuals that have been contacted are Dr. Matt Loper, instructor at Shoreline Community College; Dave Krueger, student at Shoreline Community College; Ed Barnes, Shoreline Resident and volunteer; Mike Derrick, Ronald Wastewater District; David Steiner and other staff of Adopt a Stream; and Washington Trout.

The author has identified salmonid use in Thornton Creek above Twin Ponds and below the Jackson Park Golf Course (outside the City limits). The presence of quality food organisms in Thornton Creek at Twin Ponds provides additional evidence of the potential for salmonid utilization. Factors that may inhibit the use of Twin Ponds by salmonids include temperature and stormwater runoff. Chapter 2 documents salmonid presence in other stream reaches within the city.

In addition to the salmonid utilization, significant areas of non-salmonid use have been identified. As indicated in the discussions of specific watersheds, saltwater forage species utilize most of the saltwater shorelines of the City. A stream walk with Andy Loch, City of Shoreline Watershed Biologist, identified several areas of intertidal function associated with the stream at the culvert crossings under the railroad tracks and at the outlet of Boeing Creek. These areas are used for feeding, migration, spawning and rearing for a number of forage fish species including herring, surfsmelt, Pacific sand lance, eulachon and longfin smelt.

Non-salmonid fishes were observed in Echo Lake and Twin Ponds on October 5, 2001. Most of the fish observed were very small juveniles that appeared to be recently spawned spiny ray species (sunfish or bass). Young largemouth bass were observed along the shoreline of Echo Lake.

All of the small streams in the City of Shoreline have the potential to provide enhanced salmonid habitat. The critical parameters that are inhibiting the function of these streams are a result of impervious surfaces (streets, parking lots and roof tops) that result in altered hydrologic functions during and after storm events. Streams have been piped or channelized into narrow straight channels with no pool/riffle habitat. Road culverts impede fish movement and riparian cover is significantly altered with development. The use of chemicals on lawns and gardens and consequent runoff into streams result in the removal of critical food organisms which are especially sensitive to water quality.

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PERSONAL COMMUNICATION

Barnes, Ed. Shoreline Resident. September 2001.

Photos 1 and 2. Boeing Creek at the BNSF Railroad Tracks

Photo 3. Habitat Restoration on Boeing Creek above BNSF Railroad Tracks

Photo 4. Sheet Pile Dam on Boeing Creek

Photo 6. Bank Destabilization from Tunneling by Humans and Mountain Beaver

Photo 5.
Boeing Creek
Down-stream of
Sheet Pile Dam

Photo 7. Habitat on Boeing Creek above Hidden Lake

Photo 8. Large Woody Debris Habitat on Boeing Creek above Hidden Lake

Photo 9. Habitat on Boeing Creek above Hidden Lake

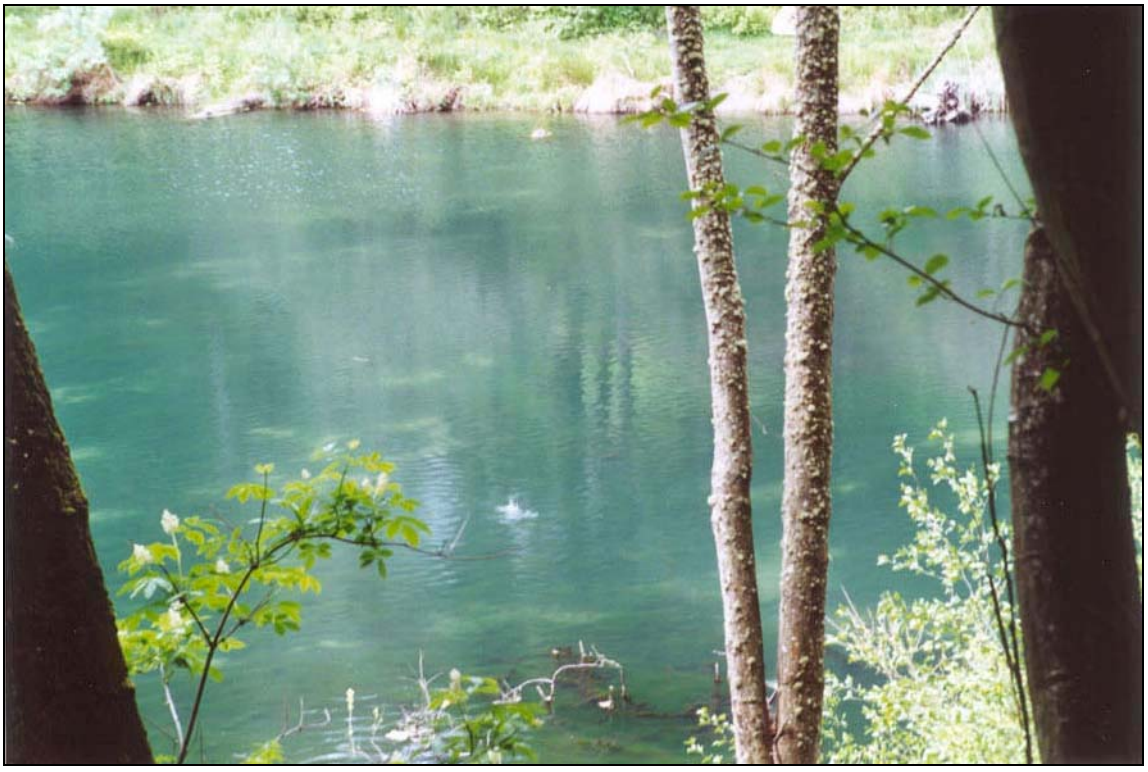


Photo 10. Fish Feeding on the Surface of Hidden Lake

Photo 11. Culvert Under Forest Park Drive on McAleer Creek

Photo 12. Culvert Under Forest Park Drive on McAleer Creek; Blockage at Upper End of Pipe

Photo 13. Pool Downstream of Culvert under Forest Park Drive on McAleer Creek

Photo 14. Vertical Barrier to Anadromous Fish Migration on Storm Creek in Middle Puget Sound Basin

Photo 16. Innis Arden South Creek Culvert under BNSF Railroad Tracks in the Middle Puget Sound Basins

Photo 15. Vertical Barrier to Anadromous Fish Migration on Innis Arden North Creek in Middle Puget Sound Basin

Photo 17. Unnamed Creek culvert under BNSF Railroad Tracks in the Middle Puget Sound Basins

Photo 18. Unnamed Creek Culvert under BNSF Railroad Tracks in the Middle Puget Sound Basins

Photo 19. Unnamed Creek Culvert under BNSF Railroad Tracks in the Middle Puget Sound Basins

CITY OF SHORELINE

Stream & Wetland Inventory & Assessment

Why:

To protect our natural resources and wildlife, the City of Shoreline will soon begin to inventory streams and wetlands within the City limits. As these areas are mapped and classified, opportunities for habitat enhancement will also be identified. The inventory will help form City policies and ensure Shoreline complies with the Endangered Species Act and Clean Water Acts.

What:

The City of Shoreline will be holding a series of open houses to discuss its plans for the stream and wetland inventory and assessment. Three of the open houses will concentrate on particular Shoreline watersheds and a fourth will provide an overview of citywide watersheds. Besides learning more about the City's plans, community members are invited to share information about the conditions of streams and wetlands in their area.

When:

Please join us at the following locations:

Thornton Creek Watershed Open House

Tuesday, April 3rd, from 7 p.m. to 8:30 p.m.
Parkwood School, Reference Room
N 155th Street & Wallingford Avenue N

Boeing Creek Watershed Open House

Thursday, April 5th, from 7 p.m. to 8:30 p.m.
Shorewood High School Cafeteria
N 175th Street & Fremont Avenue N

McAleer Creek Watershed Open House

Tuesday, April 10th, from 7 p.m. to 8:30 p.m.
Shoreline Center, Spartan Room
NE 185th Street & 1st Avenue NE

Citywide Watersheds Open House

Wednesday, April 11th, from 7 p.m. to 8:30 p.m.
Shoreline Center, Mount Rainer Conference Room
NE 185th Street & 1st Avenue NE

February 22, 2001

Dear City of Shoreline Resident:

The City of Shoreline has hired Tetra Tech/KCM, an environmental consulting firm, to inventory streams and wetlands within the city limits. This work is in response to the Endangered Species Act and Clean Water Act, and will help us to better protect our remaining natural resources.

The City's consultant will be conducting physical and biological surveys of most of the stream reaches within the city during May and June of 2001. Scientists will study the stream corridors to establish information about the stream's ecology. The information gathered will be helpful to private property owners, the City of Shoreline, and other interested parties in our collective efforts to help save the salmon. For example, this information will help improve the quality and speed of environmental review for projects located near watercourses.

The City is also making arrangements to hold several public meetings in April – details will follow in a separate mailing. These meetings will inform City residents on the purpose of the inventory and assessment, and will be an opportunity for residents to provide relevant information about habitat conditions and fish use.

In order to complete this work, the City will need access to private property crossed by wetlands, streams, tributaries, and ditches. The consultant's survey activities would primarily be limited to walking along the watercourse, and the time spent at any one site would be brief. Where there is a need to enter private property to access a watercourse, the City will contact the resident for permission. In some areas the City will access the watercourse across established drainage easements, City Parks, or sewer easements held by Ronald Wastewater District (a partner in this project).

Your cooperation will make it possible for us to complete a comprehensive survey of the City watercourses. Please fill out and return the attached Property Access Permission Form. If you want to make specific access arrangements in advance or have other concerns regarding the survey, please contact Lori Henrich, at 546-1700. Thank you for your cooperation in this important step toward improving watershed management in the City of Shoreline.

Sincerely,

Edward Mulhern
City of Shoreline
Surface Water Coordinator

CITY OF
SHORELINE

Property Access Permission Form

Please complete this permission form and return in the enclosed envelope to Lori Henrich, City of Shoreline Public Works, 17544 Midvale Avenue North, Shoreline, WA 98133-4921.

I give permission to the City of Shoreline, and or Tetra Tech/KCM staff to walk the watercourse on my property located at _____, during the months of May and June of 2001. I understand the will City provide written notice 48 hours in advance of survey work at my property. The survey will be conducted on weekdays, between 8:00 AM and 4:00 PM.

_____ _____
Signature Date

If you have any special instructions regarding access to the watercourse on your property, please provide details:

Stream & Wetland Observation Form

Please complete the following information to help us inventory, protect and enhance our Shoreline streams, wetlands and other sensitive areas. If you have questions, call Lori Henrich at 546-1905. Forms can be mailed to Lori Henrich, City of Shoreline Public Works, 17544 Midvale Ave. N., Shoreline, WA 98133. ***Please use a separate form for each observation.***

1. What did you see? (check the box)

Fish	Mammals e.g. coyotes	Reptiles or Amphibians	Flooding	Erosion	Discolored Water	Blocked Stream	Large Trees	Birds e.g. Pileated Woodpeckers	Other

2. Date of your observation: _____

3. Describe the details of your observation: _____

_____

_____

_____

_____

4. Draw a map on the back of this page to show the exact or approximate location of your observation.

Your name, address and phone will be confidential, but the information will allow us to reach you with updates and if we have questions.

Name: _____ Telephone: _____ Address: _____

APPENDIX E.
BIRDS OF SHOREVIEW PARK

*Courtesy Of Michael Dossett, Shoreline Resident

Corvids:
___ Steller's Jay
___ Clark's Nutcracker
___ American Crow
___ Common Raven

Chickadees and Bushtit:
___ Black-capped Chickadee
___ Chestnut-backed Chickadee
___ Bushtit

Nuthatches and Creeper:
___ Red-breasted Nuthatch
___ Brown Creeper

Wrens:
___ Bewick's Wren
___ Winter Wren

Dipper:
___ American Dipper

Kinglets:
___ Golden-crowned Kinglet
___ Ruby Crowned Kinglet

Thrushes:
___ Western Bluebird
___ Mountain Bluebird
___ Townsend's Solitaire
___ Swainson's Thrush
___ Hermit Thrush
___ American Robin
___ Varied Thrush

Pipits:
___ American Pipit

Waxwings and Starlings:
___ Cedar Waxwing
___ European Starling

Shrikes:
___ Northern Shrike

Vireos:
___ Cassin's Vireo
___ Hutton's Vireo
___ Warbling Vireo
___ Red-eyed Vireo

Warblers:
___ Orange-crowned Warbler
___ Nashville Warbler
___ Yellow Warbler
___ Yellow-rumped Warbler
___ Black-throated Gray Warbler
___ Townsend's Warbler
___ MacGillivray's Warbler
___ Common Yellowthroat
___ Wilson's Warbler

Tanagers:
___ Western Tanager

Sparrows:
___ Black-headed Grosbeak
___ Lazuli Bunting
___ Spotted Towhee
___ American Tree Sparrow
___ Chipping Sparrow
___ Black-throated Sparrow
___ Savannah Sparrow
___ Fox Sparrow
___ Song Sparrow
___ Lincoln's Sparrow
___ Vesper Sparrow
___ Harris' Sparrow
___ White-throated Sparrow
___ Golden-crowned Sparrow
___ White-crowned Sparrow
___ Dark-eyed Junco

Blackbirds and Orioles:
___ Red-winged Blackbird
___ Western Meadowlark
___ Brewer's Blackbird
___ Brown-headed Cowbird
___ Bullock's Oriole

Finches and Weaver Finches:
___ Purple Finch
___ House Finch
___ Red Crossbill
___ Pine Siskin
___ American Goldfinch
___ Evening Grosbeak
___ House Sparrow

_____
_____
_____
_____
_____

Birds Of

Shoreview Park

The area encompassed by Shoreview Park supports a number of different habitat types. This has proven attractive to a wide range of birds and other wildlife, To date, more than 135 species of birds have been seen in, or flying over Shoreview Park. Shoreview has proven to be not only a reliable place to find many of the more common birds in the area, but is also an excellent place to find many species which are rare, unusual, or out of season. The biggest problems facing many of these species throughout their range is habitat loss and degradation. This is the most immediate threat to birds inside Shoreview Park as well.

