3.8 FISH, AQUATIC HABITAT, AND THREATENED AND ENDANGERED FISH SPECIES

This section describes existing fish population and habitat conditions within the study area and assesses potential impacts of the I-405 Corridor Program. All study area streams, regardless of fish presence, were included in the analysis based on the best available data sources (King County, 1999).

3.8.1 Studies and Coordination

3.8.1.1 Baseline Conditions

The baseline conditions were assessed by basin to adequately identify the widely varying watershed conditions, general habitat conditions, and fish populations throughout the study area. Basins were defined according to King County (1999) delineations. Baseline fish habitat conditions are described in this EIS based on numerous published and unpublished references. Sources include the computer databases and Geographic Information System (GIS) of King County, recent assessment reports for Water Resource Inventory Area (WRIA) 8 (Cedar River/Lake Washington) and WRIA 9 (Green/Duwamish River), the Washington Department of Fish and Wildlife (WDFW), and a number of basin plans and assessments produced by various cities and counties within the study area.

Existing fish species distribution and habitat conditions were described using the most recent and comprehensive available sources. These sources are cited in the *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report* (DEA, 2001a).

It is important to note that baseline conditions as defined for this program do not equate to existing conditions. The No Action Alternative projects are included in all the action alternatives and will be implemented with or without the I-405 Corridor Program; therefore baseline conditions are identified prior to implementation of the No Action Alternative projects. However, mitigation for the No Action Alternative impacts may not be implemented by WSDOT as part of the I-405 Corridor Program.

3.8.1.2 Federal Regulations

Section 404 of the Clean Water Act requires that permits be obtained for discharges to waters of the United States. Proponents of individual improvement projects involving such activities coordinate with the U.S. Army Corps of Engineers as necessary.

Puget Sound chinook salmon and bull trout are listed as "threatened" under the federal Endangered Species Act (ESA). The Puget Sound/Strait of Georgia coho salmon is currently a "candidate" species for federal listing.

The National Marine Fisheries Service (NMFS), in conjunction with state and local jurisdictions as documented in the Federal Register (50 CFR Part 223) issued on July 10, 2000, identified 13 programs and criteria for future programs for which it is not necessary and advisable to impose ESA Section 9(a)(1) prohibitions because they contribute to conserving the Evolutionarily Significant Unit (ESU) upon which listed species rely. These programs and criteria for future programs are commonly referred to as Section 4(d) rules. NMFS can provide ESA coverage through Section 4(d) rules, Section 10 research and enhancement permits, incidental take permits, or through Section 7 consultations with federal agencies. FHWA and WSDOT will

work with NMFS and USFWS to identify actions that could result in the take of listed species. FHWA and WSDOT will be initiating programmatic Section 7 consultation under the ESA with NMFS and USFWS on the I-405 Corridor Program Preferred Alternative. FHWA and WSDOT will be working with NMFS and USFWS to define the best method for ESA Section 7 consultation on a programmatic level. Potential impacts to listed species will be fully addressed during the consultation process with both federal agencies.

The 1996 Sustainable Fisheries Act amended federal fisheries management regulations to require identification and conservation of habitat that is "essential" to federally managed fish species. Essential habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Pacific Fishery Management Council (PFMC) is the body responsible to review relevant habitat issues in the Pacific Northwest, including the study area. The PFMC has designated Essential Fish Habitat (EFH) for the Pacific salmon fishery, federally managed groundfish, and coastal pelagic fisheries (NMFS, 1999b; PFMC, 1999). Only EFH associated with the Pacific salmon fishery is present in the study area. Federal agencies must consult with NMFS on all activities or proposed activities authorized, funded, or undertaken by the agency that may adversely affect EFH.

The Pacific salmon management unit includes chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), and pink salmon (*Oncorhynchus gorbuscha*). The EFH designation for the Pacific salmon fishery includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to these species in Washington, Oregon, Idaho, and California, except above the impassible barriers identified by PFMC (1999). Pacific salmon EFH also extends into the estuarine and marine areas.

3.8.1.3 State and Local Regulations

The Washington State Hydraulic Code requires review and approval by the WDFW of any project activity within or over streams, including discharge of stormwater. King County and Snohomish County, as well as the municipalities in the study area, have ordinances regulating development within critical areas. The I-405 Corridor Program will comply with the specific standards set by these ordinances, as necessary. Compliance may include production of site-specific baseline studies and detailed impact assessment, establishment of specified buffers, and implementation of mitigation measures. Some local regulations, such as Snohomish County Habitat Management Plan Administrative Rule for Puget Sound chinook salmon, would serve to comply with the ESA Section 4(d) rules and potentially obtain a limitation on the prohibition against taking a protected species.

3.8.1.4 Indian Tribal Treaty Fishing Rights

The "Boldt Decision" of 1974 interpreted treaties between the United States and Indian Tribes in Washington State. The court determined that Indian Tribes have rights to 50 percent of harvestable salmon and have the right to co-manage salmon fisheries within Washington State. The study area falls entirely within the "usual and accustomed" fishing area of three federally recognized Indian Tribes: the Muckleshoot, Snoqualmie, and Yakama Nation; and two state recognized Indian Tribes: the Kikiallus and Duwamish. In 1854 and 1855 many Indian Tribes in the Pacific Northwest entered into treaties with the United States wherein they reserved the right to fish, hunt, and gather in areas off their reservations. These reserved treaty rights are the "supreme law of the land" and where in conflict with state law are preemptive. Judicial

decisions have affirmed that treaty Indian Tribes have a right to harvest fish free of state interference, subject to conservation principles; to co-manage the fishery resource with the state; and to harvest up to 50 percent of the harvestable fish. See United States v. Washington, 384 F. Supp. 312 (WD Wn. 1974), aff'd 520 F, 2d 676 (9th Cir. 1975); Washington v. Washington State Commercial Passenger Fishing Vessel Ass'n, 443 U.S. 658 (1979).

The study area falls within the recognized and court-affirmed treaty fishing areas of the federally recognized Muckleshoot Tribe and Yakama Nation, subject to the limitations on the exercise of those rights as set out in the court decisions. In addition, the federally recognized Snoqualmie Tribe has ancestral ties to the study area, but has no affirmed off-reservation rights. No other federally recognized Indian group has an interest in the study area, and no other federally recognized Indian group has any affirmed fishing rights or other affirmed treaty interest in the study area. The Muckleshoot Indian Tribe has a staff of fisheries biologists, operates two salmon hatcheries, one of which is on a Green River tributary, and has taken an active role in managing salmon in the study area.

Since the study area is within recognized and affirmed treaty fishing areas, and could potentially impact access to these areas, coordination with the Muckleshoot Tribe has been initiated and will continue to resolve potential conflicts prior to construction. WSDOT will implement measures that will reduce the likelihood of conflict including coordination with the Muckleshoot Tribe to document important access points in areas where project-specific actions will occur. Adherence to designated fish windows as outlined by the appropriate agencies (WDFW, NMFS, and USFWS) will eliminate in-water interference during periods when returning adult salmonids are present. Avoiding placing structures within streams and rivers will further reduce the likelihood of interference during periods of harvest. Compliance with Presidential Executive Order 12898 and Federal Highway Administration Order 6640.23 is discussed in Appendix G, I-405 Corridor Program EIS Environmental Justice Analysis.

3.8.2 Methodology

Impact assessment for fish and aquatic habitat was based on comparing among alternatives the number of stream encroachments, number of specific locations where construction is proposed within 300 feet of streams, and the amount of new impervious surface. For program-wide comparison of alternatives, impact assessment included consideration of varying fish populations and habitat conditions among the various basins. All study area streams, regardless of fish presence, were included in the analysis based on the best available data sources (King County, 1999; WDFW, 2000a). A description of impacts by basin is included in the *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report* (DEA, 2001a) herein incorporated by reference. In February of 2002 all alternatives were reassessed using ArcInfo GIS. The re-analysis resulted in approximately the same number of potential stream crossings; however, potential encroachments increased because of additional refinements of the data. The overall analysis and relative impact of the alternatives remains unchanged from the DEIS and does not change the results or decision-making processes based on the DEIS.

