3.7 SOOS CREEK SUBBASIN

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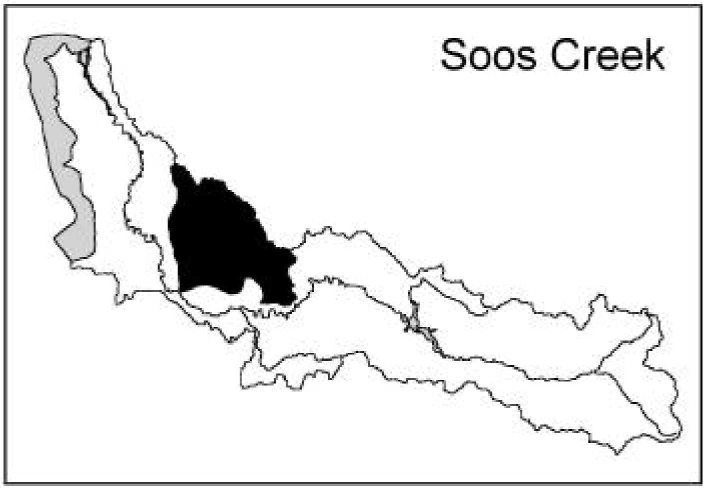

PHYSICAL DESCRIPTION

SUBBASIN

The Soos Creek subbasin is best defined as an area in south King County, north and east of the Green River and southeast of the City of Renton. The Soos Creek subbasin consists of the mainstem Big Soos Creek (09.0072) with approximately 25 identified tributary streams totaling over 60 lineal miles. There are three major tributaries:

- Covington (09.0083);
- Jenkins (09.0087); and
- Soosette (09.0073, also known as the West Branch of Soos Creek).

STREAM COURSE AND MORPHOLOGY

The subbasin drains an area of approximately 44,800 acres (70 square miles). The basin is comprised of three distinct physical settings (Figure HM-2 in the Hydromodifications Appendix).

The headwaters of Soos Creek originate on a rolling glacial outwash plain. The channel is unconfined, has a gradient of less than 0.1 percent, and flows through extensive wetland complexes. Stream flows are generally small, with little erosive energy, and the channel is described as alternating between “sections of good gravel and sections of swampy channel splits with mud bottoms” (Williams 1975), characteristic of a Palustrine channel type.

At approximately RM 4.75, Soos Creek enters a narrow, steep-sided ravine containing long riffles with pools. The channel becomes a Moderate Gradient Mixed Control type, with a gradient of approximately 1.4 percent. Major lakes in this system include Lake Youngs (a domestic water supply for the City of Seattle), Shadow Lake, Lake Meridian, Lake Sawyer, Morton, Pipe/Lucerne and Wilderness Lakes. These lakes have a combined surface acreage of approximately 1,370 surface acres (Wolcott 1973).

Downstream of RM 2, the channel gradient decreases to around 0.5 percent, and Soos Creek becomes a Floodplain channel type that occupies a steep-sided valley.

Pool-to-riffle ratios differ considerably between the upper and lower reaches of Soos, Little Soos, Covington, Jenkins and Soosette Creeks (Table Soos-1). Ideal pool-to-riffle ratios should have approximately equal frequencies of each element.

Table Soos-1. Pool - to - Riffle Ratios of Streams in the Soos Creek Subbasin.

Stream Name	Upper Reaches	Lower Reaches
Little Soos Creek	20:80	50:50
Big Soos Creek	30:70	20:80
Covington Creek	90:10	5:95
Jenkins Creek	90:10	10:90

Source: King County 1990.

SALMONID USE

The known freshwater distribution of anadromous salmonids is depicted in the report Appendix.

The headwaters of Soos Creek arise on a rolling glacial outwash plain. In such landforms, streams often originate in wetlands, and exhibit low-gradient, palustrine-type channels until flows become sufficient to regularly transport coarse sediment. The gradient of mainstem Soos Creek is 1 to 2 percent throughout its course (Cutler 2000), and no natural barrier falls or cascades have been identified (Williams et al.1975). The upstream extent of spawning by anadromous fish, is not known, but is presumed to be limited by flow, substrate or in-stream vegetation and not gradient. Juvenile fish are expected to use the entire length of available channel and associated wetlands for rearing.