In order to preserve the wild quality of Shoreview Park for everyone to enjoy, it is essential to minimize the impacts of further human use. To avoid disturbing the wildlife which calls the park home, it is important that people stay on established trails and keep pets leashed while visiting the wooded and brushy areas. As less and less wild space becomes available for everyone's recreation, it is even more important that we try to preserve the natural aspects of Shoreview Park for the future.

A special thanks go to Dave Beaudette, Ray Pelley, Darryl Thompson, and John and Anne Winskie whose contributions to this list were invaluable. I would also like to thank Jason Starfire, who had the idea to compile this list, and everyone else who has contributed their sightings to this list.

-- Michael Dossett

-- March 2001

Loons and Grebes:
___ Common Loon
___ Pied-billed Grebe

Cormorants and Herons:
___ Double-crested Cormorant
___ Great-blue Heron
___ Green Heron

Waterfowl:
___ Snow Goose
___ Canada Goose
___ Mallard
___ Gadwall
___ American Wigeon
___ Northern Shoveler
___ Ring-necked Duck
___ Common Goldeneye
___ Barrow's Goldeneye
___ Bufflehead

Raptors:
___ Turkey Vulture
___ Osprey
___ Bald Eagle
___ Northern Harrier
___ Sharp-shinned Hawk
___ Cooper's Hawk
___ Red-tailed Hawk
___ American Kestrel
___ Merlin
___ Peregrine Falcon

Gallinaceous Birds:
___ Ruffed Grouse
___ California Quail

Rails:
___ American Coot

Shorebirds:
___ Killdeer
___ Spotted Sandpiper
___ Common Snipe

Gulls:
___ Heerman's Gull
___ Mew Gull
___ Ring-billed Gull
___ California Gull
___ Glaucous-winged Gull

Terns:
___ Caspian Tern

Doves and Pigeons:
___ Rock Dove
___ Band-tailed Pigeon
___ Mourning Dove

Owls:
___ Western Screech Owl
___ Great-horned Owl
___ Snowy Owl
___ Northern Pygmy-owl
___ Barred Owl
___ Northern-Saw-whet Owl

Nighthawks and Swifts:
___ Common Nighthawk
___ Black Swift
___ Vaux's Swift

Hummingbirds:
___ Anna's Hummingbird
___ Rufous Hummingbird

Kingfishers:
___ Belted Kingfisher

Woodpeckers:
___ Red-naped Sapsucker
___ Red-breasted Sapsucker
___ Downy Woodpecker
___ Hairy Woodpecker
___ Northern Flicker
___ Pileated Woodpecker

Flycatchers:
___ Olive-sided Flycatcher
___ Western Wood-pewee
___ Willow Flycatcher
___ Hammond's Flycatcher
___ Dusky Flycatcher
___ Pacific-slope Flycatcher
___ Say's Phoebe
___ Western Kingbird

Larks and Swallows:
___ Horned Lark
___ Tree Swallow
___ Violet-Green Swallow
___ Northern Rough-winged Swallow
___ Cliff Swallow
___ Barn Swallow

APPENDIX F.
HYDRAULIC PROJECT APPROVAL
STORMWATER MAINTENANCE
HIDDEN LAKE

HYDRAULIC PROJECT APPROVAL

RCW 75.20.100 or RCW 75.20.108

State of Washington
Department of Fish and Wildlife
Region 4 Office
16018 Mill Creek Boulevard
Mill Creek, Washington 98012

DATE OF ISSUE: August 9, 2000

LOG NUMBER: 00-E6343-01

PERMITTEE	AUTHORIZED AGENT OR CONTRACTOR
City of Shoreline ATTENTION: Edward Mulhern 17544 Midvale Avenue N Shoreline, Washington 98133-4921 206-546-1700	Not Applicable

PROJECT DESCRIPTION: From 26 existing surface water management facilities excavate sediments and clear vegetation which interferes with the operation and function of the facility. Apply grout to seal existing surface water management facilities.

PROJECT LOCATION: 26 locations throughout Shoreline

#	WRIA	WATER BODY	TRIBUTARY TO	1/4 SEC.	SEC.	TOWNSHIP	RANGE	COUNTY
1	08.0030	Thornton Creek	Lake Washington	SE	17	26 North	04 East	King
2	08.0017	Boeing Creek	Puget Sound	SE	12	26 North	03 East	King
3	08.0052	Lyon Creek	Lake Washington	NE	04	26 North	04 East	King
4	08.0052	McAleer Creek	Lake Washington	NE	04	26 North	04 East	King
5	08.0017	Hidden Lake	Boeing Creek	SE	12	26 North	03 East	King

PROVISIONS

1. **TIMING LIMITATIONS:** The project may begin **Immediately** and shall be completed by **October 15, 2002.**

2. Work shall be accomplished per plans and specifications described on attachment to JARPA, dated June 23, 2000, and submitted to the Washington Department of Fish and Wildlife, except as modified by this Hydraulic Project Approval. These plans reflect design criteria per Chapter 220-110 WAC. These plans reflect mitigation procedures to significantly reduce or eliminate impacts to fish resources. A copy of these plans shall be available on site during construction.

3. The work in the streams shall be done in the dry or in isolation from the stream flow by the installation of a bypass flume or culvert, or by pumping the stream flow around the work area. Care shall be taken so that the stream below the project area is never dewatered, even momentarily. At least half the flow of the stream shall be maintained in the downstream reach at all times, even when water is first being impounded with sand bags into the diversion channel or pump, and even when the stream flow is first being restored into the dried channel reach of this project.

4. Every effort shall be taken during all phases of this project to ensure that sediment-laden water is not allowed to flow downstream. This may be accomplished by placing a series of low gravel bag dams downstream of the project. The gravel bag dams shall consist of burlap bags filled with clean gravel with a minimum diameter of 7/8 inches. The streambed and dams shall be overlain with filter fabric on the upstream side of the dams. Accumulated silt shall be

removed from the filter fabric during the project as needed, and upon completion of the project, at which time the burlap bags may be slit to allow the gravel to disperse downstream. Where necessary, hand tools may be used to ensure stream flow and fish passage are not impeded by the gravel.

5. Erosion control methods shall be used to prevent silt-laden water from entering the stream. These may include, but are not limited to, straw bales, filter fabric, temporary sediment ponds, check dams of burlap bags filled with gravel at least 7/8 inches in diameter and lined with filter fabric, and/or immediate mulching of exposed areas.

6. All waste material such as construction debris, silt, excess dirt or overburden resulting from this project shall be deposited above the limits of flood water in an approved upland disposal site.

7. If high flow conditions that may cause siltation are encountered during this project, work shall stop until the flow subsides.

8. Extreme care shall be taken to ensure that no wet grout, petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into the stream.

9. Fresh grout or concrete or concrete by-products shall not be allowed to enter the stream at any time during this project. All forms used for concrete shall be completely sealed to prevent the possibility of fresh concrete from getting into the stream. Grout shall be dried and cured before stream water is allowed to flow over it.

10. Alteration or disturbance of the bank and bank vegetation shall be limited to that necessary to maintain the facility, or to enhance riparian vegetation. Vegetation shall be left to shade the streams to the fullest extent possible. Within seven calender days of project completion, all disturbed areas shall be protected from erosion using vegetation or other means.

SEPA: City of Shoreline, DNS, June 21, 2000

APPLICATION ACCEPTED: June 30, 2000 **ENFORCEMENT OFFICER:** Peck 024 [P3]

Douglas G. Hennick (425) 379-2303 Douglas G. Hennick **for Director**
Area Habitat Biologist **WDFW**

GENERAL PROVISIONS

This Hydraulic Project Approval (HPA) pertains only to the provisions of the Fisheries Code (RCW 75.20). Additional authorization from other public agencies may be necessary for this project.

State of Washington
Department of Fish and Wildlife
Region 4 Office
16018 Mill Creek Boulevard
Mill Creek, Washington 98012

DATE OF ISSUE: August 9, 2000

LOG NUMBER: 00-E6343-01

This HPA shall be available on the job site at all times and all its provisions followed by the permittee and operator(s) performing the work.

This HPA does not authorize trespass.

The person(s) to whom this HPA is issued may be held liable for any loss or damage to fish life or fish habitat which results from failure to comply with the provisions of this HPA.

Failure to comply with the provisions of this Hydraulic Project Approval could result in a civil penalty of up to one hundred dollars per day or a gross misdemeanor charge, possibly punishable by fine and/or imprisonment.

All HPAs issued pursuant to RCW 75.20.100 or 75.20.160 are subject to additional restrictions, conditions or revocation if the Department of Fish and Wildlife determines that new biological or physical information indicates the need for such action. The permittee has the right pursuant to Chapter 34.04 RCW to appeal such decisions. All HPAs issued pursuant to RCW 75.20.103 may be modified by the Department of Fish and Wildlife due to changed conditions after consultation with the permittee: PROVIDED HOWEVER, that such modifications shall be subject to appeal to the Hydraulic Appeals Board established in RCW 75.20.130.

APPEALS - GENERAL INFORMATION

IF YOU WISH TO APPEAL A DENIAL OF OR CONDITIONS PROVIDED IN A HYDRAULIC PROJECT APPROVAL, THERE ARE INFORMAL AND FORMAL APPEAL PROCESSES AVAILABLE.

A. INFORMAL APPEALS (WAC 220-110-340) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 75.20.100, 75.20.103, 75.20.106, AND 75.20.160:

A person who is aggrieved or adversely affected by the following Department actions may request an informal review of:

(A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA; or

(B) An order imposing civil penalties.

It is recommended that an aggrieved party contact the Area Habitat Biologist and discuss the concerns. Most problems are resolved at this level, but if not, you may elevate your concerns to his/her supervisor. A request for an INFORMAL REVIEW shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091 and shall be RECEIVED by the Department within 30-days of the denial or issuance of a HPA or receipt of an order imposing civil penalties. The 30-day time requirement may be stayed by the Department if negotiations are occurring between the aggrieved party and the Area Habitat Biologist and/or his/her supervisor. The Habitat Protection Services Division Manager or his/her designee shall conduct a review and recommend a decision to the Director or its designee. If you are not satisfied with the results of this informal appeal, a formal appeal may be filed.

B. FORMAL APPEALS (WAC 220-110-350) OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 75.20.100 OR 75.20.106:

A person who is aggrieved or adversely affected by the following Department actions may request an formal review of:

(A) The denial or issuance of a HPA, or the conditions or provisions made part of a HPA;

(B) An order imposing civil penalties; or

(C) Any other "agency action" for which an adjudicative proceeding is required under the Administrative Procedure Act, Chapter 34.05 RCW.

A request for a FORMAL APPEAL shall be in WRITING to the Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501-1091, shall be plainly labeled as "REQUEST FOR FORMAL APPEAL" and shall be RECEIVED DURING OFFICE HOURS by the Department within 30-days of the Department action that is being challenged. The time period for requesting a formal appeal is suspended during consideration of a timely informal appeal. If there has been an informal appeal, the deadline for requesting a formal appeal shall be within 30-days of the date of the Department's written decision in response to the informal appeal.

DATE OF ISSUE: August 9, 2000 **LOG NUMBER:** 00-E6343-01

C. FORMAL APPEALS OF DEPARTMENT ACTIONS TAKEN PURSUANT TO RCW 75.20.103 or 75.20.160:
A person who is aggrieved or adversely affected by the denial or issuance of a HPA, or the conditions or provisions made part of a HPA may request a formal appeal. The request for FORMAL APPEAL shall be in WRITING to the Hydraulic Appeals Board per WAC 259-04 at Environmental Hearings Office, 4224 Sixth Avenue SE, Building Two - Rowe Six, Lacey, Washington 98504; telephone 360/459-6327.

D. FAILURE TO APPEAL WITHIN THE REQUIRED TIME PERIODS RESULTS IN FORFEITURE OF ALL APPEAL RIGHTS. IF THERE IS NO TIMELY REQUEST FOR AN APPEAL, THE DEPARTMENT ACTION SHALL BE FINAL AND UNAPPEALABLE.

JARPA Attachment

Attachment 1

This attachment provides site-specific information to the JARPA application for City of Shoreline routine maintenance operations at drainage facilities within the city that require an HPA, as per site visit with Doug Hennick. The facilities are listed by category as follows:

- Combined Open Channel/Pipe and Catch Basin Conveyance System: Ballinger Creek Storm Water Flood Control Facility.
- Open Channel Conveyance Systems: Darnell Park
- Pipes and Catch Basin Conveyance Systems: Storm Creek Drainage Improvement, EO 310, Ronald Bog Outlet, EO 300
- R/D Ponds: Hidden Lake , Boeing Creek M1 Dam, Boeing Creek North Pond, McAleer Creek, Paramount Park

Combined Open Channel/Pipe and Catch Basin Conveyance System

FACILITY **LC-1**: Ballinger Creek Storm Water Flood Control Facility

4. PROPERTY OWNER: City of Shoreline - Parks Department

5. LOCATION: NE 200th Court, just west of 24th Ave NE, Shoreline, King County, 98155. Please see attached map for further detail.