Federal ESA listings were obtained from the NMFS web site.

3.8.3 Affected Environment

The I-405 Corridor Program study area lies entirely within two major watersheds. Most of the area lies within the Cedar River/Lake Washington watershed (including Lake Sammamish and

the Sammamish River), and a relatively small portion in the southwest corner of the area lies within the Green River watershed (Figure 3.8-1).

The Cedar River/Lake Washington watershed (WRIA8) includes all streams discharging through Lake Washington and the Lake Washington Ship Canal (including Union Bay, Portage Bay, and Lake Union) to Puget Sound (Figure 3.8-1). This is one of the major watersheds of western Washington and encompasses nearly 200 square miles (King County, 1993). This basin includes hundreds of streams, and encompasses much of the greater Seattle urban area. The proposed transportation improvements lie primarily within heavily developed portions of the basin east of Seattle. Cedar and Sammamish are the major rivers in this basin. The Cedar River/Lake Washington watershed includes all study area basins except Soos Creek, Black River, and Lower Green River.

Cedar River flows are controlled by three dams located upstream of the study area. The overflow dike at river mile (RM) 37.2 impounds Chester Morse Lake. The Masonry Dam at RM 35.6 generates hydropower, and the Landsburg Diversion Dam at RM 21.6 diverts flow from the Cedar River to supply about 70 percent of greater Seattle's water supply (King County, 1993). The City of Seattle manages most of the upper two-thirds of the watershed lying upstream of these dams to maintain high-quality water runoff.

The Green/Duwamish River watershed (WRIA 9) drains the southern part of the study area. Approximately river miles 11 through 21 of the Green River flow through this portion of the study area (Figure 3.8-1). Basins within this watershed in the study area have been defined as Lower Green River, Black River, and Soos Creek (King County, 1999). These basins include heavily developed areas, including primarily industrial areas in the cities of Kent and Renton.

Green River flows have been altered by the diversion of the White River in 1906, diversion of the Cedar/Black River in 1913, construction of Tacoma Water's Headworks Diversion in 1911, and construction of the Howard A. Hanson Dam in 1962 (Kerwin and Nelson, 2000). The Howard A. Hanson Dam, located at RM 64.5, blocks upstream fish migration. Its control of flooding in the lower Green River valley has allowed rapid, intensive industrial development that has adversely affected salmonid habitat and water quality (Grette and Salo, 1986).

3.8.3.1 Fish Species Present

The Puget Sound chinook salmon is listed as "threatened" under the Endangered Species Act and is a "candidate" for the State of Washington listing. The Puget Sound stocks of chinook salmon occur throughout much of the study area, in the Cedar, Green, and Sammamish rivers, as well as larger tributary streams including Swamp Creek, North Creek, Bear Creek, Little Bear Creek, Evans Creek, Mercer Slough, Coal Creek, May Creek, Kelsey Creek, Juanita Creek, and Soos Creek (King County, 2000a; King County, 2001a; WDFW, 2000a).

The Puget Sound/Strait of Georgia coho salmon is currently a "candidate" species for federal listing. WDFW's GIS database shows coho salmon present in the major streams of all study area basins except Mercer Island. Other sources, including the WRIA 9 habitat reconnaissance and local agency publications, show coho salmon inhabiting many smaller streams in each basin.

Bull trout are federally listed as "threatened" and are a "candidate" for State of Washington listing. They are known to occur in both of the major watersheds in the study area, but spawning has been documented only in locations far upstream of the study area (WDFW, 1998). Known self-sustaining populations within the Lake Washington Basin are limited to the Cedar River

Legend: Stream Basins and Fish Migration Barriers

- Fish Migration Barriers
- Streams
- Drainage Basins
- East Lake Washington — Drainage Basin Labels
- Study Area Boundary
- County Boundaries
- Highways
- Roadways
- Railways

N

1 0 1 2 3 Miles

Data source for fish migration barriers: Washington Department of Fish and Wildlife, Priority Habitats and Species Database, July 1998

SNOHOMISH

KING

Mill Creek
Lynnwood
Edmonds
Woodway
Mountlake Terrace
Brier
Bothell
Kenmore
Shoreline
Lake Forest Park
Woodinville
Duvall
Kirkland
Redmond
Lake Washington
Lake Washington Ship Canal
Portage Bay
Union Bay
Lake Union
Hunts Point
Clyde Hill
Medina
Seattle
Bellevue
Lake Sammamish
Sammamish
Beaux Arts
Mercer Island
Duwamish River
Newcastle
Issaquah
Tukwila
Renton
Burien
Normandy Park
SeaTac
Des Moines
Kent
Maple Valley
Covington
Auburn
Federal Way

North Lake Washington
North Creek
Swamp Creek
Little Bear Creek
Bear Creek
East Lake Washington
Juanita Creek
Sammamish River
Forbes Creek
Evans Creek
Kelsey Creek
Mercer Slough
West Lake Sammamish
Mercer Island
Coal Creek
May Creek
Black River/Springbrook Creek
Lower Green River
Lower Cedar River
Soos Creek

Simonds Rd NE
NE 128th St
NE 8th St
148th Ave SE
Coal Creek Pky SE
SE 128th St
SE Petrovitsky Rd
68th Ave
132nd Ave SE
Redmond Fall City Rd

5 405 90 99 520 522 524 527 202 203 169 167 515 509 900 18 516

Stream Boundaries and Fish Migration Barriers

Figure No. 3.8-1

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drainage upstream of Lower Cedar Falls at RM 34.2, and within the Chester Morse Reservoir and Rex River (WDFW, 1998; King County Department of Natural Resources [KCDNR], 2000). Other known populations outside of WRIA 8 have been documented in the Snohomish and Skykomish river system, and the White River drainage (KCDNR, 2000).

Confirmed individual occurrences of bull trout, a type of char, in the study area have been scarce and sporadic. One adult bull trout was captured in the Duwamish River estuary on May 24, 1994, while feeding on outmigrating juvenile chinook salmon (Warner and Fritz, 1995). One native char was captured by an angler in Lake Washington in 1981, and four more were captured in Lake Washington by the University of Washington during a multi-year sampling effort between 1984 and 1985 (Beauchamp, unpublished data as reported in KCDNR, 2000). Three native char have been observed in Lake Sammamish and an associated tributary, and at Shilshole Bay (KCDNR, 2000). Furthermore, a small number of native char have been captured in the lower Cedar River below the Landsburg Diversion Dam. Based on the scarce and sporadic pattern of documented occurrence of bull trout in the study area, it is uncertain if these char are native to the watershed or opportunistic marine residents. A review of the existing data indicates migrating bull trout may occasionally be present within the study area in the Green and Duwamish rivers, in the Cedar River, and in Lake Washington.

Study-area salmonids include several species not currently addressed by the ESA, including pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), sockeye salmon (*O. nerka*), kokanee, steelhead trout (*O. mykiss*), coastal cutthroat trout (*O. clarki*), and mountain whitefish (*Prosopium Williamsii*).

Although the Green River stock of pink salmon has been characterized as extinct, a few pink salmon have been observed and captured in the Green River (King County, 2000a). The Green River supports a remnant natural run of chum salmon that is supplemented by the Muckleshoot Tribe's hatchery operations. Spawning habitat occurs upstream of the study area, and emerging juvenile chum salmon migrate out almost immediately to rear in salt water estuaries (Grette and Salo, 1986). Therefore, chum salmon would use the Green River in the study area primarily for spawner migration and juvenile out-migration. However, rearing could also occur in the study area depending on flow conditions and the upstream extent of marine influence (salt wedge). A few chum salmon have been observed in Lake Sammamish tributaries; however, these are assumed to be strays from other stocks since no run is documented in the Cedar/Lake Washington Basin.