Chinook, sockeye, coho, pink and chum salmon (along with winter steelhead adults) have been observed spawning in the Soos Creek subbasin (WDFW Spawning Ground Survey database).

A single bull trout was reported captured at the Soos Creek State Fish Hatchery (SFH) in 1956 (Beak Consultants 1996). Resident and anadromous cutthroats have been observed throughout the streams and lakes.

SFH captures adult chinook and coho for on- and off-station releases, with an annual production of approximately 3.2 million fall chinook sub-yearlings and 600,000 coho yearlings.

FACTORS OF DECLINE

FISH PASSAGE

Known barriers to anadromous salmonids are shown in the report Appendix.

SOOS CREEK SALMON HATCHERY

The Soos Creek Salmon Hatchery (located at RM 0.7) was constructed in 1901 and has been in continuous operation since that time. Between 1902 and 1924, portable double racks were installed in the mainstem Green River at the mouth of Soos Creek to provide eggs for the hatchery, since chinook salmon did not enter Soos Creek at that time (Becker 1967). Annual installation of the portable weirs on the mainstem was discontinued in 1924, as large numbers of chinook had begun to return to Soos Creek by that time (Becker 1967).

The existing hatchery rack consists of two removable weirs located approximately 100 feet apart that are used to create a holding pond (Figure Pass-15). The weirs are generally installed around August 15, when the first chinook begin to arrive , and removed around the 3rd week of November when coho egg take requirements have been met (Chamblin 2000). A sheet-pile dam (used to divert water into the hatchery) is located just upstream. The diversion dam is equipped with a fish ladder (Figure Pass-16).

The hatchery rack acts as a barrier when it is in place. However, large storm events or other unforeseen occurrences may wash out the weirs or allow fish to pass the structure. For example, during a storm in September 1997, over 8,000 chinook were able to leave the hatchery and move upstream into Soos Creek when the weir failed (Finney 2000). Beavers have also been responsible for causing holes that allow adult salmonids to migrate upstream (Kerwin 2000). When the hatchery weirs are not in place, anadromous salmonids can move freely upstream. The hatchery does not interfere with the downstream movement of juvenile fish.

CULVERTS

Although a number of barriers associated with road crossings have been identified on tributary streams (Figure Pass-4 located in the Fish Passage Appendix), no existing barriers to upstream migration in mainstem Soos Creek have been identified.

King County is currently conducting a comprehensive Green River Basin investigation of culvert and bridge crossings of county roads. It is expected that this investigation will lead to a database that identifies culverts and other structures that block or constrict stream channels. That survey should be completed in late 2000 or early 2001.

LOW INSTREAM FLOWS

Low flows reportedly reduce the ability of chinook to reach the Soos Creek hatchery (WDFW and WWTT 1994), and thus influence the amount of natural spawning downstream of the hatchery as well as the number of chinook that may be released upstream of the hatchery rack. The specific location of low flow concerns was not identified, and could include low flow concerns in the mainstem (WDFW and WWTT 1994). However, a declining trend in the average

7-day low flows just upstream of the hatchery has been identified (Culhane 1995), and is discussed in more detail in this chapter(see Hydrology). Declining flows support the hypothesized low flow concerns in Soos Creek.

WATER TEMPERATURE

There are no segments of mainstem Soos Creek listed on the 1998 Washington State 303(d) list for temperature concerns (WDOE 1998), thus temperature is currently assumed not to limit the upstream migration of adult salmonids in Soos Creek. However, temperature concerns that represent potential passage barriers have been identified on a number of tributaries (Figure Pass-4 in the Fish Passage Appendix). In addition, DO levels less than 8 mg/l have been recorded near RM 10. Low DO levels could cause salmonids to avoid entering this section of the stream, thereby delaying upstream migration.

