CHAPTER 8.
BASIN SUMMARY AND CHARACTERIZATION

8.1 SUMMARY OF FINDINGS

The findings on stream habitat, water quality, geomorphology, and flooding/erosion problems, as outlined in the preceding chapters, are summarized here to provide an overall characterization of existing conditions in the Patterson Creek Basin.

8.1.1 Stream Habitat

The Patterson Creek Basin consists of three main areas: the upland plateau, the steep ravines descending off the plateau, and the low-gradient mainstem in the valley along SR 202. Much of the area along the mainstem has been cleared for agricultural use and portions of the upper plateau have been cleared for residential use. Still the basin remains biologically diverse and contributes a significant portion of the Snoqualmie River wild coho salmon fishery. Coho, chinook, steelhead, rainbow trout and cutthroat trout inhabit the basin. Due to the rapid urbanization of the basin, it is important that critical reaches of habitat be protected or restored. A summary of each subbasin is provided below.

Subbasin 1

Subbasin 1 originates in a broad, low-gradient catchment on the upland plateau and descends through a steep ravine to the floodplain reach of Subbasin 2. The stream habitat is in fair condition despite channel incision up to 1 foot deep, localized scour down to the underlying silty sand substrate, embedded substrates, and sparse LWD (King County SWM 1993). Channel incision is likely to continue due to occasional flooding of the moderate-gradient channel combined with the lack of velocity calming stream components such as in stream boulders and LWD. The stream reach in Subbasin 1 is a mix of moderate-gradient mixed-control, palustrine, moderate-gradient contained, and alluvial fan channel types. The subbasin has been moderately impacted by residential development.

Fish passage barriers are the most significant limitation to salmonid production in Subbasin 1 and prevent access to approximately 2.5 miles of spawning and rearing habitat. Elimination of these passage barriers would open up substantial spawning habitat for salmonids and should be a high priority improvement measure. The stream channel and riparian alterations at the Stevlingson property are significant impairments to habitat conditions in the subbasin and provide an area of opportunity for habitat improvement projects. Restoration of habitat conditions on the property could produce a valuable segment of spawning and rearing habitat.

Aside from these specific areas of impairment, Subbasin 1 remains relatively intact; and measures should be taken to maintain the subbasin's hydrologic and riparian integrity.

Subbasin 2

Subbasin 2 includes the mainstem of Patterson Creek from RM 2.7 to RM 8.3 and numerous lateral tributaries, including five Class 2 streams. In this reach, Patterson Creek is a low-gradient floodplain channel that has been highly impacted by land use practices. The once Sitka spruce, western red cedar, and hemlock dominated floodplain has been largely converted to agricultural land, leaving the riparian habitat in poor condition (King County SWM 1993). In addition, the stream has been channelized and dredged, altering the channel morphology and condition, as well as floodplain connectivity. Habitat complexity is limited by the lack of LWD in this reach. Historically, LWD was likely important for stream channel dynamics, the development of macro- and microhabitats, and providing cover.

The lateral tributaries are steep streams that flow off the surrounding slopes of the basin. They are susceptible to erosion and contribute fine sediment to the mainstem of Patterson Creek (King County SWM 1993). The most significant tributaries to Patterson Creek in Subbasin 2 in terms of fish production are Dry Creek and Tributary 0383. The habitat in the Tributary 0383 watershed is relatively intact, while the Dry Creek subbasin has been significantly impacted by development (King County SWM 1993).

Improvements to Patterson and Dry Creek in this subbasin should focus on restoring the riparian habitat and floodplain connectivity, and increasing habitat complexity in the channel. Replacing the culvert crossing of Patterson Creek at SR 202 would restore floodplain connectivity, and habitat improvements could be incorporated into the replacement project. The improvements would likely benefit juvenile rearing habitat and increase potential salmonid production. The lower quarter-mile of Dry Creek has the potential for some habitat improvement. However, the proximity of the roadway and steep banks limit the available space for restoration that can be done in this area. In addition, barriers at culverts on the upper reaches of Dry Creek that limit access to 1,137 feet of potential spawning habitat should be removed.

Subbasin 3

Canyon Creek, whose watershed makes up Subbasin 3, is a significant tributary for salmonid production in the Patterson Creek Basin. The Canyon Creek drainage is a forested watershed that originates on Grand Ridge, and has some of the best high-gradient channel stability and fish habitat in the Patterson Creek Basin (King County SWM 1993). The stream habitat is in relatively good condition, with clean gravel substrate, abundant woody debris, and high habitat complexity. The reach below RM 0.7 is the only significantly degraded portion of the subbasin, with degradation similar to other floodplain reaches in the Patterson Creek Basin. Canyon Creek is primarily a moderate-gradient, moderately contained channel type, with intermittent areas of palustrine channels.