Sockeye, a salmon species adapted to complete part of their life cycle in freshwater lakes, occupy lakes Washington and Sammamish in the project area. These sockeye are believed to have originated from non-native stock introduced from Baker Lake in northwestern Washington (WDFW and Western Washington Treaty Tribes [WWTT], 1994). Several publications from the turn of the century suggest that sockeye salmon were in Lake Washington prior to the introduction of the Baker Lake stocks. It is uncertain if these were resident kokanee or sockeye salmon. Although the exact identity of these early stocks is uncertain, a thorough review of the history of sockeye salmon in Lake Washington concluded that "limited runs of sockeye salmon were probably present at the turn of the 19th century" (Hendry 1995 as reported by Kerwin, 2001). Within the study area, they occur in the Cedar River, Sammamish River, and North, Swamp, Little Bear, Bear, Coal and May creeks. Spawning occurs throughout the basin, including most accessible stream reaches and along the lake margin where upwelling occurs

(Kerwin, 2001). The lower reaches of the Cedar River are used extensively by sockeye salmon and several other species (e.g., longfin smelt) for spawning.

Kokanee are sockeye salmon that spend their entire lifecycle in freshwater lakes without migrating to salt water. They spawn in numerous Lake Washington and Lake Sammamish tributaries within the study area including Juanita, Bear, Little Bear, North, Lewis, Kelsey, Laughing Jacobs, Issaquah, and Swamp creeks, and Cottage Lake (Kerwin, 2001). Kokanee within the Lake Washington Basin are segmented by run timing into an early-run and late-run. The escapement level of the early-run kokanee began decreasing dramatically during the early 1980s and as a result was petitioned in 1999 for listing as "Endangered" under the ESA (Kerwin, 2001). The USFWS has yet to officially list the Lake Washington early-run kokanee stock under the ESA.

Coastal cutthroat trout are present in all study area basins. Sea-run cutthroat may be present in many of the accessible streams, and have even been documented in the urbanized East Lake Washington tributaries (Watershed Company, 1998). Resident cutthroat trout are widespread in small streams throughout the study area, including areas above migration barriers for salmon (May, 1996).

Winter runs of steelhead trout are present in both the Green/Duwamish and Cedar/Lake Washington portions of the study area, and both include native wild fish (Grette and Salo, 1986; King County, 1993; WDFW and WWTT, 1994). A non-native summer steelhead run is also present in the Green/Duwamish Basin (WDFW and WWTT, 1994).

Mountain whitefish have been reported in the Cedar River. Atlantic salmon (*Salmon salar*) have been found recently in the Green River, and are assumed to be escaped from net pen fish farming operations in Puget Sound (King County, 2000a).

Non-salmonid native fishes distributed widely throughout large and small streams in the study area include the various species of sculpins (*Cottus spp*.), dace (*Rhinichthys spp*.), stickleback (*Gasterostus aculeatus*), and lampreys (*Lampetra spp*.). The river lamprey (*Lampetra ayresi*) is a "candidate" for State of Washington listing. Species that reside mainly in lakes Washington and Sammamish but may venture into streams include suckers (*Catostomus spp*.), smelt (*Spirinchus spp*.), and chubs (*Mylocheilus spp*.) (King County, 1993).

Numerous non-native exotic and invasive fishes, including various species of bullheads, bass, perch, and sunfish, are also present. Several of these introduced "warmwater" fish prey on juvenile native salmon smolts (Wydoski and Whitney, 1979). Smallmouth and largemouth bass in particular have been found to consume substantial numbers of outmigrating salmonid smolts in Lake Washington and the Ship Canal (Tabor and Footen, 2000).

3.8.3.2 Baseline Conditions of Basins

Table 3.8-1 shows the percentage of impervious area that exists in each basin in the study area. Note: the added impervious surface resulting from the No Action Alternative projects is incorporated into the baseline conditions reported here.

Table 3.8-1: Baseline Impervious Area by Basin

BASIN[a]	Basin Area within Study Area (acres)	Existing Conditions % Impervious[b]	Impervious Area within Study Area (acres)	Baseline (No Action Alternative)	
Cedar/Sammamish/ Lake Washington Watershed (WRIA 8):				New Impervious Acres	% Conv.[d]
Swamp Creek	6,733	41%	2,761	12	0.2%
Bear Creek	9,343	23%	2,149	0	0.0%
Cedar River[c]	13,809	[c]	---	12	---
Coal Creek	3,020	28%	846	1	0.0%
West Lake Sammamish	7,291	40%	2,916	5	0.1%
East Lake Washington	13,104	40%	5,242	13	0.1%
Evans Creek	1,560	22%	343	9	0.6%
Forbes Creek	2,322	43%	998	0	0.0%
Juanita Creek	4,208	45%	1,894	10	0.2%
Kelsey Creek	5,291	44%	2,328	0	0.0%
Little Bear Creek	3,022	28%	846	15	0.5%
Sammamish River	16,375	37%	6,059	19	0.1%
May Creek	5,858	22%	1,289	9	0.2%
Mercer Slough (S. Kelsey)	5,137	46%	2,363	12	0.2%
North Lake Washington	1,079	43%	464	0	0.0%
North Creek	8,357	38%	3,176	33	0.4%
Green/Duwamish Watershed (WRIA 9):					
Lower Green River/Duwamish[a]	3,837	47%	1,627	0	0.0%
Soos Creek	9,408	17%	1,599	8	0.1%
Black River (Springbrook)	14,293	44%	6,289	6	0.0%
Unassigned				9	
Total	**134,047**	**---**	**43,188**	**173**	**0.1%**

[a] A portion of this basin lies outside the study area.
[b] Unpublished data, King County DNR GIS Data.
[c] Study area impervious area not available for this basin.
[d] % conversion to new impervious surface (new impervious area divided by basin area within the study area).

For many of the sub-basins, the portion within the study area is heavily urbanized, as indicated by the high percentages of impervious surface. The Lower Green River Basin has the greatest percentage of impervious area, at 47 percent. Other highly degraded sub-basins include Mercer Slough, Juanita Creek, Kelsey Creek, Black River, Forbes Creek, Swamp Creek, and North Lake Washington, each with more than 40 percent impervious surface.

Several sub-basins, including Bear Creek, Evans Creek, and Soos Creek sub-basins, as well as the upper reaches of Coal Creek Basin, provide remnants of high quality salmonid habitat. Other sub-basins providing good habitat include Little Bear Creek, Swamp Creek, Juanita Creek, Forbes Creek, and Mercer Slough, each of which contains large or high quality riparian areas. Some of their habitat includes riparian wetlands. Section 3.6 of the EIS and the *I-405 Corridor Program Draft Wetlands Expertise Report* (DEA, 2001b) provide analyses of wetlands occurring

in the study area. The Lower Cedar River and Green River sub-basins, while significantly degraded, serve as important migration corridors to more functional habitat for salmon. Further discussion of habitat conditions in individual basins can be found in the *I-405 Corridor Program Draft Fish and Aquatic Habitat Expertise Report* (DEA, 2001a).

3.8.4 Impacts

Impacts to fish and their habitat were analyzed using two indicators: encroachments and new impervious area. In this analysis, potential direct construction impacts are indicated by number of riparian encroachments. Riparian encroachments are locations, including stream crossings, where clearing and grading within 300 feet of any stream would be needed. Encroachment on riparian systems is likely to reduce riparian functions such as water temperature moderation, presence of large woody debris, streambank stabilization, runoff filtration, cover, and contribution of organic matter that contribute to food sources. Impairment of riparian functions is likely to adversely affect fish habitat and population.

The area of new roadway impervious surface is a reliable indicator of potential direct operational impacts to fish and fish habitat because road runoff can contain pollutants, which may reach concentrations that are toxic to aquatic life when discharged into surface waters. In addition, increases in impervious surface alter hydrology in several ways that can adversely impact fish and aquatic habitat.

These hydraulic alterations include increased peak flows and rates of runoff, decreased base flows, increased erosion, decreased infiltration, and decreased evapotranspiration. Urbanization also increases the constructed drainage network and further accelerates the rate of stormwater runoff as it replaces natural drainage features with numerous pipes, man-made channels, etc. These developments typically increase the frequency and magnitude of high-flow and flooding events in streams. This increase in peak high flows has been shown to have numerous adverse effects on aquatic habitat and on salmonid habitat in particular, including the following (May, 1996):

- Gravel that forms spawning habitat is displaced;
- Existing salmonid eggs are washed out or crushed;
- Benthic macroinvertebrate communities on which salmonids rely for food are degraded;
- Channel erosion replaces pool and riffle habitat with less habitable, uniform runs and glides;
- Juvenile fish are directly flushed downstream; and
- Stream flow fluctuation increases more as storm flow frequency increases.