RIPARIAN CONDITION

No data was obtained during the course of this investigation that provided additional information concerning riparian types, canopy, depth, seral stage or composition.

LARGE WOODY DEBRIS

There have not been any quantitative surveys of LWD abundance.

King County (1990) reported moderate, but not sufficient, amounts of LWD to all but the steepest reaches of Soos Creek. That same document did not supply additional qualitative information on other tributaries in this subbasin.Typically, as structure (i.e.: LWD) is eliminated, the ratio shifts towards riffle-dominated reach.

HYDROLOGY

The Soos Creek subbasin is changing from forested/rural to one heavy urbanized (particularly in the western areas). The subbasin has an extensive system of interacting lakes, wetlands and infiltrating soils that collectively attenuate peak stream flows. In the 1980s, Soos Creek discharged about 8-10 cfs during the summer (Metro, 1988) 400 cfs during one-year event high flows (King County , 1990) to the Green River. The Soos Creek Basin Plan provides a detailed subcatchment peak flow tables and maps for various future and existing conditions HSPF modeling.

Existing flow-related problems are found in the upper stream reaches that undergo natural and anthropogenic low stream flows. In 1990, it was predicted that stream flows would increase by an average factor of 1.8 under build-out conditions. However, some areas were expected to have stream flows increase 3.5 times the 1985 levels (King County 1990). These higher flow increases should be in areas that had highly infiltratable soils that are converted to urban areas with impervious surfaces.

WATER RIGHTS

The majority of water rights issued by the Washington Department of Ecology (WDOE) in the Soos Creek subbasin are for groundwater. The City of Kent, the Covington Water District, and King County Water District #111 are the largest consumers of water in the subbasin. Water rights and water claims are shown in table Soos-2.

Table Soos-2. Big Soos Creek Subbasin Water Rights and Claims.

Source	Qi* (cfs)	Qa** (acre-feet)	Irrigated Acres	Total Number of Rights (R) or Claims (C)
Ground	40.8	19,297	369	99 (R)
Surface	6.1	891	103	89 (R)
Ground	43.3	3.194	1,118	1,374 (C)
Surface	21.2	357	309	296 (C)
Total Ground	84.1	22,491	1,487	1,473
Total Surface	27.3	1,248	412	385

* Qi = Allocated instantaneous water quantity.
** Qa = Annual water quantity.
Source: Culhane 1995.

The usable period of record for streamflow data for the Big Soos Creek subbasin extends from 1967 to 1995. During this period, the amount of ground water allocated (Qi) increased from 5.3 cfs to 40.8 cfs and the annual quantity (Qa) increased from 1,412 acre-feet to 19,297. In 1995, there were 30 applications for water rights for ground water in the Soos Creek subbasin. These applications totaled 40.9 cfs. This is an almost equal amount to that allocated.

The tributaries to the Green River are closed to additional surface water withdrawals since 1980 (Chapter 173-509 WAC). However, declining trends in the average 7-day low flows have been detected in Soos Creek for all years between 1968 to 1993 (Culhane 1995). The likely causes for these instream flow declines includes a combination of decreased precipitation 1993 (Culhane 1995), increases in the percentage of impervious surfaces associated with urbanization, and increased groundwater withdrawal. Potable water wells that produce less than 5,000 gallons per day do not require a water right. It is not known how many of these wells are present in the subbasin and what might cumulative impacts might be. However, it is not entirely clear if this is a long-term trend or just part of a cycle; further data would be useful.

Information in the Ground Water Management Plan (SKCGWAC 1989) and studies conducted by the USGS, ground water withdrawals from the Covington Upland have adversely impacted streamflow in Soos Creek.

The increase in percentage of impervious surfaces in the basin mentioned previously have contributed to decreases in summertime low flows. Increases in winter stormwater flows have been observed (King County 1990) and the King County Surface Water Management Division estimated a three-fold increase in impervious area from 1985 to build-out conditions.