WATERBODY: Lyon Creek
TRIBUTARY OF: Lake Washington
WRIA#: 8
1/4 SECTION: NE
SECTION: 4
TOWNSHIP: 26N
RANGE: 4W
ZONE DESIGNATION: R-12, Residential
PARCEL ID: 0426049046

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: City Park

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove approximately 2-10 cubic yards of sediments from catch basin, culvert, and sediment basin at inlet to pipe; excavate sediments in 20 ft. length of channel at the system inlet; clear debris from structures; and mow vegetation at inlet ditch along NE 200th Court, between Ballinger Creek and 24th Ave NE.

Open Channel Conveyance System

FACILITY **BC-4**: Darnell Park

4. PROPERTY OWNER: City of Shoreline

5. LOCATION: Between the 1200 and 1300 blocks of N 165th St., Shoreline, King County, 98133. The park is behind houses and buildings located on N 165th St, Aurora Ave N, and Midvale Ave N. Please see attached map for further detail.

WATERBODY: Boeing Creek
TRIBUTARY OF: Puget Sound
WRIA#: 8
1/4 SECTION: NW
SECTION: 18
TOWNSHIP: 26N
RANGE: 4E
ZONE DESIGNATION: R-6, Residential
PARCEL ID: 041410067

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Public park

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove up to 45 cubic yards of sediments and debris from stream channel and trim vegetation to allow free flow of water in the open channel.

Pipes and Catch Basin Conveyance System

FACILITY **MP-2**: Storm Creek Drainage Improvement

4. PROPERTY OWNER: Easement from the following owner; John E. and Kelley E. McHenry, 1240 NW Richmond Beach Rd, Shoreline, WA 98177 .
5. LOCATION: 1404 NW Richmond Beach Road, Shoreline, King County, 98177. Please see attached map for further detail.
   WATERBODY: Boeing Creek
   TRIBUTARY OF: Puget Sound
   WRIA#: 8
   1/4 SECTION: NW
   SECTION: 1
   TOWNSHIP: 26S
   RANGE: 3W
   ZONE DESIGNATION: R-12, Residential
   PARCEL ID: 0126039040
6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Drainage easement on apartment development.

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove approximately 1-2 cubic yards of sediments from catch basins, clear inlet, trash rack, and vegetation from around structures.

FACILITY **TC-6**: Ronald Bog Outlet

4. PROPERTY OWNER: City of Shoreline, system lies in City right of way.
5. LOCATION: Corliss Place N between the south end of Ronald Bog at approximately N 173rd St to N 170th St. Shoreline, King County, 98133. The system is piped along Corliss with one catch basin located at N 170th St. Please see attached map for further detail.
   WATERBODY: Thornton Creek
   TRIBUTARY OF: Lake Washington
   WRIA#: 8
   1/4 SECTION: NW
   SECTION: 8
   TOWNSHIP: 26S
   RANGE: 4W
   ZONE DESIGNATION: R-6, Residential
   PARCEL ID: 0826049048
6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Residential right of way

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: To remove sediments from pipe and catch basin.

FACILITY **TC-9**: EO310

4. PROPERTY OWNER: City of Shoreline, system lies in City right of way.
5. LOCATION: 1202 NE 152nd St, Shoreline, King County, 98133. There are four (4) catch basins located along the East side of 12th Ave NE and NE 152nd Street, as well as a culvert and open ditch. Please see attached map for further detail.
   WATERBODY: Thornton Creek
   TRIBUTARY OF: Lake Washington
   WRIA#: 8
   1/4 SECTION: SE

SECTION: 17
TOWNSHIP: 26S
RANGE: 4E
ZONE DESIGNATION: R-6, Residential
PARCEL ID: 6632900420

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Residential right of way

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Vactor approximately 2-3 cubic yards of sediment from four catch basins, grout structural gaps and cracks, and clear overgrown vegetation from around outside of structures.

FACILITY **TC-10**: EO300

4. PROPERTY OWNER: City of Shoreline, system lies in City right of way.
5. LOCATION: NE 155th St. and 12th Ave. NE, Shoreline, King County, 98133. There are two (2) catch basins located on the corner of NE 155th and one catch basin located on 12th Ave NE. Please see attached map for further detail.

WATERBODY: Thornton Creek
TRIBUTARY OF: Lake Washington
WRIA#: 8
1/4 SECTION: SE
SECTION: 17
TOWNSHIP: 26S
RANGE: 4E
ZONE DESIGNATION: R-6, Residential
PARCEL ID: 6632900491

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Residential right of way.

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Vactor approximately 4 cubic yards of sediment from seven (7) catch basins along the West side of 12th Ave NE as well as a culvert and open ditch, grout structural gaps and cracks, and clear overgrown vegetation from around the outside of structures.

R/D Pond

FACILITY **BC-1**: Hidden Lake

4. PROPERTY OWNER: City of Shoreline Shoreview Parks and easements from following properties:
   - 944 NW Innis Arden way, 3586500875
   - 16740 10th Ave N, 3586500885
   - 1700 10th Ave N, 3586500890
   - 17020 10th Ave N, 3586500895
   - 17040 10th Ave N, 3586500900
   - 17052 10th Ave N, 3586500905.
5. LOCATION: Immediately upstream of NW Innis Arden Way at Boeing Creek, Shoreline, King County, 98133. There is an access road that can be reached from NW Innis Arden Way. Please see attached map for further detail.

WATERBODY: Boeing Creek
TRIBUTARY OF: Puget Sound
WRIA#: 8
1/4 SECTION: SE
SECTION: 12
TOWNSHIP: 26S
RANGE: 3W

ZONE DESIGNATION: Public Park, R-4, Residential
PARCEL ID: 3586500890

6 DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Public park and single family residential

7a.DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove 300-600 cubic yards of sediments annually from the sediment forebay and trash rack.

FACILITY **BC-2**: Boeing Creek M1 Dam

4. PROPERTY OWNER: City of Shoreline

5. LOCATION: 16301 Greenwood Ave N, Shoreline, King County, 98133. The dam is located at the North end of Shoreline Community College Greenwood parking lot. Please see attached map for further detail.

WATERBODY: Boeing Creek
TRIBUTARY OF: Puget Sound
WRIA#: 8
1/4 SECTION: SE
SECTION: 12
TOWNSHIP: 26S
RANGE: 3E
ZONE DESIGNATION: R-4, Residential
PARCEL ID: 1226039013

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Drainage basin

7a.DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear vegetation from and around structures, fill depressions on the dam, catch basin sediment removal, lubricate sluice gate, remove approximately 100 cubic yards of sediments from two sediment forebays every 1-2 years.

FACILITY **BC-7**: Boeing Creek North Pond

4. PROPERTY OWNER: City of Shoreline

5. LOCATION: 401 NW 175th Street, Shoreline, King County, 98133.
WATERBODY: Boeing Creek
TRIBUTARY OF: Puget Sound
WRIA#: 8
1/4 SECTION: NW
SECTION: 12
TOWNSHIP: 26S
RANGE: 3E
ZONE DESIGNATION: R-4, Residential
PARCEL ID: 6190700800

6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Public Park

7a.DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear inlets, outlets, catch basins and control structure of debris, replace oil adsorbent media, maintain energy dissipater, upkeep banks and concrete cap, and clear vegetation from around structures. Routine maintenance activities would be done in the dry season and include local roadway catch basins that drain to the facility detention pond. However, the list above also includes some maintenance and repair work that may occasionally be needed at facility structures located in the riparian area of Boeing Creek. These structures are two energy dissipaters and the outer bank of the detention pond dam. The energy dissipaters are at the main detention pond outlet and the overflow outlet.

FACILITY **MC-1**: McAleer Creek

4. PROPERTY OWNER: City of Shoreline

5. LOCATION: 1516 NE 196th St, Shoreline, King County, 98133. The park is bounded by NE 148th and 152nd Streets and 10th and 12th Avenues NE. Please see attached map for further detail.
WATERBODY: McAleer Creek
TRIBUTARY OF: Lake Washington
WRIA#: 8
1/4 SECTION: NE
SECTION: 4
TOWNSHIP: 26N
RANGE: 4W
ZONE DESIGNATION: R-24, Residential
PARCEL ID: 7417100082
6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Public park
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: The proposed project is to maintain the control structure and surroundings at this location on McAleer Creek. This includes upkeep of the slopes, cutting back vegetation from around the structures, removing debris from around structures including fish ladder and trash rack, filling in cracks in the control structure, and lubricating the sluice gate.

FACILITY **TC-8**: Paramount Park
4. PROPERTY OWNER: City of Shoreline
5. LOCATION: 940 NE 147th St, Shoreline, King County, 98133. The park is bounded by NE 148th and 152nd Streets and 10th and 12th Avenues NE. Please see attached map for further detail.
WATERBODY: Thornton Creek
TRIBUTARY OF: Lake Washington
WRIA#: 8
1/4 SECTION: SE
SECTION: 17
TOWNSHIP: 26S
RANGE: 4E
ZONE DESIGNATION: R-6, Residential
PARCEL ID: 6632900780
6. DESCRIBE THE CURRENT USE OF PROPERTY AND STRUCTURES EXISTING ON THE PROPERTY: Public park
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Approximately 5 cubic yards of material would be removed from the roughly 300 square foot area at the inlet to a culvert that provides a stream crossing at a park access trail. Also, the removal of approximately 40 cubic yards of sediment from the sediment forebay is expected every 1-2 years.

Attachment 2

This attachment provides brief information to the JARPA application for routine maintenance operations at drainage facilities that do not require and HPA, as per site visits with Doug Hennick, within the City of Shoreline. The facilities are listed by category as follows:

- Closed Channel Conveyance System: Echo Lake Outlet
- Combination Closed/Open Channel Conveyance Systems: Interurban Drainage
- Open Channel Conveyance Systems: EO 140, Interlake Ave N Drainage
- Pipes and Catch Basin Conveyance Systems: EO 250, Freemont Tracts Drainage Improvement, EO 290, EO 270, EO 320, EO 260, NE 175th and 10th Ave NE
- Pump Plant and R/D Ponds: Pump Plant 25, Pump Plant 26, Pump Plant 30
- R/D Ponds: Pan Terra Pond, Crista Pond

Closed Channel Conveyance System

FACILITY **MC-2**: Echo Lake Outlet
5. LOCATION: N 199 St. & Ashworth Ave. N
PARCEL ID:
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes when system is dry, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

Combination Closed/Open Channel Conveyance System

FACILITY **BC-6**: Interurban Drainage
5. LOCATION: N 145th St & Linden Ave N
PARCEL ID: 1826049036
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear overgrown vegetation from ditch and from around structures. Vactor sediments from catch basins and storm pipes.

Open Channel Conveyance System

FACILITY **BC-3**: EO140 (Boeing Creek Drainage - open channel)
5. LOCATION: Greenwood Pl. N & N. Carlyle Hall Rd.
PARCEL ID: 1226039013
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear debris from channel, and clear vegetation from access road as needed to prevent erosion damage to access road, and to maintain open road access.

FACILITY **TC-4**: Interlake Ave. N Drainage
5. LOCATION: Interlake Ave. N between N 145 St & N 150 St
PARCEL ID: 0558100109-0558100210
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

Pipe and Catch Basin Conveyance System

FACILITY **MP-1**: EO250
5. LOCATION: 19501 27th Ave. NW
PARCEL ID: 7278100955

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes when system is dry, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

FACILITY **MP-3**: Freemont Tracts Drainage Improvements
5. LOCATION: 20333 Dayton Ave. N
PARCEL ID: 2644900070
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins, storm pipes, and corrugated pipes, and clear vegetation from around structures.

FACILITY **TC-1**: EO290
5. LOCATION: 15216 Meridian Ave. N
PARCEL ID: 3928200010
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

FACILITY **TC-2**: EO270
5. LOCATION: 15200 Meridian Ave. N
PARCEL ID: 2881700590
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

FACILITY **TC-3**: EO320
5. LOCATION: 15063 Wallingford Ave. N
PARCEL ID: 7952800060
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

FACILITY **TC-7**: EO260
5. LOCATION: 17401 Meridian Ave. N
PARCEL ID: 0826049048
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and storm pipes, grout structural gaps and cracks, and clear overgrown vegetation from around structures.

FACILITY **TC-12**: NE 175th & 10th Ave. NE
5. LOCATION: NE 175th & 10th Ave. NE
PARCEL ID: 0927100385
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove sediments from catch basins and clear vegetation from around structures.

Pump Plant and R/D Pond
FACILITY **TC-11**: Pump Plant 30
5. LOCATION: NE 170 St. & 15 Ave. NE
PARCEL ID: 5589300160

7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove approximately 40 cubic yards of sediments from detention pond every 1-2 years, upkeep detention pond banks, grout work, and clear vegetation from around structures.