As water runs off more quickly from these urbanized areas, there is typically a corresponding decrease in shallow groundwater recharge. Therefore, base flows are reduced, and water levels may decline much more quickly to levels inadequate for maintaining fish survival through the dry summer season. Reduced base flows kill or injure fish directly by stranding, oxygen depletion, and temperature increase.

Overall, severe degradation of stream habitat has been found to occur as impervious surface exceeds about 5 percent of the area in a drainage basin. Rehabilitation of habitat is generally likely to be feasible in streams for which impervious surface occupies less than 20 percent of the

basin. Performance of fundamental natural ecological functions is likely to be problematic in streams with impervious surfaces covering more than 45 percent of their basins (May, 1996).

Impacts to each study area basin, by action alternative, are summarized in Tables 3.8-2 and 3.8-3. Table 3.8-2 shows the number of locations at which proposed improvements cross or encroach within 300 feet of any stream. Table 3.8-3 lists the estimated new impervious surface that would be constructed in each basin under the various alternatives.

Table 3.8-2: Number of Riparian Encroachments per Basin by Alternative

Basin	No Action Alternative	Alternative 1 HCT/TDM	Alternative 2 Mixed Mode with HCT/Transit	Alternative 3 Mixed Mode	Alternative 4 General Capacity	Preferred Alternative
Cedar/Sammamish/ Lake Washington Watershed (WRIA 8):						
Swamp Creek	6	13	19	16	18	16
Bear Creek	1	8	18	16	11	16
Lower Cedar River	2	14	29	27	19	27
Coal Creek	0	3	4	2	3	3
West Lake Sammamish	0	8	9	1	1	1
East Lake Washington	0	22	27	10	17	17
Evans Creek	1	1	2	2	2	2
Forbes Creek	0	28	45	21	41	21
Juanita Creek	1	4	11	12	18	15
Kelsey Creek	0	6	6	0	0	0
Little Bear Creek	4	6	17	16	16	16
Sammamish River	51	94	136	128	130	129
May Creek	0	5	11	9	6	9
Mercer Slough	0	14	18	5	8	5
North Lake Washington	0	0	1	1	1	1
North Creek	4	19	23	19	18	21
Green/Duwamish Watershed (WRIA 9):						
Lower Green River/Duwamish	0	1	5	4	9	7
Soos Creek	0	3	3	3	0	3
Black River	4	12	37	33	36	21
TOTAL	**74**	**261**	**421**	**325**	**354**	**330**

Table 3.8-3: New Impervious Area per Basin by Alternative

BASIN [a]	No Action Alternative		Alternative 1 HCT/TDM		Alternative 2 Mixed Mode with HCT/Transit		Alternative 3 Mixed Mode		Alternative 4 General Capacity		Preferred Alternative	
	New Imp. Area (Acres)	% Conv.[b]	New Imp. Area (Acres)	% Conv.[b]	New Imp. Area (Acres)	% Conv.[b]	New Imp. Area (Acres)	% Conv.[b]	New Imp. Area (Acres)	% Conv.[b]	New Imp. Area (Acres)	% Conv.[b]
Cedar/Sammamish/ Lake Washington Watershed (WRIA 8):												
Swamp Creek	12	0.2%	15	0.2%	47	0.7%	47	0.7%	58	0.9%	54	0.8%
Bear Creek	0	0.0%	6	0.1%	23	0.2%	18	0.2%	17	0.2%	18	0.2%
Cedar River	12	0.1%	25	0.2%	33	0.2%	46	0.3%	45	0.3%	45	0.3%
Coal Creek	1	0.0%	13	0.4%	15	0.5%	13	0.4%	13	0.4%	18	0.6%
West Lake Sammamish	5	0.1%	12	0.2%	12	0.2%	5	0.1%	5	0.1%	5	0.1%
East Lake Washington	13	0.1%	43	0.3%	68	0.5%	73	0.6%	140	1.1%	154	1.2%
Evans Creek	9	0.6%	9	0.6%	12	0.8%	12	0.8%	12	0.8%	12	0.8%
Forbes Creek	0	0.0%	15	0.7%	23	1.0%	16	0.7%	32	1.4%	17	0.7%
Juanita Creek	10	0.2%	29	0.6%	41	0.9%	38	0.9%	76	1.8%	49	1.1%
Kelsey Creek	0	0.0%	14	0.3%	14	0.3%	0	0.0%	0	0.0%	0	0.0%
Little Bear Creek	15	0.5%	15	0.5%	19	0.6%	19	0.6%	19	0.6%	19	0.6%
Sammamish River	19	0.1%	48	0.3%	83	0.5%	95	0.6%	113	0.7%	110	0.7%
May Creek	9	0.2%	14	0.3%	14	0.4%	13	0.3%	15	0.3%	28	0.5%
Mercer Slough	12	0.2%	47	0.9%	103	2.0%	97	1.8%	160	3.1%	12	0.2%
North Lake Washington	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	87	1.0%
North Creek	33	0.4%	61	0.7%	104	1.2%	111	1.3%	160	1.9%	141	2.5%
Green/Duwamish Watershed (WRIA 9):												
Lower Green River	0	0.0%	4	0.1%	36	0.9%	35	0.9%	43	1.1%	38	1.2%
Soos Creek	8	0.1%	15	0.2%	15	0.2%	15	0.2%	8	0.1%	10	0.1%
Black River (Springbrook)	6	0.0%	83	0.5%	145	1.0%	111	0.7%	139	0.9%	142	1.0%
Impacts Unassigned to a Specific Basin	9	0.2%	9	0.2%	9	0.2%	9	0.2%	9	0.2%	14	0.3%
Rounding Error Adjustment	0	--	4	--	0	--	0	--	0	--	1	--
Total	**173**	**0.1%**	**478**	**0.3%**	**820**	**0.6%**	**773**	**0.5%**	**1,061**	**0.8%**	**974**	**0.7%**

[a] Some of the basins lie outside the project area.
[b] % conversion to new impervious surface (new impervious area divided by basin area within the study area).

3.8.4.1 No Action Alternative

Construction Impacts

The No Action Alternative would create 74 new riparian encroachments. Fifty-one of these would occur in the Sammamish Basin, and no more than six would occur in any of the other sub-basins (Table 3.8-2). This results in less than one-third of the encroachments found in any action alternative.

Operational Impacts

The No Action Alternative would increase impervious surface in the study area basins by 0.1 percent (Table 3.8-1). This percentage represents 173 acres of new impervious surface. The greatest increase would occur in the North Creek Basin, followed by the Sammamish River, Little Bear Creek, Mercer Slough, Cedar River, Swamp Creek, and Juanita Creek sub-basins. No increase is expected for the Bear Creek, Forbes Creek, Kelsey Creek, Lower Green River,

and North Lake Washington sub-basins. The *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a) concluded that no substantial direct effects on hydrology or water quality are expected under this alternative. Refer also to Section 3.5.4.1.

Overall, the No Action Alternative will result in less than half the potential impact on fish populations and habitats, including threatened species, of any of the I-405 Corridor Program action alternatives. As discussed in Section 3.8.4, the chief indicator of habitat degradation for this scale of analysis is the creation of new impervious surface area. The No Action Alternative would add less than half the amount of new impervious surface as that found in any of the action alternatives, whether express as acreage or percent of basin. These committed projects provide the baseline for the potential impacts found in the action alternatives.

3.8.4.2 Alternative 1: HCT/TDM Emphasis

Construction Impacts

Two hundred and sixty-one riparian encroachments would occur, with the majority on the Sammamish River, East Lake Washington, Forbes Creek, and North Creek (Table 3.8-2). Alternative 1 would create substantially fewer riparian encroachments than other action alternatives. This indicates substantially less potential for direct construction impacts to fish habitats and populations.