The mean annual streamflow in Soos Creek decreased about 14 percent and the low mean monthly flow decreased about 33 percent during the time period from 1967 to 1992. Precipitation as measured at Palmer decreased only 5 percent during that same period. In the Newaukum Creek subbasin, the mean annual flow decreased 20 percent, the low mean monthly flow decreased about 24 percent and precipitation at Palmer decreased 16 percent from 1953 to

1992. A comparison of this data indicates that while annual streamflow declines were similar between the two basins, the low mean summer monthly flows in the more urbanized Soos Creek subbasin were significantly greater. The declines cannot be attributed to decreases in precipitation alone, but more likely a combination of ground water removal, increases in the percentage of impervious surfaces and decreases in precipitation 1993 (Culhane 1995).

Culhane (1995) concluded that additional groundwater removal from the Soos Creek subbasin upper three or four aquifers would likely contribute to an additional reduction of surface flows.

The amount of water actually used has not been compared against the allocated water rights and water claims in the basin. However, as previously mentioned, the amount of water allocated has risen. Carlson (1994) did a comparison of potential safe water yield within the Soos Creek subbasin. It was the conclusion of this study that the hypothetical ground water yield of the basin is less than the quantity of water already allocated through exempt well water withdrawals and water rights. When water claims are factored into this analysis, the difference is increased even more significantly.

SEDIMENT CONDITION

Erosion and sediment problems were identified in the Soos Creek Basin Plan (King County 1990). That document indicated that while areas of significant bank erosion would expand only marginally, they would likely increase in intensity. Further, the rates of bedload material transported by increased flows and enlarged stream channels will increase several fold. This will increase the magnitude of sedimentation problems where the transported material settles out. Finally, because of uncertainties in the analysis, it is believed that there is an underestimation of actual future sediment movement. Erosion problems (including associated sedimentation and flooding issues) were also identified in Soos Creek Basin Annual Reports (King County 1993, King County 1994).

Investigation within the Soos Creek subbasin (King County 1990) identified six sites with erosion problems, four sites with debris and related erosion problems, and five sites with sedimentation-related problems. In the upper reaches of Soos Creek, sedimentation was identified as a problem between RM 7.2 to 10.4 (King County 1990). In the lower reaches of Soos Creek, sedimentation was identified as a problem in the vicinity of the Green River SFH (RM 0.8). Bank failures and bank erosion was identified as problems in Soos Creek between Jenkins and Covington Creeks, at RM 4.6 and, in the lower 0.6 miles of Covington Creek.

Erosion and sediment problems were also identified in the 1992/93 and 1994 Soos Creek Basin Annual Reports (King County 1993, King County 1994).

In January 1990, Soosette Creek experienced a dam break flood at about RM 1.0 when a gravel pit road culvert became plugged by a cottonwood during a storm event. An estimated 30,000 cubic yards of fill from the road crossing scoured the stream bed and delivered much of the sediment to Soos Creek, about 0.5 mile upstream of the SFH.

Gravels within this subbasin have not been investigated but also have not been identified as a limiting factor. None of the published literature (Williams et al. 1975; Goldstein 1982; King County 1989)on Soos Creek describing fish habitat and environmental conditions contains specific information on the extent of gravel bars in mainstem Soos Creek. King County (1990) found spawning gravels “dispersed” and occurring as patches rather than extensive beds. In that same document it was noted that Little Soos and Soosette Creeks had patches of gravels with smaller particle size throughout the upper reaches of these creeks. These gravels were believed to be both consolidated and unconsolidated, the former condition probably the result of low stream gradients and streambank erosion immediately upstream. Substrate in the floodplain channel segment was described as predominantly gravel (70-80 percent), and “remarkably few areas of problematic erosion or sedimentation were identified” (King County 1989). Aerial photograph coverage of Soos Creek was 1:12,000 scale or larger, and the channel was generally obscured by vegetation, thus no information on either the historic or current extent of gravel bars is available.

Gravels in Covington and Jenkins Creeks tended to be “clean and unconsolidated” but still patchy (King County 1990).