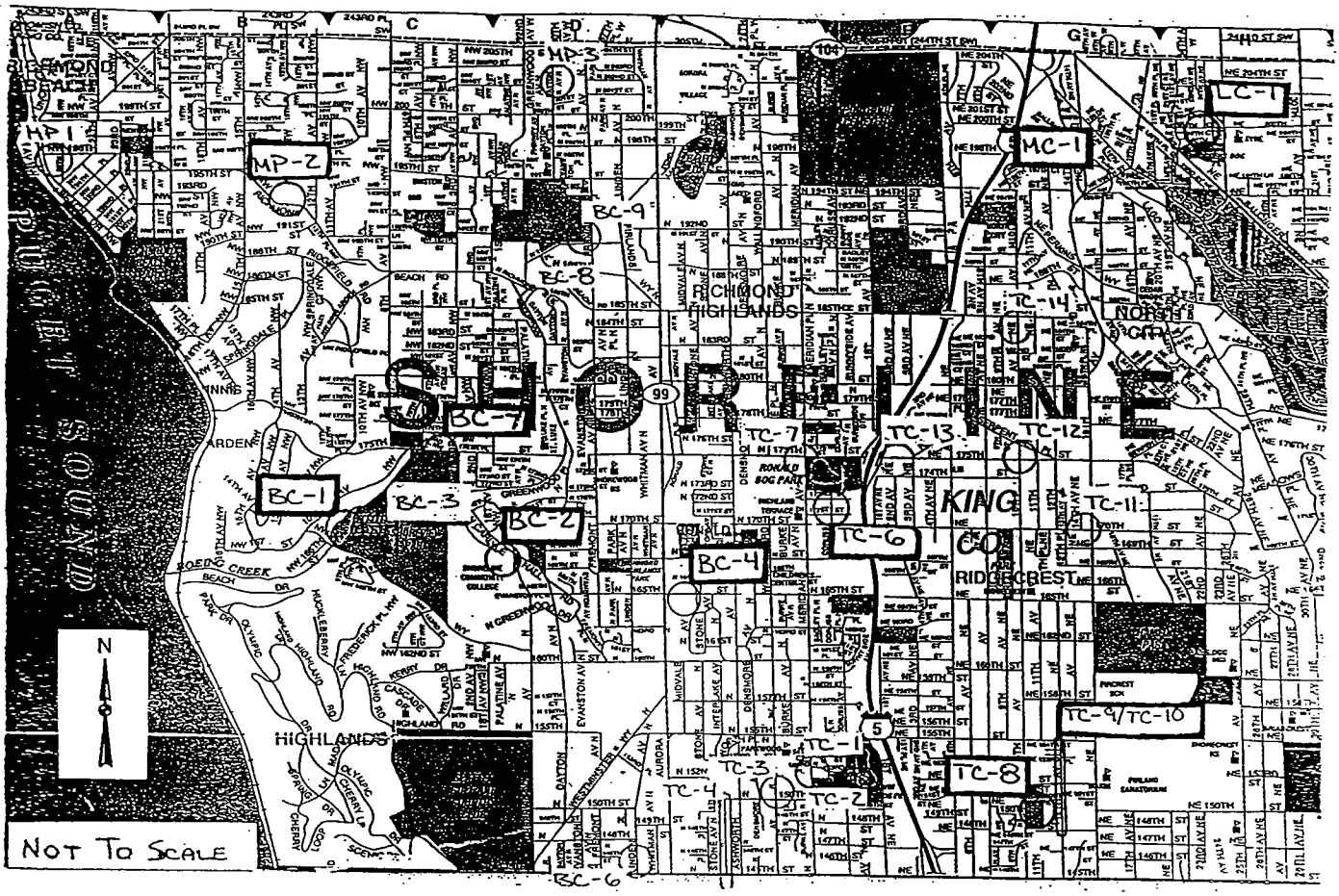
FACILITY **TC-13**: Pump Plant 25 - Shoreline Park
5. LOCATION: 17548 - 2nd Pl. NE
PARCEL ID: 1115100230
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove approximately 40 cubic yards of sediments from detention pond every 1-2 years, upkeep detention pond banks, grout work, and clear vegetation from around structures.

FACILITY **TC-14**: Pump Plant 26
5. LOCATION: 18331 - 10 Ave. NE
PARCEL ID: 6163900133
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Remove approximately 40 cubic yards of sediments from detention pond every 1-2 years, upkeep detention pond banks, grout work, and clear vegetation from around structures.

R/D Pond
FACILITY **BC-8**: Pan Terra Pond
5. LOCATION: 18500 Dayton Ave. N
PARCEL ID: 7282300045
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear debris from inlets and outlets, remove sediments from control structure catch basin, upkeep banks, clear vegetation from around structures, and mow vegetation in retention basin.

FACILITY **BC-9**: Crista R/D Pond
5. LOCATION: 370 N 190th Pl.
PARCEL ID: 0626049164
7a. DESCRIBE THE PROPOSED CONSTRUCTION AND/OR FILL WORK FOR THE PROJECT THAT YOU WANT TO BUILD THAT NEEDS AQUATIC PERMITS: Clear overgrown vegetation from around structures.

Five-Year Surface Water Facility Maintenance Project Locations



Requires HPA

No HPA Required

Hydraulic Project Approval (HPA) Required:

MP-1 (Hidden Lake): Remove sediments from the constructed sediment forebay and the trash rack. Repair trash rack, including grouting the cracks and gaps and repairing the rack itself. Maintenance of the overflow area will also take place, needing the replacement of rock in the designated area.

MP-2 (Boeing Creek M1 Dam): Upkeep of dam structure, catch basin sediment removal, clear vegetation from and around structures, replicate sluice gate, routine maintenance of the two energy dissipaters, vegetation control on bank, and remove approximately 100 cubic yards of sediments from the two sediment forebays. The access road may need vegetation cutback and the replacement of gravel in potholes to facilitate access to site.

BC-4 (Darnell Park): Remove sediments and debris from stream channel and trim vegetation to allow free flow of water in the open channel.

BC-7 (Boeing Creek North Pond): Clear inlets, outlets, catch basins and control structure of debris, replace oil adsorbent media, maintain energy dissipater, upkeep banks and concrete cap, and clear vegetation from around structures. The replacement of rip-rap, if ever needed, repair of erosion/sluffing of internal side slopes of the pond as needed.

TC-1 (McAleer Creek): Upkeep of the slopes, cutting back vegetation from around the structures, removing debris from around structures including the fish ladder and trash rack, filling in cracks in the control structure, and lubricating the sluice gate.

TC-2 (Storm Creek Drainage): Remove sediments from catch basins, clear inlet, trash rack, and vegetation from around structures.

TC-3 (Ballinger Creek): Remove sediments from catch basin, 20ft culvert underneath NE 200th St, and sediment basin at inlet to pipe; excavate sediments in 20 ft. length of channel at the system inlet; clear debris from structures; and mow vegetation inlet ditch along 24th Ave NE to allow free flow of water.

TC-6 (Ronald Bog Outlet): Remove sediments from pipe and catch basin.

TC-8 (Paramount Park): Remove sediments and debris from the inlet culvert at the access trail and the sediment forebay. The culvert needs repair work for restoration to the original shape.

TC-9/TC-10 EO300 and EO310: Remove sediments from each catch basin and open ditch in the two connected facilities, grout structural joints and cracks, and clear overgrown vegetation from around the outside of structures.

Hydraulic Project Approval (HPA) Not Required:

BC-3 EO140 (Boeing Creek Drainage - open channel), BC-6 (Interurban Drainage), BC-8 (Pan Terra Pond), BC-9 (Crista R/D Pond), MP-1 EO250, MP-3 (Freemont Tracts Drainage Improvements), TC-1 EO290, TC-2 EO270, TC-3 EO320, TC-4 (Interlake Ave. N Drainage), TC-7 EO260, TC-11 (Pump Plant 30), TC-12 (NE 175th & 10th Ave. NE), TC-13 (Pump Plant 25 - Shoreline Park), TC-14 (Pump Plant 26).

CITY OF SHORELINE

Planning and Development Services

17544 Midvale Avenue N.
Shoreline, WA 98133-4921
(206) 546-1811 ♦ Fax (206) 546-8761

SEPA THRESHOLD DETERMINATION
DETERMINATION OF NONSIGNIFICANCE (DNS)

FIVE-YEAR SURFACE WATER FACILITY MAINTENANCE PROGRAM

PROJECT INFORMATION

DATE OF ISSUANCE	**June 21, 2000**
APPLICANT:	**City of Shoreline (Public Works Department)**
PROJECT APPLICATION NUMBER:	**2000-000899**
DESCRIPTION OF PROPOSAL:	**Routine maintenance of City owned and maintained stormwater facilities over a five-year period beginning Summer 2000. Activities include sediment and debris removal from retention/detention ponds, system inlets, catch basins, culverts, ditches, outlets, and control structures; vegetation maintenance along ditches, inlets, outlets, structures, and dams; maintenance and minor repair of inlets, outlets, energy dissipaters, trash racks, control structures, and dams; and other similar work. Work will take place during dry months, remaining flows will be piped around work areas where sediment removal is proposed, and additional sediment and erosion control measures will be implemented as detailed in the environmental checklist.**
LOCATION OF PROPOSAL:	**City-wide (various locations).** Sites include **facilities within and adjacent to Ballinger Creek, Boeing Creek, Darnell Park, Little's Creek, Hidden Lake, McAleer Creek, Paramount Park, Ronald Bog/Thornton Creek, Storm Creek, as well as control and conveyance systems within public road right-of-ways.** See attached map for more details about project locations.
SEPA RESPONSIBLE OFFICIAL:	**Gabe Snedeker, Planner II** **Planning and Development Services**
LEAD AGENCY:	**City of Shoreline (Planning and Development Services Department)**

THRESHOLD DETERMINATION: Determination of Nonsignificance (DNS)

The City of Shoreline has determined that the proposal will not have a probable significant adverse impact on the environment and that an environmental impact statement is not required under RCW 43.21C.030(2)(c). This decision was made after review of the environmental checklist, site plans, and other information on file with the lead agency. This information is available to the public upon request at no charge. This project will require Hydraulic Project Approval (HPA) by the Washington Department of Fish and Wildlife. The City of Shoreline has determined that these routine maintenance activities are exempt from grading permit requirements.

PUBLIC COMMENT AND APPEAL INFORMATION

This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 15 days from the date of issuance. This may be your only opportunity to submit written comments on the above proposal. Any interested party may submit written comments on this DNS to the City of Shoreline Department of Planning and Development Services at the address listed below. **Written comments must be received before 5:00 PM on July 5, 2000.** If you have any questions, comments, or would like a copy of the environmental checklist, please contact Gabe Snedeker, at (206)546-8656, or write to: City of Shoreline, Planning and Development Services, 17544 Midvale Avenue North, Shoreline, WA 98133.

Appeals of the SEPA threshold determination must be received by the City Clerk's Office at 17544 Midvale Avenue North, Shoreline, WA 98133 by 5:00 p.m. on July 13, 1999. Appeals must include a fee of $350.00 and must comply with the requirements of S.M.C. 16.45.030 and Resolution 130, Exhibit A, Section 7.

John Gabriel Snedeker — 6/20/00

Gabe Snedeker
SEPA Responsible Official
Planning and Development Services
City of Shoreline

Date

Hidden Lake Facility
Routine Maintenance - Removal of Sediments from the Forebay

See attachment for Hydraulic Project Approval.

BACKGROUND:

Hidden Lake is an inline lake located along Boeing Creek, immediately upstream of Innis Arden Way. It was constructed by the Boeing family for recreational use. In 1998 King County completed a restoration project at the site that included construction of a sediment pond to trap sediment from ongoing erosion of Boeing Creek, and development of a facility operation and maintenance manual.

This manual, calls for the removal of sediment from the sediment pond on an annual basis, or more frequently if needed. The Washington State Department of Fish and Wildlife issued a Hydraulic Project Approval (HPA) for construction of the restoration project. The HPA requires excavation of the sediment forebay annually. King County last did this, in November of 1998.

In March of 1999 the County formally transmitted the operations and maintenance responsibility of Hidden Lake to the City of Shoreline.

In the Summer of 1999, the City of Shoreline entered an agreement with Westwater Construction Company, for $12,840, to provide for excavation, haul and disposal of approximately 400 cubic yards of accumulated sediments. As required by the project HPA, the project costs included temporarily by-passing the creek water flow around the work area, and removing any fish from the work area.

TYPICAL ROUTINE EXCAVATION ACTIVITIES:

Project Frequency: Once every 1-2 years.

The project will take approximately 1-2 weeks to complete, including mobilization, BMP installation, removing fish from project area, excavation operations, site cleanup, and removal of BMPs.

BMPs include installation of a suspended silt fence (with floats at top and weights at bottom) to divide the sediment forebay from the other area of the lake. Additionally, Boeing Creek water flow is diverted around the site through two structures. The first is a diversion channel along the south side of the lake. This is accomplished by removing the cover to a culvert inlet that connects to the diversion channel and placing sandbags across the creek channel to divert stream flow into the culvert. This diversion site is located approximately a few hundred feet upstream from the sediment forebay. The second bi-pass structure is a pipe along the north side of the lake. Any stream flow that gets past the sandbags at the first diversion site is directed into the second structure by installing a board across a concrete weir and removing the cover to the diversion pipe inlet. The concrete weir and pipe inlet are located immediately upstream of the sediment forebay.

APPENDIX G.
ESA SPECIES LIST CONFIRMATION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Western Washington Office
510 Desmond Drive SE, Suite 102
Lacey, Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

DEC 0 3 2001

Dear Species List Requester:

We are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us (U.S. Fish and Wildlife Service).