Operational Impacts

Alternative 1 would add 478 acres of new impervious area to the study area basins for a 0.3 percent increase (Table 3.8-3). The Black River (Springbrook), Mercer Slough, Sammamish River, East Lake Washington, and North Creek sub-basins would experience the greatest increases. For the West Lake Sammamish Basin, this alternative, along with Alternative 2, would create the most impervious surface of any alternative.

Overall, Alternative 1 has the least potential impact on fish populations and habitats, including threatened species, of any action alternative. As discussed above, the chief indicator of habitat degradation for this scale of analysis is the creation of new impervious surface area. Alternative 1 would create half or less the amount of new impervious surface of any other action alternative, whether expressed as acreage or percent of basin. The *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a) concluded that no substantial effects on hydrology or water quality are expected under this alternative. Refer also to Section 3.5.4.2 of the EIS.

3.8.4.3 Alternative 2: Mixed Mode with HCT/Transit Emphasis

Construction Impacts

Four hundred and twenty-one riparian encroachments would occur, with the highest numbers on the Sammamish River, Forbes Creek, East Lake Washington, the Lower Cedar River, North Creek and the Black River (Table 3.8-2). Alternative 2 would result in the most or equal to the most encroachments of any alternative in all but two of the basins within the study area. Alternative 2 would have the highest potential for construction impacts to fish habitats and populations of all the action alternatives.

Operational Impacts

Alternative 2 would create 820 acres of new impervious surface to the study area basins for a 0.6 percent increase (Table 3.8-3). The largest increase would be in the Black River (Springbrook) Basin, followed by Mercer Slough, North Creek, and the Sammamish River. Alternative 2 would also create the most impervious surface in Coal Creek Basin and Evans Creek (equal to Alternatives 3 and 4), potentially impacting water quality in the Black River and hydrology of Forbes Creek, Mercer Slough, and the Black River. The *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a) noted that Alternative 2 could have substantial impacts on hydrology and water quality in several study area sub-basins. Refer to Section 3.5.4.3 of the EIS. In addition, Alternative 2 would create the most new impervious surface for several individual sub-basins, including Bear Creek Basin, which retains some of the most intact fish populations and habitat in the study area.

Alternative 2 represents the median potential impact on fish populations and habitats, including threatened species, among the five action alternatives. Alternative 2 would create more new impervious surface than Alternatives 1 or 3, but less that Alternative 4 and the Preferred Alternative, whether expressed as acreage or percent of basin.

3.8.4.4 Alternative 3: Mixed Mode Emphasis

Construction Impacts

Alternative 3 would result in 325 riparian encroachments, with the Sammamish River, Forbes Creek, the Lower Cedar River, North Creek and the Black River experiencing the most impacts within Alternative 3 (Table 3.8-2). Alternative 3 has approximately the same number of impacts as the Preferred Alternative. Impacts on fish habitats and populations are lower than other action alternatives.

Operational Impacts

Alternative 3 would create 773 acres of new impervious surface in the study area sub-basins (Table 3.8-3). This results in a 0.5 percent increase. This is the most added impervious surface of any alternative for the Cedar River Basin. For the Evans Creek and Little Bear Creek sub-basins, Alternatives 2, 3, and 4 create similar amounts of impervious surface. For the North Lake Washington Basin, Alternatives 2 and 3 create similar impacts. For the Soos Creek Basin, Alternatives 1, 2, and 3 create similar impacts. The *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a) concluded that Alternative 3 could have substantial impacts on hydrology and water quality in the South Kelsey Creek and North Creek sub-basins. Refer also to Section 3.5.4.4 of the EIS. Overall, Alternative 3 has the second lowest potential impact on fish populations and habitats, including threatened species, of any action alternative.

3.8.4.5 Alternative 4: General Capacity Emphasis

Construction Impacts

Alternative 4 would result in 354 riparian encroachments, and the highest number of encroachments of any alternative for the Juanita Creek and the Lower Green River sub-basins (Table 3.8-2). Alternative 4 has a similar distribution of impacts throughout sub-basins, albeit lower in total impact.

Operational Impacts

Alternative 4 would result in 1,061 acres of new impervious surface, an increase of 0.8 percent (Table 3.8-3). This is the greatest amount of new impervious surface that any alternative would cause in the East Lake Washington, Forbes Creek, Juanita Creek, Lower Green River, Sammamish River, North Creek, and Swamp Creek sub-basins.

Hydrology of the East Lake Washington, Forbes Creek, Juanita Creek, North Creek, Mercer Slough, and Black River sub-basins, and water quality in the Black River (Springbrook Creek), may be impacted as a result of Alternative 4. Alternative 4 has the highest potential for operational direct impacts based on area-wide impervious surface creation. Alternative 4 would create substantially more new impervious cover than other action alternatives and more than double the new impervious surface compared to Alternative 1. In addition, Alternative 4 includes the only proposed activity outside the Urban Growth Area, an expansion of Highway 202 in the Sammamish River Basin.

The *I-405 Corridor Program Draft Surface Water Resources Expertise Report* (CH2M HILL, 2001a) concluded that hydrology could be substantially altered in seven sub-basins under Alternative 4. Substantial water quality impacts are expected in Springbrook Creek. Refer also the Section 3.5.4.5 of the EIS.

Overall, Alternative 4 has the greatest potential impact on fish populations and habitats, including threatened species, of any action alternative. Alternative 4 would create greater than 120 percent more new impervious surface than Alternative 1, which adds the least new impervious surface among the action alternatives.

3.8.4.6 Preferred Alternative

Construction Impacts

The Preferred Alternative would result in 330 riparian encroachments, with the Sammamish River, Forbes Creek, the Lower Cedar River, North Creek, and the Black River experiencing the most impacts within the Preferred Alternative (Table 3.8-2). The Preferred Alternative has very similar impacts on fish habitats and populations to those of Alternative 3.

Operational Impacts

The Preferred Alternative would create 974 acres of new impervious surface in the study area sub-basins (Table 3.8-3). This results in a 0.7 percent increase. This is the most added impervious surface of any alternative for the Coal Creek, May Creek, and East Lake Washington sub-basins. Refer also to Section 3.5.4.6 of the EIS.

Overall, the Preferred Alternative has the second highest potential impact on fish populations and habitats, including threatened species, of any action alternative. The Preferred Alternative would create more than twice the amount of new impervious surface of Alternative 1, whether expressed as acreage or percent of basin.

3.8.5 Mitigation Measures

Avoiding impacts is the most effective mitigation strategy for fish and aquatic habitat, and is being addressed first by selection of an alternative through the environmental process, and will continue to be addressed later in the design of specific projects. Impacts to fish and aquatic habitat were considered in the selection of the Preferred Alternative. The design of individual

projects under any action alternative would minimize in-stream structures or disturbance and riparian vegetation disturbance, and would minimize creation of new impervious surface. Generally, the following mitigation measures apply to all alternatives where appropriate. Impacts avoidance and minimization measures include, but are not limited to, the following:

- Redirecting proposed improvements through developed uplands where practicable;
- Reducing project footprint where practicable;
- Spanning waterways with bridges outside of the active floodplain where practicable;
- Using best available science to document, avoid, and then mitigate for potential impacts; and
- Using permeable pavements and other infiltration techniques, where practicable.

Where impacts to fish and habitat are unavoidable, compensating for lost habitat functions would provide mitigation. Compensatory fish and habitat mitigation measures for the I-405 Corridor Program can be divided into three categories: 1) on-site/in-kind, 2) sub-basin, and 3) watershed level. It is WSDOT policy, at a minimum, to control and treat stormwater runoff that could impact fish and habitat such that downstream flood damage and/or serious water quality problems are not increased as a result of new road projects. This could require on-site/in-kind measures to avoid impact. When a project entails unavoidable environmental impacts that require compensatory mitigation, many regulatory agencies have typically favored on-site/in-kind mitigation. This mitigation type replicates as closely as possible specific lost environmental functions (such as suitable spawning habitat for a specific fish species). On-site/in-kind mitigation may be applicable to the I-405 Corridor Program at the project-level, as the specific impacts of each project are assessed. Mitigation can then be incorporated into project design, or mitigation opportunities can be identified in the immediate vicinity.