WATER QUALITY

Although no direct pre-development data was found as a part of this report, it is assumed that Soos Creek water quality was historically excellent for salmonids due to the large acreage of headwater wetlands and lakes. This historic wetland /lake complex allows for natural filtration and ground water adsorption keeping flows clean, cool and steady (qualities most likely led to the siting of the SFH near the mouth of the system in 1902).

The Soos Creek Basin Plan (King County, 1990) notes that localized water quality degradation has been observed, including high levels of fecal coliforms in Little Soos Creek and high nutrient levels in the lakes. Non-point pollution of these types are expected to become an increasing threat to fish habitat ands the subbasin develops.

Water quality existing conditions, trends and data gaps for this subbasin is covered in detail in The Water Quality Chapter (Part II, Chapter 1.2) of this report. This chapter notes the recent chemical and biological (B-IBI) monitoring efforts within the subbasin.

Prych (1995) sampled streambed sediments for the presence of metals. Seven streambed samples were collected from three sites. Two sites were in Big Soos Creek (one each upstream and downstream of the confluence with Little Soos Creek), and the third site was in Little Soos Creek. Streamwater samples were also collected at the time of the streambed samples were collected. The concentrations of metals in the streambed sediments were typical of or slightly higher than those in soils from the same subbasins. Cadmium, copper, mercury, manganese, lead, arsenic, antimony, selenium and zinc had maximum observed concentrations in streambed sediments approximately twice as high as terrestrial soil samples (Prych 1995). None of the levels were high enough by themselves to be a limiting factor to fish production.

LAND USE

Land within in this subbasin been converted from old-growth forest to commercial timber production, then to agricultural uses, and now to hobby farms and urban uses and has had significant and adverse effects.

In the Soos Creek subbasin, riparian and instream habitat contributes to the stream diversity and complexity. King County (1987) estimated the riparian forest in the Soos Creek subbasin (table Soos-3.)

Table Soos-3. Riparian Forest Cover in the Soos Creek Subbasin.			
Creek Name	**Total Length Surveyed (miles)**	**Forested Length* (miles)**	**Percent**
Soos Creek	14.2	8.9	63
Little Soos Creek	4.5	2.1	47
Soosette Creek	5.1	3.0	59
Covington Creek	11.3	8.7	77
Jenkins Creek	6.0	3.7	62
Cranmar Creek	3.8	3.4	90
* Forested is defined as having >51 percent upper canopy cover in an area of undisturbed natural vegetation.			

The northern and western portions of the Soos Creek and Big Soos Creek subbasins exhibit the highest density of urban subdivisions; commercial retail centers, and scattered single-family residences. The land along the borders with Kent and Renton (along the Kent-Kangley Road) are the most urbanized. The effective impervious area of Soosette Creek subbasin had reached 8.5 percent by 1985.

Elsewhere in the subbasin, the land is predominantly rural but under increasing pressure of urbanization. The cities of Black Diamond, Covington and Maple Valley are all within the Urban Growth boundaries (UGB) of the Growth Management Act (GMA) as adopted by King County Ordinance 11575 in August 1994 (Appendix C, Map 1). The UGB is a 20-year growth and development line.

The entire subbasin is currently one of the most rapidly developing in the county. As such, these lands are expected to see increased urbanization and the demands on habitats. It should be expected that adverse impacts would increase, especially in those areas inside the UGB. The Soos Creek Basin Plan (King County, 1990) predicted that under future conditions, the flood peaks with a reoccurrence interval of two years would increase up to 3.5 times with an average of 1.8 times over 1985 land use.

NON-NATIVE SPECIES

ANIMALS

Several non-native fish species (primarily warmwater species) are known to be present in the subbasin lakes (table Soos-4). It is not known what adverse impacts these fish have on salmonid populations in this subbasin. However, small- and large-mouth bass and yellow perch are pisceverous and it should be expected that salmonids will make up a portion of their prey.