Further development in this subbasin poses a threat to habitat conditions. This subbasin is partially within the Urban Growth Area Boundary of the City of Sammamish and has denser zoning than the other subbasins. The northwest corner of the subbasin contains R-6 and R-8 zoning. Zoning adjacent to Patterson Creek in this subbasin is R-1.The subbasin alteration analysis indicates that existing development in the upper watershed has altered the hydrology and negatively impacted the stream channel. Habitat projects in this subbasin should focus on preserving existing conditions and reducing the level of impact

related to riparian areas, culverts, and landscape alteration. Projects should include working with private landowners to improve the riparian habitat on their property, replacing problem culverts, and maintaining the natural hydrology. It is also important to verify that none of the culverts are barriers or are failing. Canyon Creek would also benefit from improvement of the riparian condition and increased LWD in the lower agricultural reaches.

Subbasin 4

Subbasin 4 includes Tributary 0377, a right-bank tributary to Patterson Creek at RM 1.2, and Tributaries 0378 and 0379, which are tributaries to 0377 draining the northeast slopes of Mitchell Hill. Subbasin 4 is the second largest of the subbasins in terms of stream miles. The upper stream channels are in good condition, with abundant cover and LWD, but the lower reaches pass through livestock pastures and have been degraded similarly to other floodplain channel reaches in the Patterson Creek Basin (King County SWM 1993). The streams in Subbasin 4 are primarily moderate-gradient mixed-control and moderate-gradient contained channel types.

Subbasin 4 is an important subbasin of the Patterson Creek Basin for its miles of stream spawning and rearing habitat. However, the integrity of the habitat has been impaired by fish passage barriers and degradation of the riparian area. These impairments are the most significant limiting factors to salmonid production in Subbasin 4 and should be addressed. Improvement of the riparian habitat in degraded areas is necessary for restoration of the stream to a healthy stream channel. Removal of passage barriers is also necessary so that the entire potential stream habitat area in the subbasin can be used by salmonids.

Subbasin 5

The primary stream in Subbasin 5 is Patterson Creek from its confluence with Canyon Creek to the Snoqualmie River, but the subbasin also contains Tributary 0381. The stream banks of Patterson Creek in this subbasin are dominated by agriculture and pastureland, with little or no riparian vegetation (King County SWM 1993). Channelization, deepening, dredging, and livestock trampling have severely degraded the channel and stream banks through this reach. The scarcity of LWD contributes to low habitat complexity and poor channel conditions. Tributary 0381's drainage area remains a forested watershed, but fish passage barriers limit the use of habitat (Haring 2002). In Subbasin 5, the mainstem of Patterson Creek is a floodplain channel type, and Tributary 0381 is a moderate-gradient, mixed-control channel type.

Projects in this subbasin should be directed toward restoring natural stream and floodplain function. Tributary 0381 contains over 1 mile of habitat, of which a large portion is in good condition but inaccessible due to a passage barrier. Removal of this barrier should be a priority action and would quickly increase the amount of habitat accessible to salmonids.

8.1.2 Geomorphology

Soil types in the Patterson Creek Basin can be grouped into upper, middle, and lower reaches. The predominant soils in the upper reach and plateau area of the watershed are in the Alderwood association. Middle reach soils are predominantly in the Alderwood-Kitsap-

Indianola association. Soils in the lower reach near the confluence with the Snoqualmie River are predominantly of the Oridia-Seattle-Woodinville association.

The total drainage area of the basin is 12,711 acres and the elevations vary from 1,400 feet above mean sea level to 70 feet at the confluence of Patterson Creek and the Snoqualmie River.

The basin areas to the north and east are relatively flat, draining Union Hill and the Sammamish Plateau. Many of the tributaries originate in upland lakes or wetlands. The basin area to the south is relatively steep, draining the north slope of Mitchell Hill. The basin area to the west originates near 264th Avenue NE and is moderately steep as it drains to Patterson Creek. The main channel of Patterson Creek is relatively flat with lateral wetlands extending nearly the entire length of the system from Redmond-Fall City Road to the confluence with the mainstem of the Snoqualmie River. Agricultural development in the Patterson Creek Valley has modified the creek channel by straightening it and removing vegetation.

Each subbasin was analyzed based on current and future land use. All of the subbasins except Subbasin 1 have less than 65 percent forest cover. The overall forest cover for the basin is about 57 percent. The EIA in each subbasin is well below 10 percent for current conditions. At future buildout conditions, the EIA is expected to increase in all subbasins, most dramatically in subbasins 2C and 3, which are expected to see increases of 63 and 76 percent, respectively, from 4.9 to 8 percent in subbasin 2C and from 4.6 to 8.1 percent in subbasin 3. The EIA in Subbasin 2B is expected to increase only about 5 percent. This analysis suggests that the Patterson Creek Basin is more impacted by reduction of forest cover than by increase in impervious area.