However, it is not always feasible to provide suitable mitigation near a project site, particularly in a highly developed mostly urban area such as the I-405 corridor. Some regulatory agencies believe that on-site mitigation may be less effective in a highly urbanized area where pre-existing watershed conditions prevent restoration of good quality salmonid habitat. In these areas, they suggest that advanced watershed-based mitigation elsewhere in the sub-basin or watershed would be a more effective and efficient use of mitigation to protect resources. Advanced watershed-based mitigation may involve efforts such as preservation of higher-quality habitat in locations upstream of the study area. In addition, mitigation could be provided outside the project area to address cumulative impacts associated with transportation improvements in the I-405 corridor.

Compensatory fish habitat mitigation concepts at the sub-basin and watershed levels were obtained primarily from existing published information such as basin plans and from information gathered during a 3-day "fish and basin mitigation" meeting between WSDOT and 13 local jurisdictions/agencies in May 2001. The meeting served to:

- Collect existing information on conditions of watersheds around I-405 related to fish habitat;
- Gather possible mitigation activities that are priorities and/or planned projects in each basin; and
- Initiate local agency involvement in the mitigation planning process for the I-405 Corridor Program.

This mitigation approach allows broader issues such as watershed functions and Puget Sound chinook salmon recovery to be addressed through the I-405 Corridor Program mitigation efforts.

Jurisdictions attending and presenting data included King and Snohomish counties, as well as the cities of Kenmore, Bothell, Woodinville, Kirkland, Bellevue, Renton, and Kent. Other agencies and representatives involved with WRIAs 8 and 9 were also present, including NMFS, Ecology, WDFW, USEPA, and the Kikiallus Nation. Agency comments and project information were compiled in meeting minutes (DEA, 2001c). A breakdown of encroachments by local jurisdictional authority can be found in Table 3.8-4.

Table 3.8-4: Number of Riparian Encroachments per Jurisdiction by Action Alternatives

Basin	No Action Alternative	Alternative 1 HCT/TDM	Alternative 2 Mixed Mode with HCT/Transit	Alternative 3 Mixed Mode	Alternative 4 General Capacity	Preferred Alternative
Bellevue	0	31	41	14	27	22
Bothell	11	31	47	41	47	48
Issaquah	0	2	2	0	0	0
Kenmore	0	2	6	6	4	2
Kent	0	0	10	10	10	0
King County	21	44	81	75	75	78
Kirkland	0	42	61	26	44	26
Lynnwood	0	0	1	1	1	1
Newcastle	0	0	5	5	5	5
Redmond	26	52	61	56	48	56
Renton	4	24	41	35	25	34
SeaTac	0	0	1	1	1	1
Snohomish County	8	15	19	16	18	16
Tukwila	0	4	9	5	15	7
Woodinville	4	14	36	34	34	34
TOTAL	**74**	**261**	**421**	**325**	**354**	**330**

It must be noted that assigning credit for advanced watershed-based mitigation to project-specific impacts will likely require additional analysis and negotiation. Several regulatory agencies would need to agree on the value and degree of replacing lost environmental functions with similar or different functions in different locations. For example, what would the agreement be between jurisdictions/agencies if preservation of upper watershed habitat is encouraged as a mitigation measure for impacts such as a new migration blockage, a thousand square feet of new impervious surface, a thousand square feet of riparian clearing, or placement of a piling in a salmonid spawning area? Many regulatory issues will need to be resolved. As an example, a mitigation ratio might be established to define the area of habitat preservation required for each square foot of new impervious surface.

The State of Washington has developed interagency policy guidance for evaluating aquatic mitigation approaches, including regional mitigation (Ecology, 2000b). In general, regional mitigation may be considered when it will provide equal or better biological and other functional values compared to traditional on-site/in-kind mitigation. In making regulatory decisions, the agencies are instructed to "consider whether the mitigation plan provides equal or better functions and values, compared to existing conditions, for the target resources and species."

3.8.5.1 On-Site/In-Kind Mitigation

Construction Impact Mitigation

Impact Avoidance Measures

A number of best management practices (BMPs) will be employed during construction to reduce the potential for adverse stream impacts. The following bullets describe the types of mitigation measures that will be implemented where appropriate and practicable; however, use of alternate, equally effective BMPs or negotiated mitigation may be developed in the future.

- Construction disturbances will be limited to the smallest area practical. When feasible, clearing activities will be staged such that construction areas are cleared no earlier than one week ahead of the start of construction.
- Seasonal in-stream work "windows", as established by the WDFW, USFWS, and NMFS will be observed. Major clearing and grading will be limited to the dry season: usually May 1 through September 1, where reasonable and feasible to avoid construction impacts. If other construction activities are to take place during the wet season, an erosion and sediment control plan will be prepared detailing measures required to provide adequate control and treatment of construction site runoff during wet season conditions. These measures could include shortened intervals for ground-disturbing activities; ceasing of construction activities and rapid stabilization measures during and following storms greater than one-half inch in 24 hours; and additional treatment to remove suspended solids and turbidity from collected project site runoff prior to discharge (CH2M HILL, 2001b).
- Exposed bare soil will be covered as soon as possible after grading to minimize erosion potential using typical techniques such as hydroseeding, mulching, or matting.
- Erosion on slopes will be minimized by using techniques such as roughening, terracing, or contouring slopes before seeding.
- Sediment transport off-site or into drainage features/facilities will be avoided, using techniques such as filter fabric fence installed downstream of all exposed slopes, around existing drainage inlets, and along river, stream, and drainage channels in the vicinity of work areas.
- Toxic pollution will be controlled by requiring that all equipment be maintained and refueled where potential spills and stormwater runoff can be contained. Toxic spill response plan will be designed to contain any spills that occur. Water quality monitoring programs may be required by jurisdictional agencies to sample above and below construction areas, before, during and after project construction.

Specific construction techniques will be designed at the project phase to reduce the potential of adverse stream impacts. For example, bridge construction methods that avoid temporary work bridges will be considered, and any temporary stream structures will avoid the use of chemically treated wood materials such as creosote or chemonite. Furthermore, creosote-treated wood will not be used for any temporary or permanent instream structures.

Compensatory Measures

On-site/in-kind mitigation is most effective in avoiding construction impacts, but direct displacement of habitat may require compensation. For example, riparian areas cleared for construction staging or access will be revegetated with native plant species. If in-stream habitat is unavoidably displaced by new structures, on-site opportunities for creating additional habitat will be investigated. Habitat enhancement will compensate for the habitat functions that were lost, specific to fish species and life-stage.

Operational Impact Mitigation

Impact Avoidance Measures

The I-405 Corridor Program alternatives presently identify projects only at a conceptual level; no detailed project design has been completed. The most effective mitigation for operational impacts will be to design individual projects for impact avoidance or minimization. Examples of the types of mitigation that will be implemented where practicable and appropriate to the project include:

- Designing stream crossings to be passable for migrating fish.
- Stormwater runoff quantity: Detaining runoff from new impervious surfaces in accordance with Washington State Department of Ecology's (Ecology's) current stormwater drainage manual, or functionally equivalent stormwater guidance, and infiltrate to groundwater where feasible.
- Stormwater runoff quality: Treating collected stormwater runoff from new impervious surface in accordance with the Ecology drainage manual or functionally equivalent stormwater guidance etc. using sedimentation ponds, filter systems, wetponds, vegetated swales and filtering devices.

Compensatory Measures

One compensatory measure for operational impacts will be retrofitting of existing impervious surface for stormwater runoff quantity and quality. Extent of impervious surface has been identified as one of the main factors in fish habitat degradation due to urbanization (May, 1996). Several jurisdictions have mentioned retrofitting of impervious surface as the highest priority mitigation strategies (DEA, 2001c).

Stormwater retrofitting would result in early implementation of WSDOT's current drainage policy to control and treat stormwater according to the most current version of the Ecology Stormwater Management Manual for Western Washington (August 2001) or functionally equivalent stormwater guidance. While current WSDOT standards commit to some stormwater retrofitting in the design of new facilities, retrofitting of additional existing I-405 pavement area could potentially be credited as "out-of-kind" compensatory mitigation for other unavoidable impacts. Beyond this, additional compensation for specific project impacts could be implemented, because I-405 was constructed at a time of less stringent stormwater control standards and much of the stormwater runoff was not detained or treated.