Table Soos-4. Non-native Fish Species Present in Soos Creek Subbasin.	
Lake/Creek Name	**Fish Species Present**
Meridian Lake	LMB, SMB, PS, YP, BBH
Lake Sawyer	LMB, SMB, BC, YP, BBH
Shadow Lake	LMB, BC, PS, YP
Soosette Creek[1]	BC
Jenkins Creek[1]	PS, C
Unnamed tributary 0089[1]	PS
Unnamed tributary 0090[1]	PS, SMB, BC
Soos Creek[2]	BC, LMB
C = Catfish BBH = Brown Bullhead BC = Black Crappie LMB = Large-Mouth Bass 1 Source: Nelson 2000. 2 Source: Wilson 1999.	PS = Pumpkinseed SMB = Small-Mouth Bass YP= Yellow Perch

PLANTS

Reed canarygrass (*Phalaris arundinacea*) is abundant throughout this subbasin. King County conducted a mapping project to assess the existing and potential threats of invasive, non-native aquatic plants in King County Lakes during 1994 and 1995. That report, published in 1996 (Walton 1996) examined lakes Lucerne/Pipe, Meridian, Morton, Sawyer, Shadow, Shady, and Wilderness in this subbasin and found Eurasian watermilfoil (*Myriophyllum spicatum*) in Lucerne/Pipe, Meridian, Sawyer, Shadow, Shady and Wilderness lakes. Hydrilla (*Hydrilla verticillata*) was identified in Lucerne/Pipe lakes during the 1994 survey. At that time, this identification was the only known infestation in the Pacific Northwest and represented the northern-most occurrence of the plant in North America. Eradication efforts, while successful in reducing total biomass, have not fully eliminated this non-native from these lakes. Purple loosestrife (*Lythrum salicaria*) was identified in Lucerne/Pipe and Meridian lakes.

The survey was not inclusive of all the lakes and ponds in the subbasin. It is not clear what adverse impacts these non-native plant species have on salmonids in this subbasin.

HYDROMODIFICATION

The Soos Creek Basin Plan indicated that channelization has occurred since the early 1900s in the upper Soos Creek system (King County 1989). However, no specific information on the extent and location of bank protection structures was located. No levees maintained by King County or the USACE appear in the GIS database.

Local channelization has occurred in streams in the upper plateau since the early 1900’s. No quantitative data has been collected that shows the loss of stream habitat in this subbasin. The result has been the overall reduction of channel complexity, reduction of diversity and abundance of aquatic organisms (King County 1989).

OFF CHANNEL HABITAT

None of the published literature on Soos Creek describes off-channel habitat either qualitatively or quantitatively (Williams et al. 1975; Goldstein 1982; King County 1989). Available aerial photograph coverage of Soos Creek is 1:12000 scale or larger, and except for the lower reaches, the channel was generally obscured by vegetation, thus no information is currently available to assess either the historic or existing extent or condition of off-channel habitat.

Within the floodplain, the Soos Creek subbasin has one of the largest wetland areas in the Green River basin. Wetland complexes are common throughout the upper plateau of Soos Creek and include open-water, scrub-shrub, forested, emergent marsh, wet meadow and bog wetlands. Wetland surveys conducted by King County (King County 1986, 1987a, 1987b) listed over 225 individual wetlands in the Soos Creek subbasin. These wetlands covered approximately 2,076 acres (4.8 percent of the land area in the subbasin). When combined with the lakes in the system over 3,436 acres of the subbasin area are covered with water (7.7 percent of the land in the subbasin).

There has been a trend of filling and draining of wetlands to create agricultural lands, mine peat and create building sites. A comparison of aerial photographs from 1936 to 1995 showed extensive draining and/or filing of wetlands. The loss of wetlands appeared to peak in the mid to late 1960s, when approximately 800 acres disappeared in the upper plateau area of Soos Creek (King County 1990).

The draining and filling of wetlands is still occurring despite regulatory protection (King County 1990). Edge encroachment is also another threat, particularly to the larger wetlands. The cumulative effect of the long-term historic loss is difficult to quantify, but is known to adversely impact groundwater recharge and create greater magnitude and duration flood events.