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., "major construction activity"), impacts to both listed and proposed species must be considered in a biological assessment (BA) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency's best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BA will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to adversely affect" determination, you should request our concurrence through the informal consultation process. For a "no effect" determination, we would appreciate receiving a copy for our information.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but recommended. Protection provided to these species now may preclude possible listing in the future.

For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service at (360) 753-9530 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Yvonne Dettlaff (360) 753-9582.

Sincerely,

Ken S. Berg, Manager
Western Washington Office

Enclosure(s)

cc: FHWA

ATTACHMENT A **November 29, 2001**

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR WITHIN THE VICINITY OF THE PROPOSED CITY OF SHORELINE PROJECT IN KING COUNTY, WASHINGTON

(T26N R3E S1-2,11-14; T26N R4E S4-8,17-18)

FWS REF: 1-3-02-SP-0302

LISTED

There are six bald eagle (*Haliaeetus leucocephalus*) nesting territories located in the vicinity of the project at T26N R2E S1,12-13; T26N R3E S7,11; T27N R3E S35. Nesting activities occur from January 1 through August 15.

Wintering bald eagles may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) may occur in the vicinity of the project.

Foraging marbled murrelets (*Brachyramphus marmoratus*) may occur in the ocean waters adjacent to your project.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species,

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project, and

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

PROPOSED

None

CANDIDATE

None

CRITICAL HABITAT

None

SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site.

Beller's ground beetle (*Agonum belleri*)
California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Hatch's click beetle (*Eanus hatchi*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific fisher (*Martes pennanti pacifica*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Pacific lamprey (*Lampetra tridentata*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Valley silverspot (*Speyeria zerene bremeri*)
Western toad (*Bufo boreas*)
Aster curtus (white-top aster)

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with the U.S. Fish and Wildlife Service (FWS) when a Federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with the FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species that is/are likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with the Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503-1273.

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* "Construction project" means any major Federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal action such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction.

Martin, Janice

From: Matthew Longenbaugh [matthew.longenbaugh@noaa.gov]
Sent: Thursday, November 08, 2001 3:18 PM
To: Martin, Janice
Subject: Re: Subject: Species List Confirmation for City of Shoreline Washington

Hi Janice, re your Q, the actual list is much shorter. There is only one ESA-NMFS fish species: Puget Sound chinook salmon. Note that chinook inhabit Puget Sound, and larger rivers and tribs (likely not found in freshwater areas of City of Shoreline).

All the other species on your list are either not ESA listed or outside your area.
See also: http://www.nwr.noaa.gov/ species lists>

For purely marine actions, then there 3 other spp of air-breathing marine animals, and perhaps ESA-FWS bull trout (char).

Please call if more Q, Matt L. 360-753-7761

"Martin, Janice" wrote:

> Mr. Longenbaugh:
>
> On behalf of the City of Shoreline, Tetra Tech/KCM is preparing an
> Environmental Assessment under the Endangered Species Act of 1973, as
> amended, for future project impacts within the City. The City of Shoreline
> is within the legal boundaries of:
> Township 26 N
> Range 3 E
> Sections 1, 2, 11, 12, 13 & 14.
> and
> Township 26N
> range 4E
> Sections 4, 5, 6, 7, 8, 17 & 18.
>
> The listed species we have identified within the City of Shoreline under
> NMFS jurisdiction include:
>
> Pink salmon (odd year)
>
> Coho Puget Sound ESU
> Coho Puget Sound ESU
>
> Chinook Puget Sound ESU and critical habitat
>
> Chum Hood Canal summer-run ESU
> Chum Puget Sound ESU
> Chum Strait of Georgia ESU
> Steelhead Puget Sound ESU
> Coastal Cutthroat Trout Puget Sound ESU
>
> Please confirm this analysis is correct and supply information on any other
> fish or habitat of special status in the City of Shoreline. If there are
> any questions regarding this request please email me at jmartin@kcminc.com
> or call (206) 443-2669.
>
> Thank you in advance.

APPENDIX H.
RESTORATION STANDARD DETAILS

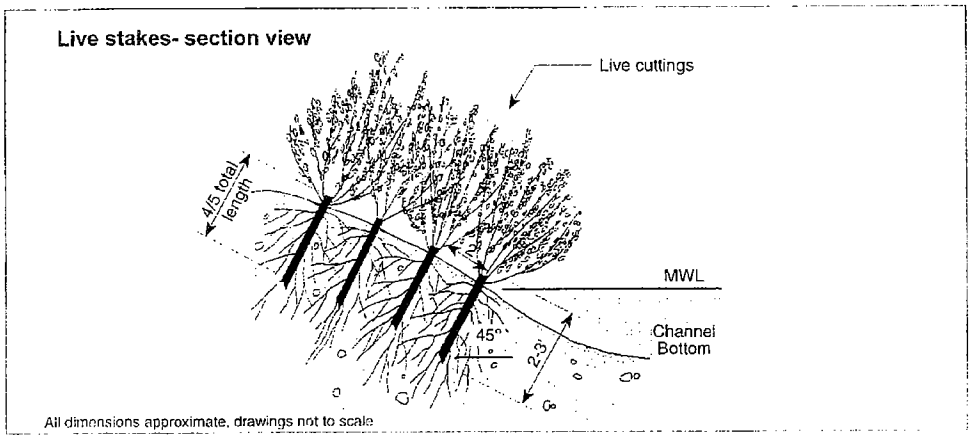
BANK PROTECTION

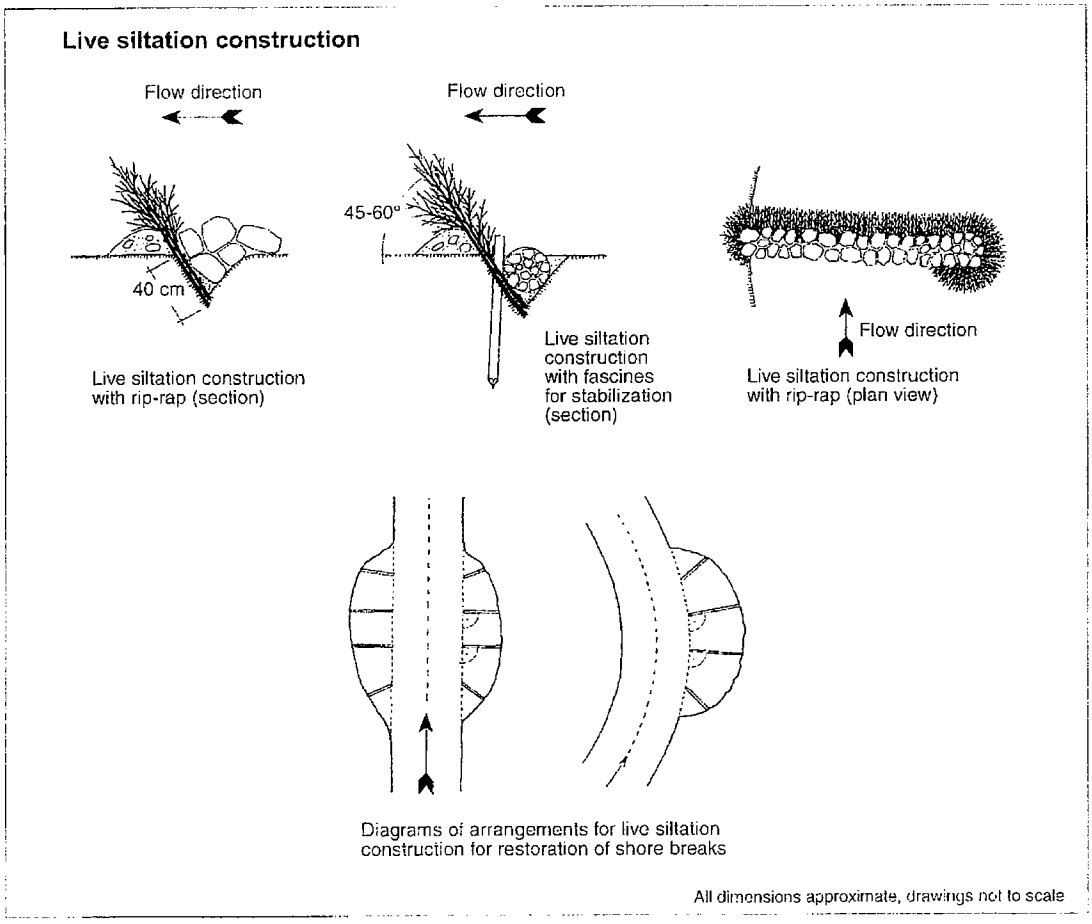
- Bioengineering
- Gabions
- Fencing
- Bank Slope Reduction
- Standard Trench Fill/Riprap Revetment

GROUP:	*BANK PROTECTION/IN-STREAM STRUCTURE PROTECTION*
ALTERNATIVE:	**BIOENGINEERING**
PURPOSE:	Protect banks and shorelines that are actively eroding.
DESCRIPTION:	Willow, alder, or cottonwood cuttings are placed into streambanks and along shorelines to stabilize them and provide structural support. Bioengineering may be used in conjunction with other structural alternatives such as gabions or riprap (for stabilizing lower banks). Site must be graded prior to vegetation placement and protected during the initial growth stage.
SKETCH:	*See Next Page*
IMPACTS:	None
IMPLEMENTATION:	
Design Requirements:	Site survey, design drawings
Materials:	Live plant cuttings, wooden stakes, iron bar to produce starter holes, fill and topsoil, seed
Equipment Needs:	Bioengineered projects typically constructed by hand. Front end loader to place and grade fill or existing soils as needed prior to installation, haul trucks
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Monitor to ensure plants are growing and bioengineered structure is stable. Maintain with new plant materials as needed.

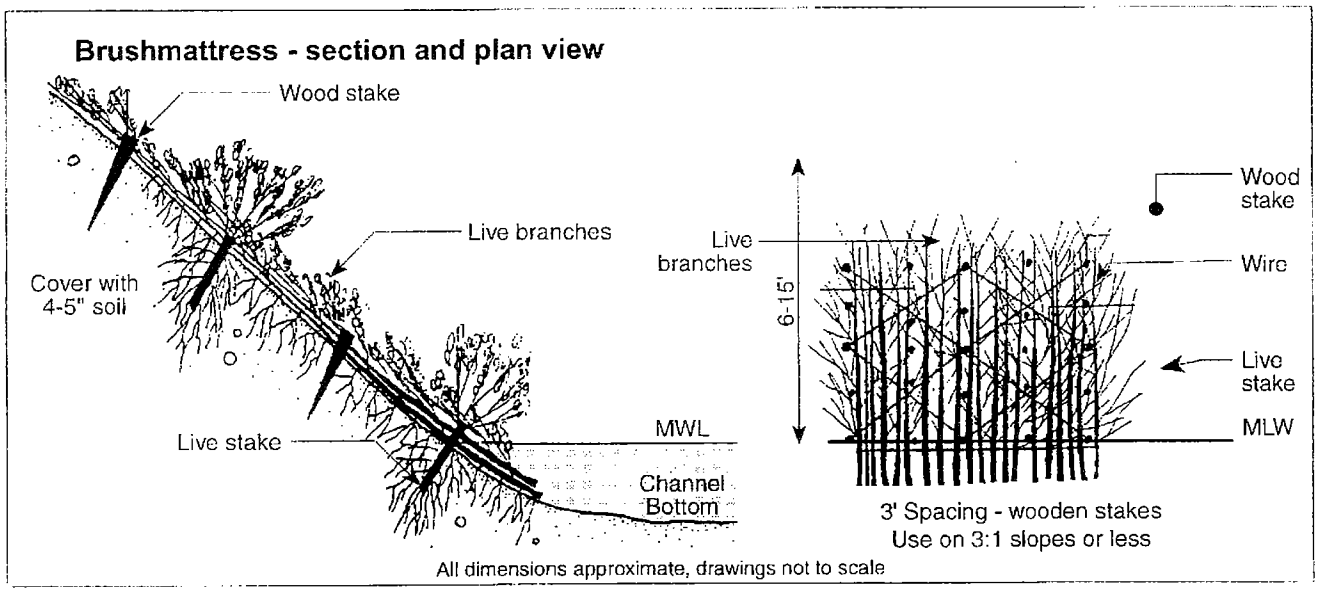
References: Schiechtl, 1980; City of Bellevue Storm and Surface Water Utility, 1989