WSDOT will also consider non-engineering solutions, such as removal of existing impervious surfaces and conversion into naturally vegetated habitat, where practicable and permitable.

3.8.5.2 Sub-Basin Level Mitigation

A number of mitigation projects have been previously identified by local jurisdictions to meet existing habitat enhancement/protection needs throughout sub-basins in the I-405 Corridor Program study area. As mitigation for the I-405 Corridor Program improvements, WSDOT will consider participating in some of these projects to gain mitigation credit for project-level impacts while contributing toward overall restoration of sub-basins and watersheds.

Mitigation opportunities identified by each local jurisdiction are summarized below.

Snohomish County Mitigation Opportunities: Swamp, North, and Little Bear Creeks

Snohomish County specifically identified a number of potential mitigation efforts:

- Fund or match funding for priority land acquisitions in Swamp, North, and Little Bear creeks.
- Fund or match funding for repair or replacement of prioritized fish blocking passage structures in Swamp, North, and Little Bear creeks.
- Fund or match funding for priority riparian corridor protection, restoration and connectivity (acquisition, conservation easement, removal of impervious surfaces and hydro-modifications) in Swamp, North, and Little Bear creeks.
- Fund or match funding for monitoring groundwater recharge in south county streams. Precipitation and stream flow could be gauged, and monitoring wells installed to investigate the condition of depth and movement of interflow, shallow groundwater, perched groundwater, as well as regional groundwater aquifers. This study could be implemented in a small pilot basin. Site-specific data needs to be correlated, and a preservation and protection plan for base flows created.
- A project could be designed (and development corporation founded to implement it) that searches out and uses the most advanced techniques to reduce impervious surfaces. Mitigation funds could be used as proactively as possible to gain lessons from these older, rapidly urbanizing watersheds which would be vital to successful development of inevitable new UGAs in the future.
- Easements, right-of-ways, native growth protection areas, community tracts, some detention ponds, and many other open spaces are not mapped in Snohomish County. A project needs to be funded to review all recorded plats, deeds and other records, and digitize the data to create a map of all currently protected open space in south county. This would allow prioritizing decisions to be made based on corridors and connectivity. It would also allow for creation of a management plan based on water quality, stormwater management, habitat, and an interconnected pedestrian trail system. Much of this interconnected open space has huge potential revegetation.
- There are several ox bows (stream features) in mainstem Swamp Creek in the vicinity of Forsgren Park that have high rearing and spawning potential but which currently have excessive flows. High water overflow swales with bio-engineered bank protections could be constructed to divert flood water and protect habitat in the ox bows.
- An inventory could be made of all the most at-risk/inappropriately located structures, and those whose removal would most benefit stormwater retention in naturally functioning

wetlands and riparian areas. Ground-floor elevations would be taken and a short and long range plan for removal created.

City of Kenmore Mitigation Opportunities: Swamp Creek

Much of the city of Kenmore lies within the Swamp Creek Basin, and the City has identified several drainage improvement needs and habitat enhancement opportunities. Swamp Creek Park is owned by King County, but lies within Kenmore at the mouth of Swamp Creek. It is occupied largely by degraded wetlands dominated by invasive exotic species, and enhancement of these wetlands would benefit the in-stream fish habitat. A feasibility study by King County for creation of a wetland mitigation bank in this area is currently underway. Other mitigation opportunities in Kenmore include:

- Retrofitting of the existing Wallace Park sedimentation trap on Swamp Creek;
- Contribute to development of regional stormwater detention facilities to reduce the impact of urbanized hydrology in reaches upstream of the city;
- Acquisition of riparian and floodplain areas, including buy-outs of flood-prone developed properties; and
- Participation in environmental restoration (outside the city of Kenmore) is being considered on a homesite acquired by the City near the mouth of Lyons Creek in Lake Forest Park.

City of Woodinville: Little Bear Creek

Several projects to improve stream habitat and drainage are underway in the Little Bear Creek Basin in the city of Woodinville, including retrofitting of two culverted crossings and acquiring open space lands. Several unfunded or preliminary projects may provide opportunities for WSDOT participation:

- Retrofitting of old rock weirs in Little Bear Creek downstream of 195th Street;
- Acquisition of riparian area along the Little Bear Creek corridor;
- Replacement of existing culverts at 134th Avenue NE with a bridge crossing;
- Creation of wetlands at the mouth of Little Bear Creek; and
- Removal of bank armoring and establishment of native riparian vegetation near the mouth of Little Bear Creek and upstream of the 195th Street crossing.

Other existing conditions that would benefit from mitigation efforts include the uncontrolled runoff from the Woodinville Auto Auction property and other impaired habitat elements such as lack of pool habitat, refugia, and large woody debris (LWD).

City of Bothell Mitigation Opportunities: North Creek and Sammamish River

The Bothell city limits include portions of the North Creek and the Sammamish River sub-basins. The City of Bothell is coordinating closely with the WRIA 8 watershed-level salmonid habitat enhancement efforts. No specific projects were identified. However, the City referred to the Sammamish River Action Plan, completed in January 2002, and the WRIA 8 (see City of Renton Mitigation Opportunities below).

In general, the City sees value in acquiring wetlands, riparian areas, and groundwater discharge/recharge areas for preservation. The City also suggested regional stormwater detention as a valuable mitigation concept for this area. Two recommendations were made for direct mitigation to address existing I-405 impacts: restoration of the compacted construction area within the WSDOT right-of-way at the intersection of SR 522 and SR 405, and retrofitting of uncontrolled stormwater drainage from this intersection.

City of Kirkland Mitigation Opportunities: Forbes and Juanita Creeks and East Lake Washington

The City of Kirkland has an ongoing program of drainage and habitat improvements in Forbes Creek, Juanita Creek, and East Lake Washington sub-basins, with numerous projects underway or fully funded. However, the City has identified several beneficial projects that are currently unfunded, offering a potential for WSDOT involvement:

- Installation of a sediment vault at Central Way and Market Street;
- Dredging of sediment deposits at several Lake Washington stream mouths;
- Culvert replacements on Juanita Creek near NE 120th Place;
- Drainage improvements and riparian property acquisition in the vicinity of NE 70th; and
- Restoration of the Forbes Creek stream corridor.

I-405 forms an impassable migration barrier on both of the two major streams of Kirkland; Juanita Creek and Forbes Creek. Reconnecting these streams across I-405 with some combination of daylighting, channel restoration, and installation of passable culverts would restore anadromous access to upstream habitat. Similar mitigation work may be possible on Yarrow Creek, which is blocked by several impassable crossings of SR 520.

The Draft Natural Environment Policies of the Totem Lake Neighborhood Plan in Kirkland also refers generally to the need for enhancement of the Juanita Creek riparian corridor, and daylighting of culverted sections of Forbes Creek.

City of Bellevue Mitigation Opportunities: Kelsey and Coal Creeks, Tributaries to Lake Sammamish, Lake Washington, and Mercer Slough

Major drainages in Bellevue include Kelsey Creek, Mercer Slough, Coal Creek, and several tributaries to Lake Sammamish. The City has an extensive program of drainage and aquatic habitat improvement. Numerous projects are underway, including culvert retrofitting, barrier removal, and habitat restoration projects at several locations. However, a number of unaddressed problems and preliminary or unfunded projects offer the potential for I-405 mitigation credit:

- Acquisition of headwater riparian areas of Lewis Creek;
- Retrofitting of I-90 culvert barriers at Lewis (tributary to Lake Sammamish), Richards (tributary to Lake Washington), and Vasa (tributary to Lake Sammamish) creeks;
- Acquistion of Kelsey Creek riparian habitat upstream of Kelsey Creek Park and Glendale Golf Course;
- Investigation and correction of drainage problems at an unnamed tributary to Mercer Slough;
- Acquisition of riparian habitat along Richards Creek;

- Replacement of existing bank armoring with more functional habitat features (LWD) outside of the bankfull corridor and retrofitting faulty weirs on Kelsey Creek near Bel-Red Road; and
- Upgrading of I-405 high-flow bypass facilities.