FLOODPLAIN CONNECTIVITY

Outside of the plateau area (RM 5.0), streams within this subbasin have not had significant modifications to their historic floodplains. There are no identified out-of-subbasin water diversions or regional flood control facilities present. However, Lake Youngs acts as a reservoir for water diverted from the Cedar River and does supply some base flow to Little Soos Creek (Nelson 2000). Immediately downstream of Lake Wilderness, water from Jenkins Creek is pumped to irrigate a golf course and the creek is often dry (King County 1990). Most of the stream channels are formed near their historic channels with only limited changes in the vicinity of road crossings.

The lower 2.5 miles of Soos Creek downstream of the confluence with Covington Creek has typical floodplain geomorpholgy. The channel in this segment is 30 to 40 feet wide (King County 1989) and occupies an alluvial valley that is approximately 500 to 800 feet wide. However, there is channel constriction, due to bank hardening, to protect roads, residential and hatchery development throughout this reach. No information was located describing the current or historic extent of the floodplain in lower Soos Creek, and it is unknown whether bank armoring or disconnection of off-channel habitats have influenced off-channel habitat connectivity. The increased flashiness of the flow regime (Section 5.1.1) has most likely increased the frequency at which floodplain surfaces are inundated, but reduced the duration of time that water is present, thus reducing floodplain recharge. Agriculture and rural development are also hypothesized to have impaired floodplain function in portions of this segment, but the extent of these impacts are unknown at this time.

Flood plains in most parts of the system are predicted to widen, some by more than twice their current width, due to increases in peak stream flows from eventual basin build-out (King County 1990).

KEY FINDINGS AND IDENTIFIED HABITAT-LIMITING FACTORS

- There is a general lack of habitat information for this subbasin, especially since the mid 1980s.

- The subbasin is undergoing a rapid transition from forest and rural to urbanization, resulting in a disturbed hydrological regime that leads to salmon habitat degradation.

- Summer low flow discharges are decreasing, which limits available rearing production for species of salmonids that require over-summer residency.

- Due to the King County Basin Plan and other efforts, this subbasin is the best studied of any downstream of Howard Hanson Dam. The existing monitoring and modeling information may make this an ideal basin to direct future studies, especially in the areas of land use and associated impacts upon salmonids (i.e., an indicator subbasin).

- The hatchery rack operation near the mouth of the subbasin has disturbed the natural migration patterns of all salmonids in the subbasin. Hatchery strays (chinook and coho) into the subbasin may be interfering with native subbasin fish spawning success.

- Future water quality and sedimentation impacts from increasing urbanization in the subbasin could threaten hatchery success.

- Although no quantifiable information was available, it was the professional judgement of Technical Advisory Group (TAG) members that the riparian buffer in this subbasin was insufficient. This is in at least partly due to historic land use practices.

- There is a lack of LWD throughout the streams in this subbasin.

- Although limited information was available, it was the professional judgement of the TAG that the increased frequency of flood flows attributed to increased impervious surfaces has been at least partially responsible for degrading salmon habitat through channel incision and excessive sedimentation. These degradations limit successful incubation by scouring and smothering redds and limit rearing by reducing channel complexity.

DATA GAPS

- Little data is available on hydromodifications or habitat in Soos Creek.
- Water quality (particularly during stormwater events) and potential adverse impacts to salmonids are unknown.
- Actual, instantaneous water use within the basin is not known.
- While there is insufficient data to determine if adequate gravel is present and of suitable quality for successful spawning, the available data does indicate that this is a concern that requires additional investigation.

EARLY ACTION RECOMMENDATIONS

- Comprehensive barrier surveys need to be completed in this subbasin.
- Comprehensive base-line habitat surveys should be initiated. These surveys should at a minimum include an inventory of LWD, riparian habitats present, quality and quantity of spawning gravels, quality and quantity of pool, an evaluation of streambank stability and associated mass wasting and erosion/sedimentation problems.
- The loss of stream channel due to channelization should be quantified.
- A flow analysis examining the impacts of seasonal high flow peaks and durations on salmonid production should be initiated.
- A water use and water level monitoring program should be established.
- Additional water flow data should be gathered to provide more certainty about long-term flow trends in this subbasin.

LIST OF TABLES