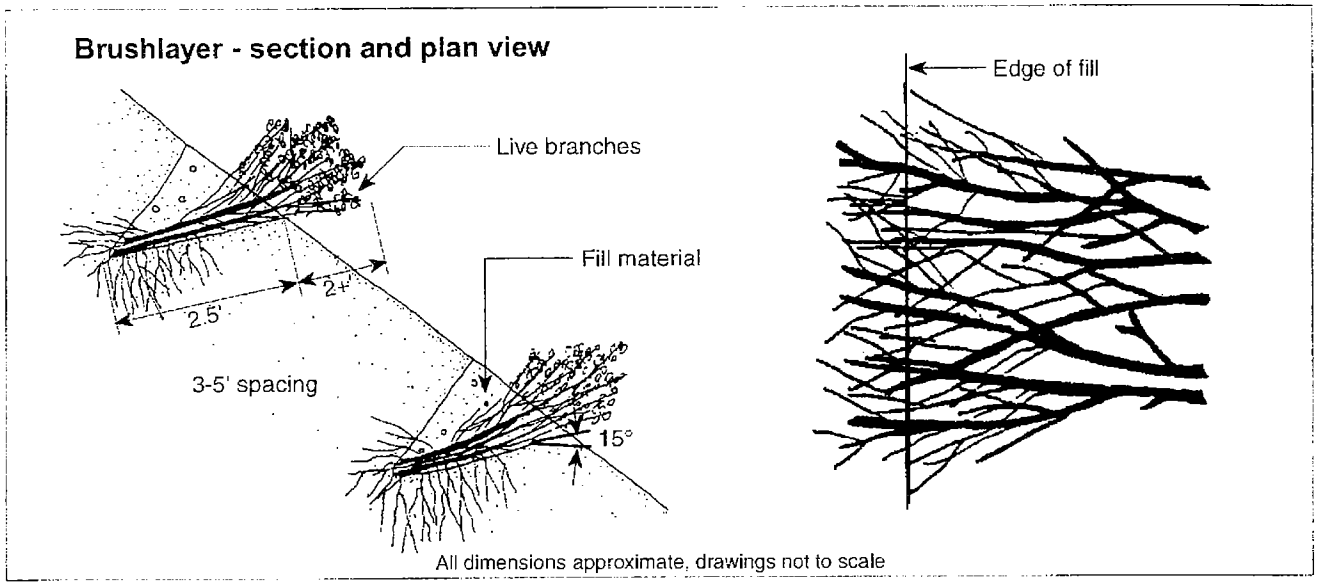
Bioengineering



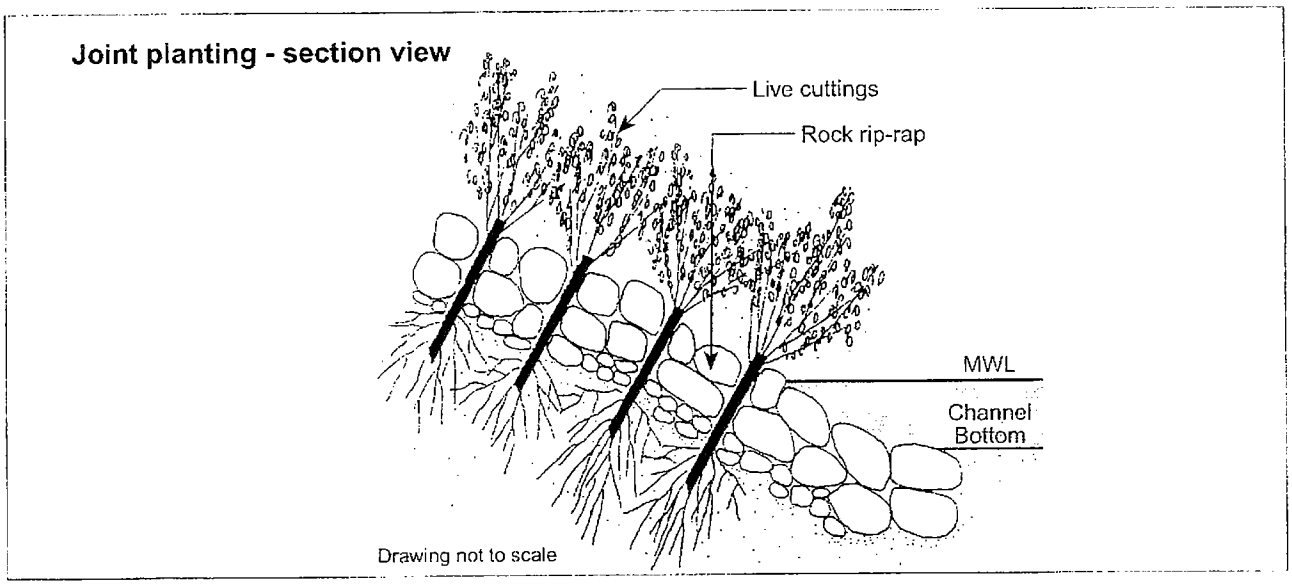


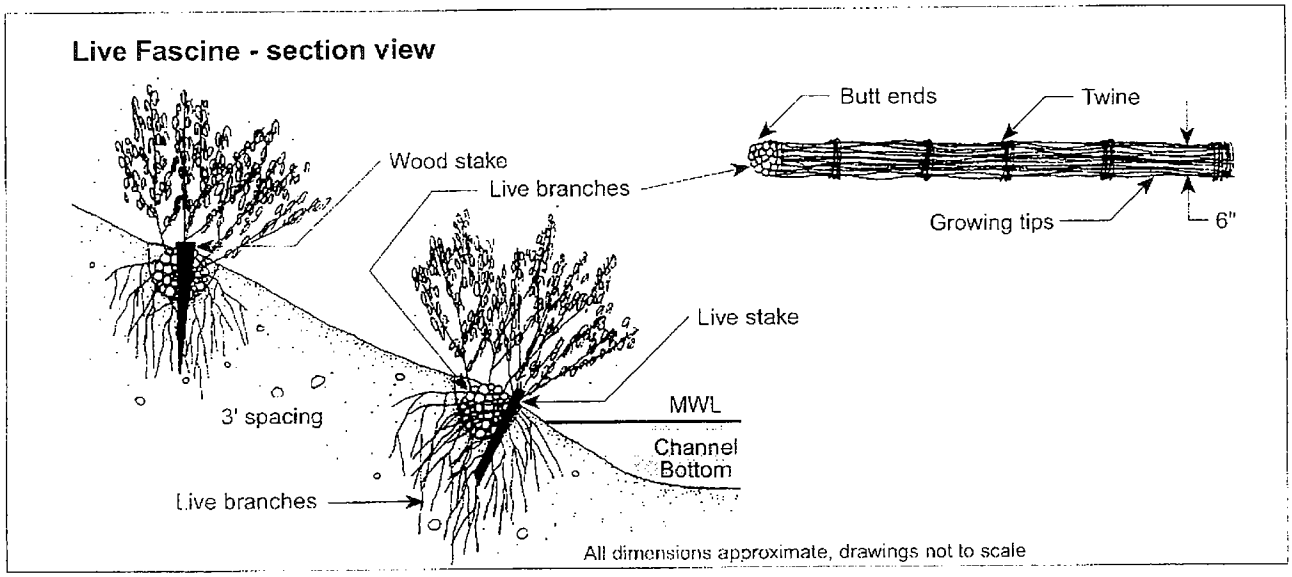
Bioengineering





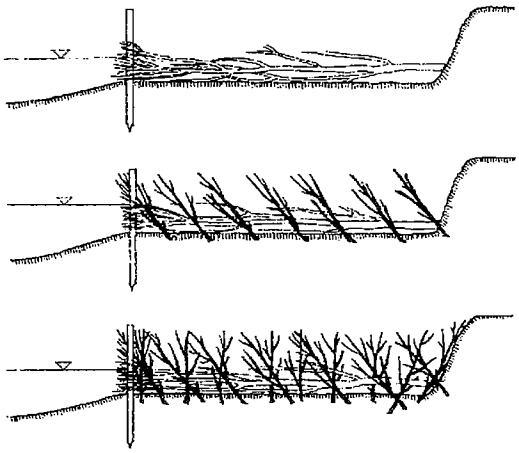
Bioengineering



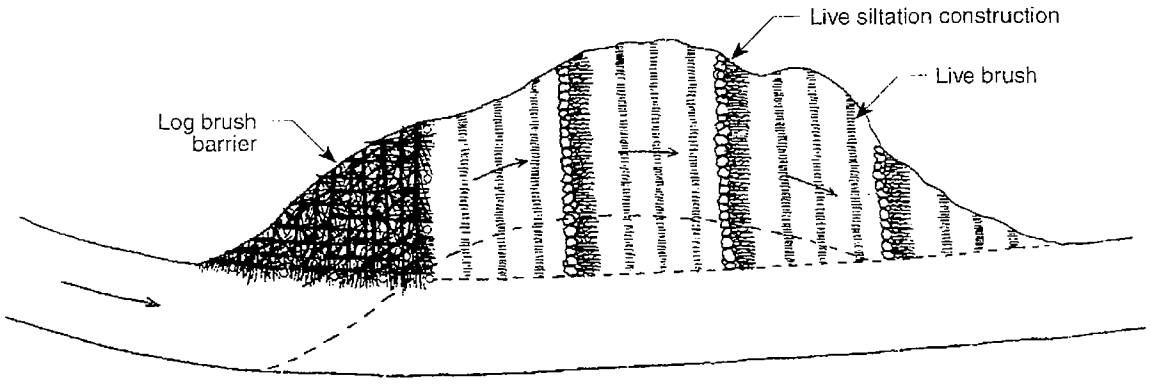


Bioengineering

Log brush barrier- section view



Brush log barrier - plan view



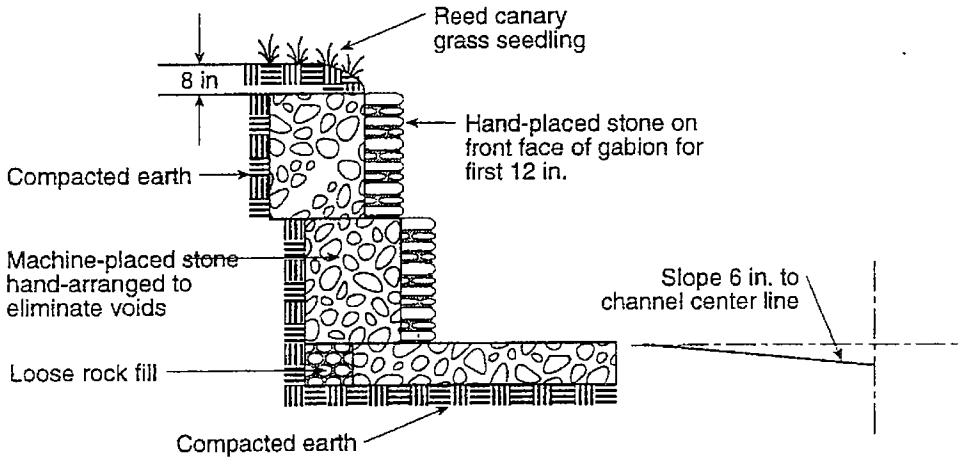
GROUP:	*BANK PROTECTION/IN-STREAM STRUCTURE PROTECTION*
ALTERNATIVE:	**GABIONS**
PURPOSE:	Provide protection of banks, bridges, or other in-stream structures.
DESCRIPTION:	Gabions are wire mesh boxes constructed on site and filled with relatively small stones (i.e., less than 8 inches in diameter). Gabions provide an additional measure of structural support over riprap using similar diameter stone. They act as large heavy porous masses to protect banks and structures, and have a measure of flexibility. A filter fabric or filter cloth may be used to prevent leaching of base materials or undermining of the baskets. *(Gabions should not be used where bedload transport or velocities are excessive and may cause premature collapse of the structure.)*
SKETCH:	*See Next Page*
IMPACTS:	Fish resources
IMPLEMENTATION:	
Design Requirements:	Site survey, design drawings
Materials:	Gabion cage, rock (slightly larger than wire mesh, maximum available density, able to withstand abrasion, and resistant to weathering)
Equipment Needs:	Excavator, front end loader, haul trucks
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Monitor for structural integrity, place additional gabions or replace existing gabions as necessary.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

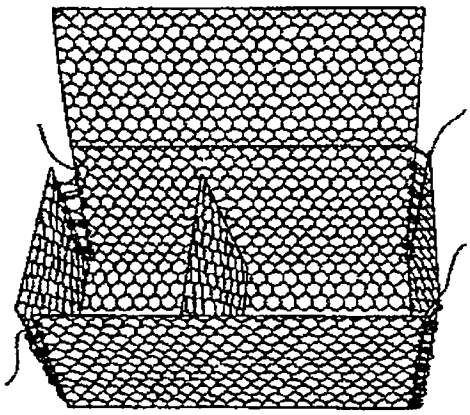
References: U.S. Army Corps of Engineers, 1981; Petersen, 1986

Gabions

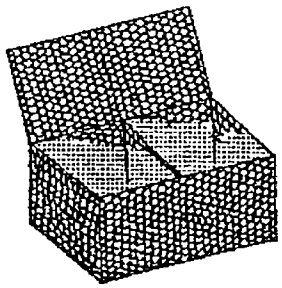
Gabion revetment, typical section



Typical gabion basket assembly



Assembly of basket



Assembled basket

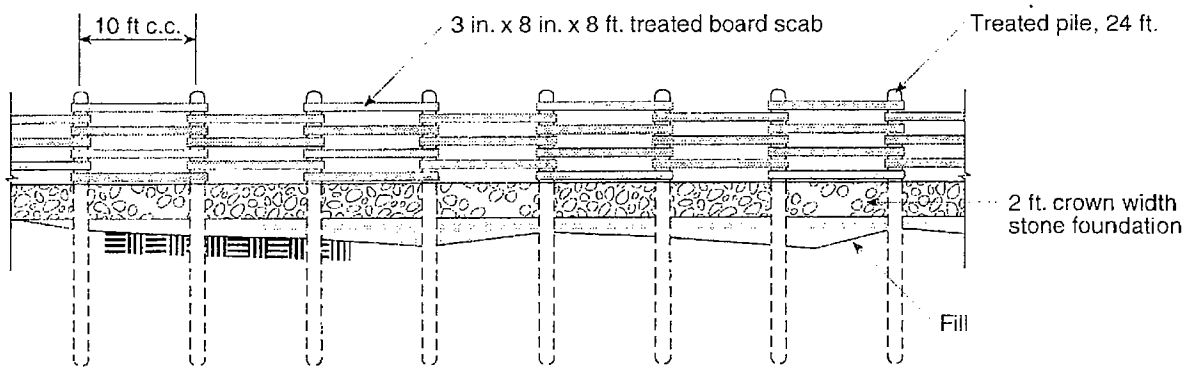
GROUP:	*BANK PROTECTION/IN-STREAM STRUCTURE PROTECTION*
ALTERNATIVE:	**FENCING**
PURPOSE:	Protect stream banks from erosion due to high velocity waters.
DESCRIPTION:	Fencing constructed of various types of new or used materials is used to reduce local velocities, trap debris, and facilitate sediment deposition and the establishment of native vegetation. Fencing can be constructed as revetment parallel to the bank, or as dikes at an angle to the flow.
SKETCH:	*See Next Page*
IMPACTS:	Fish resources; scenic, aesthetic, and historic resources
IMPLEMENTATION:	
Design Requirements:	Site survey, design drawings
Materials:	Posts: treated or untreated wood, used rails, pipe, steel beams, concrete; Fencing material: wood, wire; fill soil; rock
Equipment Needs:	Excavator with pile driver attachment, haul trucks
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Monitor for structural integrity, replace posts or boards as necessary.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