City of Newcastle Mitigation Opportunities: Boren, China, and May Creeks

The City of Newcastle generally identified some drainage and aquatic habitat issues that may offer opportunities for mitigation:

- Culvert replacement on Boren Creek;
- Channel restoration and barrier removal on China Creek;
- Wetland and floodplain property acquisition along May Creek; and
- Large woody debris installation in May Creek.

City of Renton Mitigation Opportunities: May, Panther, Springbrook Creeks and Cedar River

The City of Renton is coordinating closely with WRIA 8 watershed-level salmonid habitat enhancement efforts, and referred to the WRIA 8 Draft Near-term Action Agenda for Salmon Habitat Conservation completed in January 2002.

The May Creek Basin Action Plan makes 53 specific recommendations for implementing solutions to drainage and habitat problems in that sub-basin (City of Renton and King County, 2001). These actions range from establishing new stormwater detention standards to planting coniferous trees in riparian areas.

Several additional specific mitigation opportunities in the city of Renton were identified during the May 2001 mitigation meetings, including:

- Replacing rip-rap with bioengineering structures on the banks of the lower reaches of the Cedar River near the Renton Library;
- Retrofitting uncontrolled stormwater drainage from SR 169;
- Riparian restoration and control of Himalayan Blackberry growth;
- Study and mitigation design for wetland drainage problems between Panther Creek and Springbrook Creek;
- Funding for the proposed mitigation bank near Oakesdale and SW 34th; and
- Acquisition of the Seattle Times site near SW 34th for wetland creation.

City of Kent Mitigation Opportunities: Mill, Meridian, Soos, Soosette Creeks

Extensive restoration efforts are underway in the Black River/Springbrook Creek Basin and the Lower Green River. The City of Kent is constructing a 300-acre regional stormwater detention facility. A U.S. Army Corps of Engineers program is underway to improve drainage and habitat throughout the Mill Creek Basin, including slope stabilization, riparian restoration, and restoring channelized stream reaches. Several opportunities for I-405 mitigation credit were identified:

- Design and construction of an outlet to the proposed regional stormwater facility;
- Levee alteration and riparian revegetation along the Green River; and
- Creation of additional flood storage capacity in mitigation for existing SR 167 impacts.

The City of Kent annexed areas within the Soos Creek Basin in 1996. Extensive drainage and habitat mitigation efforts are underway in this basin as well, including culvert replacement, riparian restoration, and in-stream enhancement. Specific opportunities for potential WSDOT participation include:

- Riparian revegetation and invasive weed control near Clark Lake;
- Restoration of the channelized reaches of Meridian Creek;
- Retrofit Meridian Lake outfall;
- Culvert retrofitting and riparian revegetation on Soosette Creek;
- Enhancement of spawning habtiat upstream of 240th Street; and
- Acquisition of riparian areas on Soos Creek tributaries.

King County Mitigation Opportunities: Green/Duwamish River, May Creek, Bear Creek, Evans Creek

King County has a number of habitat mitigation priorities throughout the study area because of its broadly dispersed jurisdiction.

- In the Green/Duwamish River watershed, preservation of intact habitat in the Middle Green River Basin has been identified as critically important for salmon recovery in several recent documents including the Habitat Limiting Factors and Reconnaissance Assessment Report – WRIA 9 (Kerwin and Nelson, 2000), and WRIA 9 Factors of Decline Subcommittee Direction for 2000 (King County, 2000b). These documents identify a number of specific areas in the watershed that are extremely important to preserve. Other recently published documents identify fish restoration opportunities in the Green/Duwamish watershed, including the Green/Duwamish River Ecosystem Restoration General Investigation: Reconnaissance Report (U.S. Army Corps of Engineers, 1997).
- An immediate opportunity for mitigation participation is at the upper extent of the Sammamish River. Permitting is now underway for a plan to restore meanders to this previously channelized river. However, considerable additional funding is needed.
- About one-half mile of May Creek directly parallels I-405 at the toe of the road fill embankment. This may offer opportunities for direct on-site/in-kind mitigation credit for proposed projects in the vicinity. In addition numerous stormwater outfall pipes presently discharge onto the slopes of the May Creek ravine. Additional funding is needed to complete the retrofitting of these discharges to prevent erosion. Current installation of large woody debris in this stream reach may potentially also be augmented for mitigation credit. Buy-out of flood plain properties in the May Creek Basin has also been identified as a restoration need. The May Creek Basin Action Plan recommends numerous specific mitigation and restoration projects in that basin (City of Renton and King County, 2001).
- The County has stressed riparian acquisition and preservation in the Bear Creek Basin, and there may be potential for WSDOT to contribute to this ongoing effort. Assistance would also be helpful in obtaining easements for planned channel restoration activities along the

lowest reaches of Bear Creek. Large woody debris is lacking in Cottage Lake Creek, a tributary of Bear Creek, and addressing this issue may support a mitigation project.

3.8.5.3 Watershed-Level Mitigation

Steering committees composed of elected officials, local agency staff, and citizens have been established in the study area to oversee development of a plan that responds to salmon listings under the ESA in several WRIAs. Steering committees have been established for both of the study-area watersheds: the Lake Washington/Cedar River watershed (WRIA 8) and the Green/Duwamish watershed (WRIA 9).

The WRIA steering committees are in the process of identifying, evaluating, and prioritizing actions to protect and restore salmon populations, especially actions related to habitat. This conservation strategy will also help lead to agreements that will guide future actions that affect salmon habitat (King County, 2001b). The WRIA committee mission is "to develop a watershed conservation plan that will recommend actions to conserve and recover chinook salmon and other anadromous fish. The focus of this phase shall be to preserve, protect and restore habitat with the intent to recover listed species…"

Many of the local agency jurisdictions are contributing funding and staffing to the WRIA 8 and 9 steering committee efforts. Local agencies may rely on the steering committees to coordinate mitigation efforts throughout the watershed. Some local agencies look to the WRIA organizations to replace or augment specific on-site or in-basin mitigation efforts with broad watershed-wide efforts. Depending on the approval of jurisdictional agencies such as Ecology, WSDOT may contribute to the coordinated watershed-level conservation efforts as a form of off-site, out-of-kind mitigation for various project-specific impacts.

Two main watershed-level mitigation approaches were identified in discussions with local agencies and WRIA representatives: retrofitting stormwater control measures for existing impervious surfaces, and preservation of remaining undeveloped portions of the watersheds.

- Stormwater control retrofitting could be one of the most effective mitigation measures, because much of the existing habitat degradation in the study area can be attributed to uncontrolled and untreated runoff from existing impervious surfaces, including primarily pavement. The adverse effects of such runoff are described above in Section 3.8.4 and the benefits of stormwater control are described in Section 3.8.6.2. In addition, existing uncontrolled runoff could be treated to reduce pollutant loadings. While current WSDOT standards commit to some stormwater retrofitting in the design of new facilities, retrofitting of additional existing I-405 pavement area could potentially be credited as "out-of-kind" compensatory mitigation for other unavoidable impacts.
- Preservation of undeveloped watershed areas could serve as mitigation based on the assumption that these areas would otherwise be developed. Development in these areas would cause the loss of some level of beneficial hydrologic and habitat functions as discussed in Section 3.8.4. In addition, the beneficial functions of undeveloped watershed already extend throughout much of the watershed by such mechanisms as groundwater recharge, baseflow maintenance, and provision of habitat refuge.

Crediting of watershed-level mitigation for project-specific impacts would require close coordination between WSDOT and federal and state regulatory agencies. Comparison of

mitigation "value" between qualitatively different types of mitigation would need to be negotiated. The Washington Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements from Ecology and WDFW (*I-405 Errata and Addendum to Expertise Reports* [DEA, 2002]) states that *"Preservation as compensatory mitigation has been determined to be acceptable by the agencies when done in combination with creation, enhancement, or restoration…"* within certain criteria, but that *"Preservation alone shall only be used as compensatory mitigation in exceptional cases."*

WSDOT will use the concepts summarized here as a starting point in the impact mitigation process for the overall I-405 Corridor Program. Mitigation efforts will involve continued collaboration with local jurisdictions, other state agencies, and the WRIA committees.