8.1.3 Water Quality

Patterson Creek near Fall City is classified as a Class A freshwater stream. Patterson Creek was listed as an impaired water body in the 1994 Washington State Department of Ecology 303 (d) list. A total maximum daily load (TMDL) plan was established in 1996, and Patterson Creek is no longer listed as an impaired water body. The TMDL plan is still in place.

The most recent 303(d) report indicates turbidity and fecal coliform as the areas of greatest concern in the Patterson Creek Basin. These nonpoint sources of pollution are not surprising given the agricultural and clearing practices within the basin. These types of problems can be addressed partly through riparian and streambank restoration and protection and will require BMPs for many practices.

Eleven King County sampling stations and one WDOE station were used to evaluate the water quality of Patterson Creek. All sampling stations had excursions beyond the criteria for Class A freshwater streams, some more substantially than others. Dissolved oxygen content was below the 8 mg/l lower limit at 10 of the 11 sampling stations. Five stations had minimum pH readings below the 6.5 lower limit; three stations had minimums at or near the 6.5 lower limit. Average and maximum temperatures were below the maximum of 18°C. However, two stations were approaching the limit. Riparian plantings in these areas could help stop temperature from increasing. Turbidity readings were relatively high at

three stations. Most locations showed high turbidity during periods of overcast skies and rain. Fecal coliform was observed at the WDOE station. The geometric mean was 103 colonies per 100 ml, which is just above the 100 colonies per 100 ml standard. More than 10 percent of the measurements were over 200 colonies per 100 ml. Sampling for nutrients, fecal coliform, and other parameters as they relate to agriculture and open space management is recommended.

8.1.4 Flooding and Erosion

A list of high priority flooding and erosion problems was identified in three categories:

- **Channel incision within the steep canyon reaches**—Along these reaches, upstream development has increased the flow rate in the ravine. This increased flow rate, along with clearing activities, has caused several sections to begin experiencing accelerated erosion and channel incision. This problem is particularly evident on the lower reaches of Dry Creek along Ames Lake Road.
- **Insufficient capacity under road crossings**—Due to the increased flow rate in the basin and the placement of roads and driveways within the floodplain, there are numerous culverts that do not have sufficient capacity to pass high flows without flooding or overtopping. Patterson Creek has two undersized culverts in Subbasin 1. One is perched, creating a complete fish barrier; the other is undersized and tends to clog with debris, causing flooding and creating a partial fish barrier. The culvert crossing of Patterson Creek under SR 202 is undersized, as are several driveway culverts in the midsection of Subbasin 2. Flooding at several of these problem areas cuts off the main source of access to a number of residents.
- **Mainstem flooding**—There is a significant amount of flooding along the mainstem of Patterson Creek during large storm events. This flooding, although natural for a low gradient stream, has significant impact to residents along the stream, many of whom cross the floodplain as their primary means of access. Contributing factors to mainstem flooding include:
  - Backwater effect from the Snoqualmie River
  - Increased flows
  - Reed canary grass choking the channel capacity and reducing the ability of the channel to cut new channels around barriers such as beaver dams
  - Beaver dams

8.2 WATERSHED VULNERABILITY ANALYSIS

The Center for Watershed Protection (CWP) developed an eight-step analysis for assessing the environmental condition of subbasins and their suitability for efforts to improve those conditions. The analysis classifies subbasins as one of the following:

- Sensitive—Impervious cover is less than 10 percent of the subbasin's area and streams are of high quality, with excellent habitat and water quality.
- Impacted—Impervious cover is 10 to 25 percent of the subbasin's area and streams show signs of degradation attributable to urbanization, such as higher storm flows, unstable banks, reduced habitat and diminished water quality.
- Non-Supporting—Impervious cover exceeds 25 percent of the subbasin's area and streams can no long support diverse biological communities.

In addition to classifying the subbasins as one of these three categories, the analysis defines each basin as restorable (having enough retrofit potential for meaningful improvements in hydrology and pollutant loading) or not. The eight-step analysis provides the following information for each subbasin:

- An initial classification, based solely on impervious area
- A final classification, based on more detailed assessments of conditions along the stream corridor and throughout the subbasin
- A ranking of subbasin vulnerability to impacts from future changes, based on expected future development

Appendix E includes the CWP's description of the analysis process and a spreadsheet showing the results for the subbasins in the Patterson Creek Basin. Table 8-1 summarizes these results.

TABLE 8-1.
RESULTS OF WATERSHED VULNERABILITY ANALYSIS

Subbasin	Classification		Vulnerability Rank[a]
	Initial	Final	
1	Sensitive	Sensitive Restorable	3
2	Sensitive	Sensitive Restorable	4
3	Sensitive	Sensitive Restorable	1
4	Sensitive	Sensitive Restorable	2
5	Sensitive	Sensitive Restorable	5

a. 1 = most vulnerable to impacts from future development.