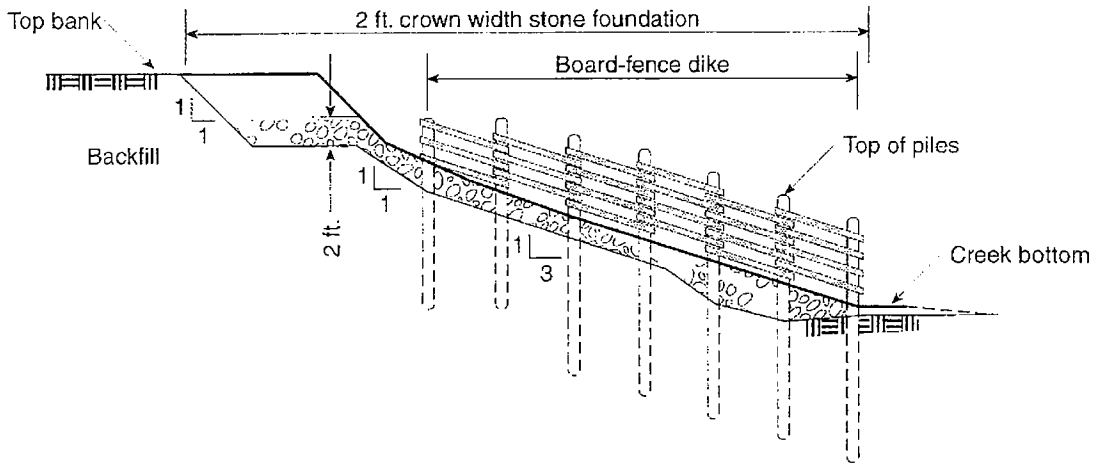
References: U.S. Army Corps of Engineers, 1981; Petersen, 1986

Fencing

Typical longitudinal board fence



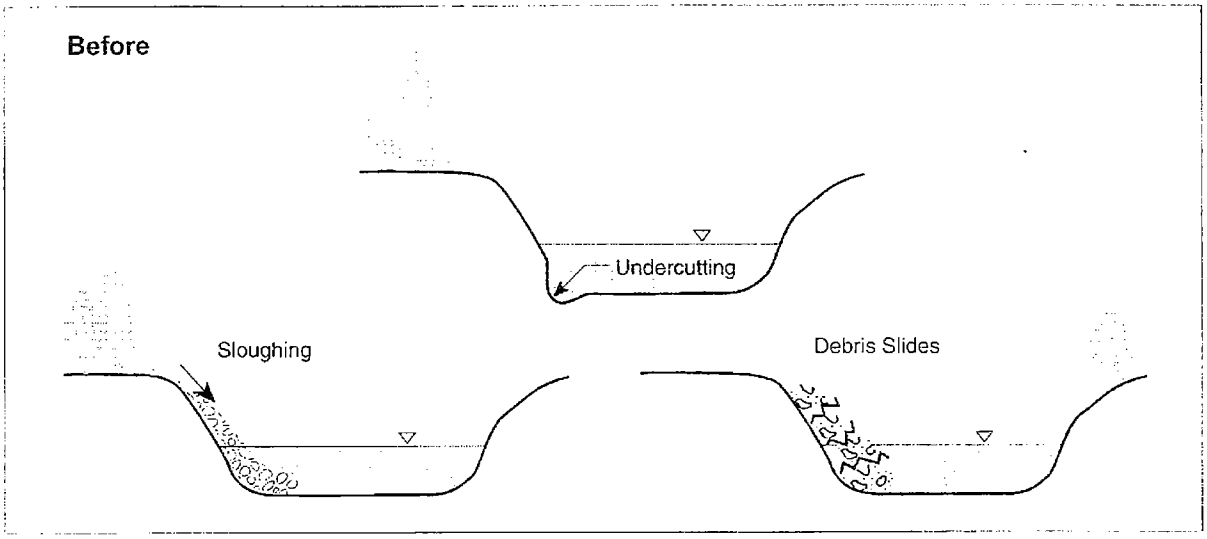
Typical transverse board fence

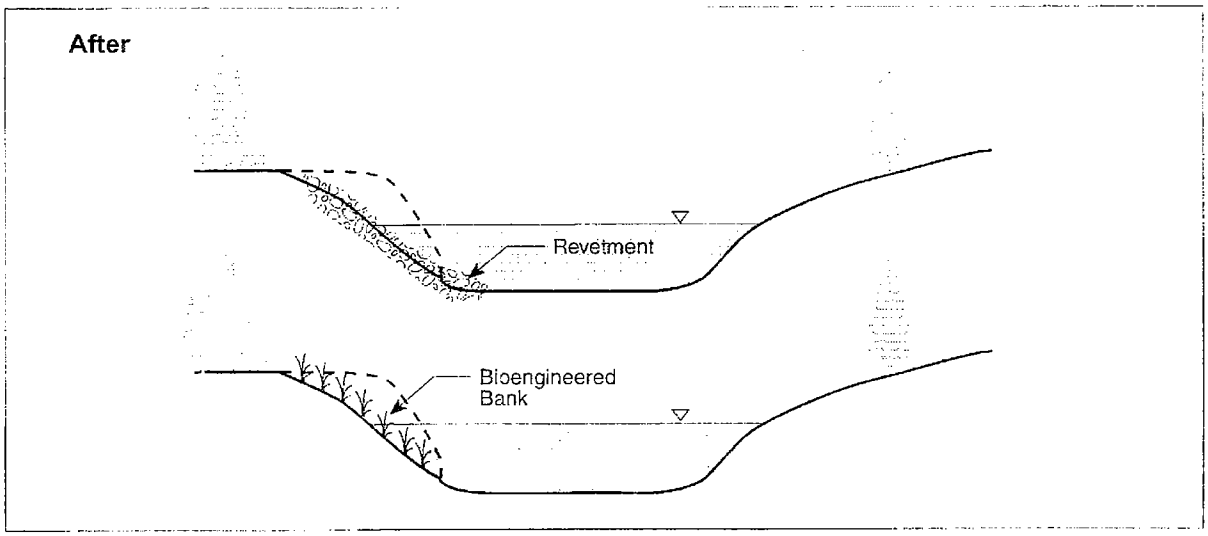


GROUP:	*BANK PROTECTION/IN-STREAM STRUCTURE PROTECTION*
ALTERNATIVE:	**BANK SLOPE REDUCTION**
PURPOSE:	Protect bank along river reaches with steep slopes that may be subject to failure due to undercutting, debris slides or sloughing.
DESCRIPTION:	Bank slopes are reduced by cutting the highest portion of the bank back away from the channel, then stabilizing the bank using bioengineering techniques, riprap, or other methods.
SKETCH:	*See Next Page*
IMPACTS:	None
IMPLEMENTATION:	
Design Requirements:	Site survey, design drawings
Materials:	Materials required contingent on structural alternative(s) used with bank slope reduction
Equipment Needs:	Excavator, haul trucks, grader
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Monitor stability of new slope after construction. Maintain as appropriate, depending on alternative(s) used.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

Bank Slope Reduction



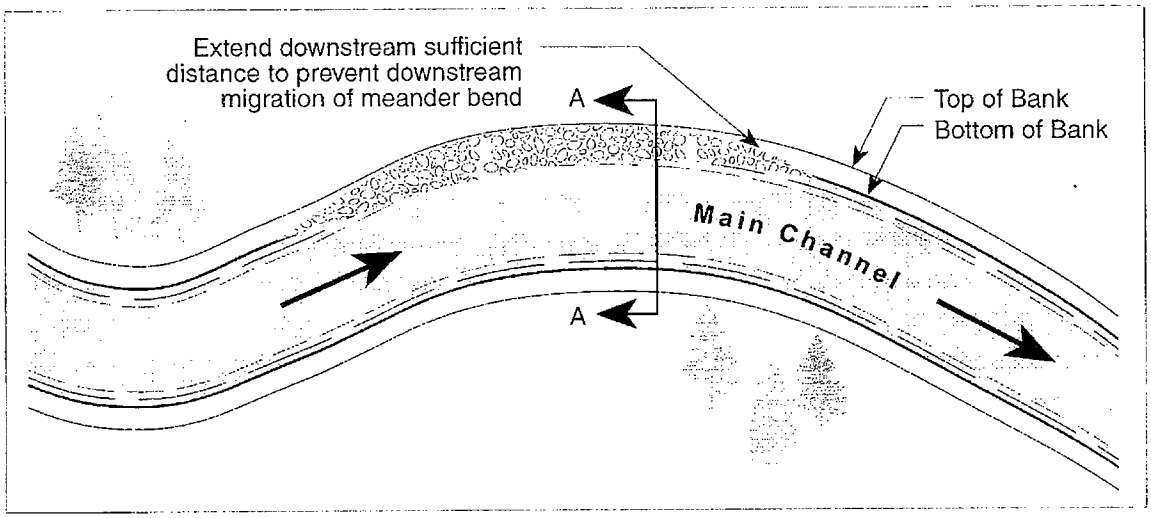


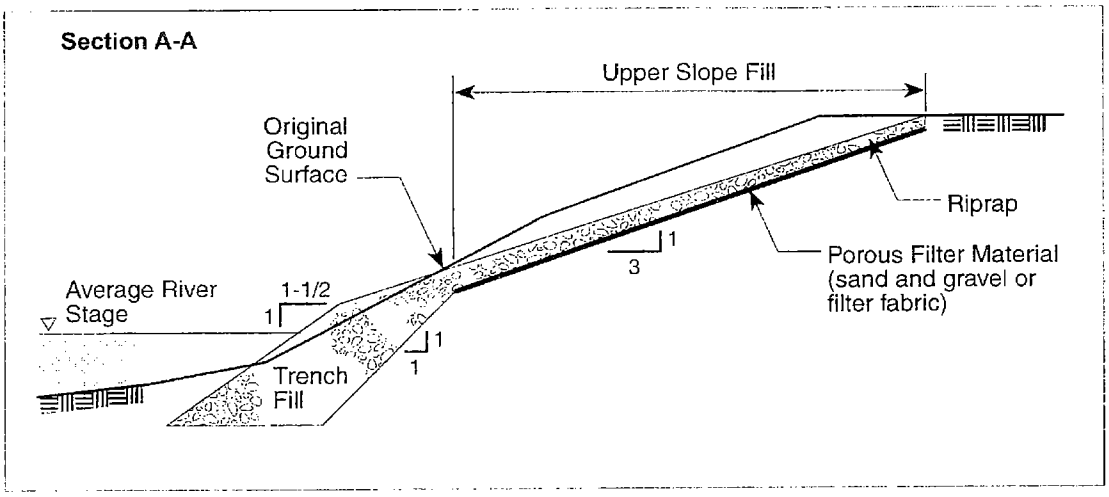
GROUP:	*BANK PROTECTION/IN-STREAM STRUCTURE PROTECTION*
ALTERNATIVE:	**STANDARD TRENCH FILL/RIPRAP REVETMENT**
PURPOSE:	Provide bank protection along stream reaches where bank erosion mitigation or prevention is necessary.
DESCRIPTION:	The stream bank is "paved" with riprap and a large mass of stone is placed into a trench on the riverward edge of the revetment. As the bank erodes and the toe of the bank is scoured, the riprap in the trench falls and paves the newly eroded lower slope, while the upper slopes remain stable.
SKETCH:	*See Next Page*
IMPACTS:	Fish resources; scenic, aesthetic, and historic resources; navigation; wildlife resources; hydrology
IMPLEMENTATION:	
Design Requirements:	Analysis of shape, size, and weight of stone required to meet stability requirements, analysis of thickness, length, and location requirements, estimates of low and high flow stages, site survey, design drawings
Materials:	Rock, gravel or porous filter material (placed directly over graded bank to allow seepage), filter fabric
Equipment Needs:	Bulldozer to grade slope as necessary, haul trucks, excavator, front end loader
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Monitor stability of riprapped slope and replace rock as necessary, monitor downstream effects.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

References: U.S. Army Corps of Engineers, 1981; Petersen, 1986

Standard Trench Fill/Riprap Revetment





STREAMBED CONTROL

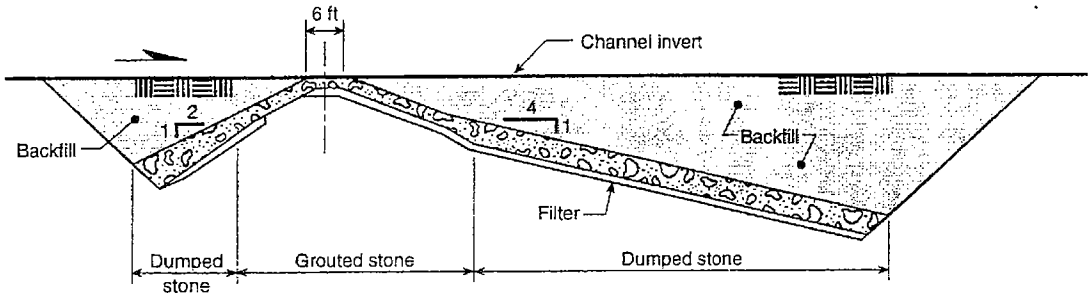
- Stabilizers
- Drop Structures

GROUP:	*STREAMBED CONTROL*
ALTERNATIVE:	***STABILIZERS***
PURPOSE:	Limit channel scour and degradation
DESCRIPTION:	Stabilizers are essentially buried weirs, which extend laterally across the channel. The channel invert upstream and downstream of the structure is about the same and coincides with the crest of the weir. Stabilizers limit channel scour and degradation and are applicable primarily in higher energy systems in which channel scour and degradation are excessive
SKETCH:	*See Next Page*
IMPACTS:	None
IMPLEMENTATION:	
Design Requirements:	Analysis of historical channel bed-slope changes, hydraulic analysis of proposed structure, site survey, design drawings, geotechnical work to determine streambed foundation parameters
Materials:	Stabilizer may be constructed of grouted or ungrouted rock, sheet piling, concrete sills, and gabions, or a combination of materials; also requires fill material appropriate for use in channel bed
Equipment Needs:	Haul trucks, excavator, concrete pump, concrete trucks, forms
Typical Permits:	Shoreline Substantial Development Permit, Water Quality Modification/Certification, SEPA Review and Environmental Checklist, HPA, COE 401 & 404/10
MONITORING/ MAINTENANCE:	Check condition of structure annually and after major flood events. Inspect channel bed upstream and downstream for excessive scour or other detrimental changes in channel characteristics.

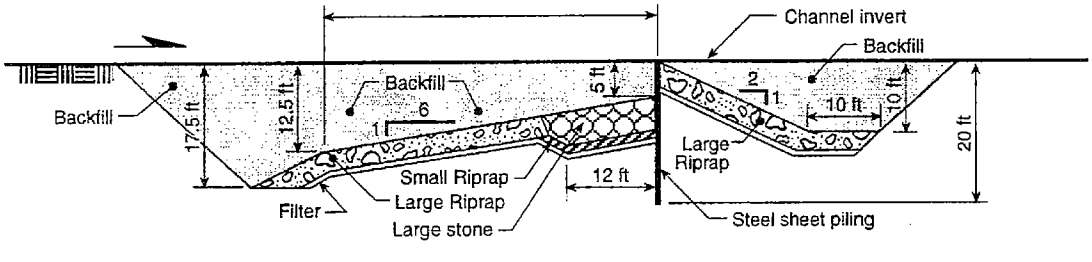
Reference: Petersen, 1986

Stabilizers

Grouted Stone Stabilizer



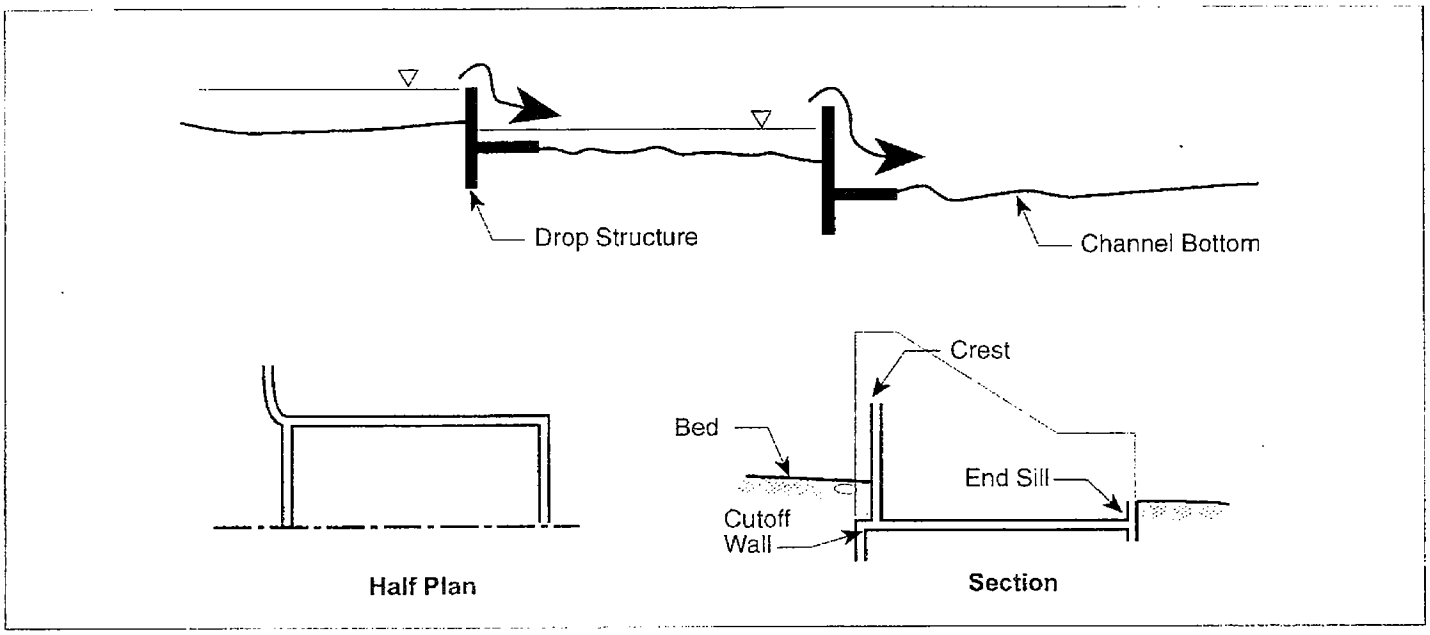
Sheet Piling Stabilizer



GROUP:	*STREAMBED CONTROL*
ALTERNATIVE:	**DROP STRUCTURES**
PURPOSE:	Limit and stabilize channel bed slope by means of a vertical drop to dissipate energy. Protect bridges or other river crossings from damage by headcutting.
DESCRIPTION:	Drop structures range in design from rectangular included chutes to weirs with downstream aprons and end sills. Water flowing over these structures loses energy at the downstream end in the turbulence that results from the elevation change. Drop structures are applicable primarily in higher energy systems in which channel scour and degradation is excessive
SKETCH:	*See Next Page*
IMPACTS:	Fish resources; scenic, aesthetic, and historic resources; navigation; hydrology
IMPLEMENTATION:	
Design Requirements:	Analysis of historical channel bed-slope changes, hydraulic analysis of proposed structure, site survey, design drawings, geotechnical work to determine streambed foundation parameters
Materials:	Drop structure typically constructed of concrete or gabions, rock required on channel side slopes and streambed below the structure to prevent erosion
Equipment Needs:	Haul trucks, excavator, concrete pump, concrete trucks, forms
Typical Permits:	Shoreline Substantial Development Permit, Water Quality Modification/Certification, SEPA Review and Environmental Checklist, HPA, COE 401 & 404/10
MONITORING/ MAINTENANCE:	Check condition of structure annually and after major flood events. Inspect channel bed upstream and downstream for excessive scour or other detrimental changes in channel characteristics. Install downstream apron and end sill if not included in original construction and erosion of bed downstream of structure becomes excessive.

Reference: Peterson, 1986

Drop Structures



ALIGNMENT CONTROL

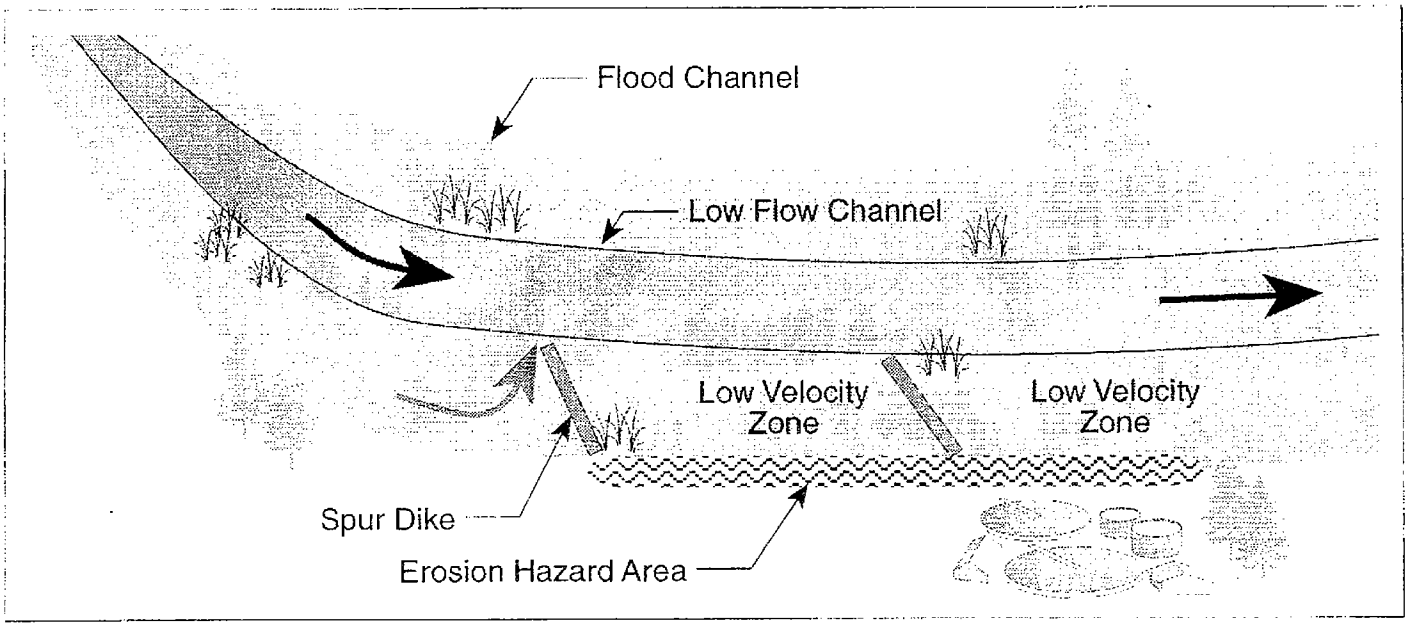
- Spur Dikes
- Vane Dikes

GROUP:	*ALIGNMENT CONTROL*
ALTERNATIVE:	**SPUR DIKES**
PURPOSE:	Deflect flow away from bank towards the center of the river.
DESCRIPTION:	A structure is installed at an angle with the bank (determined through engineering analysis) to deflect flow towards the center of the river. The structure may consist of a low rock berm, fencing, or a row of pilings. The length of the dike is determined by its location (in a crossing, bend, cutoff channel, etc.), amount of channel constriction desired, and spacing of dikes in a system.
SKETCH:	*See Next Page*
IMPACTS:	Fish resources; scenic, aesthetic, and historic resources; navigation; water quality; recreation
IMPLEMENTATION:	
Design Requirements:	Analysis of change in effective channel cross-section, estimate of design flood stage, site survey, design drawings
Materials:	Rock, timber piles, fencing materials
Equipment Needs:	Drag line with clam bucket, haul trucks
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Replace materials as needed. Observe performance and stability of structure, particularly during high flows.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

References: U.S. Army Corps of Engineers, 1981; Petersen, 1986

Spur Dikes


Flood Channel
Low Flow Channel
Low Velocity Zone
Low Velocity Zone
Spur Dike
Erosion Hazard Area

GROUP:	*ALIGNMENT CONTROL*
ALTERNATIVE:	**VANE DIKES**
PURPOSE:	Stabilize and improve the alignment of meandering rivers, with a concurrent deepening of the channel in these locations.
DESCRIPTION:	Low longitudinal stone fill structures are placed in the stream in orientations nearly parallel to the flow in order to constrict and deepen the channel and direct the flow without increasing the roughness. Flow will occur over and between the vanes at higher discharges and the longitudinal orientation will result in minimal increases in roughness.
SKETCH:	*See Next Page*
IMPACTS:	Fish resources; navigation; recreation; hydrology
IMPLEMENTATION:	
Design Requirements:	Observation or dye testing of flowpaths so that data on velocity vectors can be used in determining appropriate placement of structures, site survey, design drawings.
Materials:	Rock
Equipment Needs:	Excavator or clam bucket, haul trucks
Typical Permits:	Shoreline Substantial Development Permit if cost exceeds $2,500, Temporary Modification of Water Quality Criteria, Environmental Checklist, HPA, COE Individual Permit, Floodplain Certification
MONITORING/ MAINTENANCE:	Replace materials as needed, observe performance and stability of structure, particularly during high flows.

NOTE: *Implementation of this alternative may have significant impacts on fish life and habitat. Therefore, this alternative should be implemented with extreme caution and only to the extent necessary, in conjunction with site-specific mitigation measures to achieve the overall improvement of a reach of river.*

Reference: Petersen, 1986

Vane Dikes