Volume II, Chapter 18
Columbia Gorge Tributaries Subbasin

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18.0 Columbia Gorge Tributaries Subbasin

18.1 Subbasin Description

18.1.1 Topography & Geology

For the purposes of this analysis, the Columbia Gorge subbasin includes the tributaries in the Columbia Gorge between Bonneville Dam and the White Salmon River, excluding the Wind River and the Little White Salmon River, which are addressed in separate sections. The subbasin is located within Skamania County and is in Washington State Water Resources Inventory Area (WRIA) 29.

Rock Creek is the largest watershed in this subbasin at 43 mi^2. The headwaters of Rock Creek originate near Lookout Mountain at an elevation of over 4,000 feet. The terrain is generally very steep, with incised drainages (USFS 2000). The river empties into Rock Cove on the Columbia River just west of Stevenson, Washington. A few small tributaries enter the Columbia east of Rock Creek, including LaBong Creek, which is the water source for Stevenson. Carson Creek, which flows through Carson, WA, enters the Columbia just west of the Wind River. Between the Wind and the White Salmon Rivers are also a few tributaries, with Dog Creek being the largest.

Geologic history in the area consists of the extensive flood basalts of the Columbia River Basalt Group, which date back 6-17 million years ago. The stratovolcanoes of the Cascades began to build in the Quaternary Period. Mt. Adams and vicinity was a large site of Quaternary volcanic activity that produced some large lava flows down ancient river valleys in the subbasin. Late Miocene and Pliocene compression created the Yakima fold belt that gave rise to much of the topography of the Columbia Gorge. Syncline and anticline features have shaped the topography of most of the stream systems. Glacial floods (Bretz Floods) dating back 12,700-15,300 years ago funneled through the Columbia Gorge and deposited alluvium in lower elevation areas (Welch et al. 2002). In portions of the Rock Creek and LaBong Creek basins (near Stevenson) there is instability associated with what is known as the Bonneville Landslide. This feature involves the slippage of large blocks of conglomerate material on top of underlying saprolite (soft, clay-rich decomposed rock) (Welch et al. 2002) and contributes to instability in the area.

18.1.2 Climate

The climate is typified by cool, wet winters and warm, dry summers. Air temperatures are moderated by marine air coming through the Columbia Gorge from the Pacific. However, in winter months, cold temperatures result from the influx of cold continental air masses from the east (Welch et al. 2002). Precipitation and temperature vary considerably from the western to the eastern edge of the subbasin. Mean annual precipitation ranges from 77 inches at Bonneville Dam to 30 inches at Hood River, OR (WRCC 2003). Orographic lifting of marine air masses results in high precipitation values near the Cascade crest (western portion of subbasin), whereas eastern regions receive less precipitation due to rainshadow effects.

18.1.3 Land Use/Land Cover

The Rock Creek basin is predominantly forestland (93%), much of it within the Gifford Pinchot National Forest. Western hemlock forest associations dominate the basin, with pacific silver fir forests in the uppermost portion of the watershed. The large Yacolt Burn in 1902 destroyed much of the forest vegetation in the basin. More recently, timber harvests have served to reduce forest cover. Late-successional forests make up only 16% of the basin and early-seral conditions make up 23% of the basin. Rural residential development in the lower basin is increasing.

The smaller stream systems in the basin are mostly within private lands in either rural residential use or small-scale timber production. Lower Rock Creek and smaller streams to the east are impacted by urban development in the town of Stevenson. Carson Creek is impacted by small-scale urban development in and around the town of Carson. A breakdown of land ownership in the basin is presented in Figure 18-1. Figure 18-2 displays the pattern of landownership for the basin. Figure 18-3 displays the pattern of land cover / land-use.

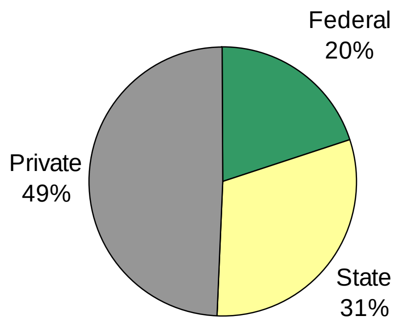

Figure 18-1. Columbia Gorge Tributaries land ownership

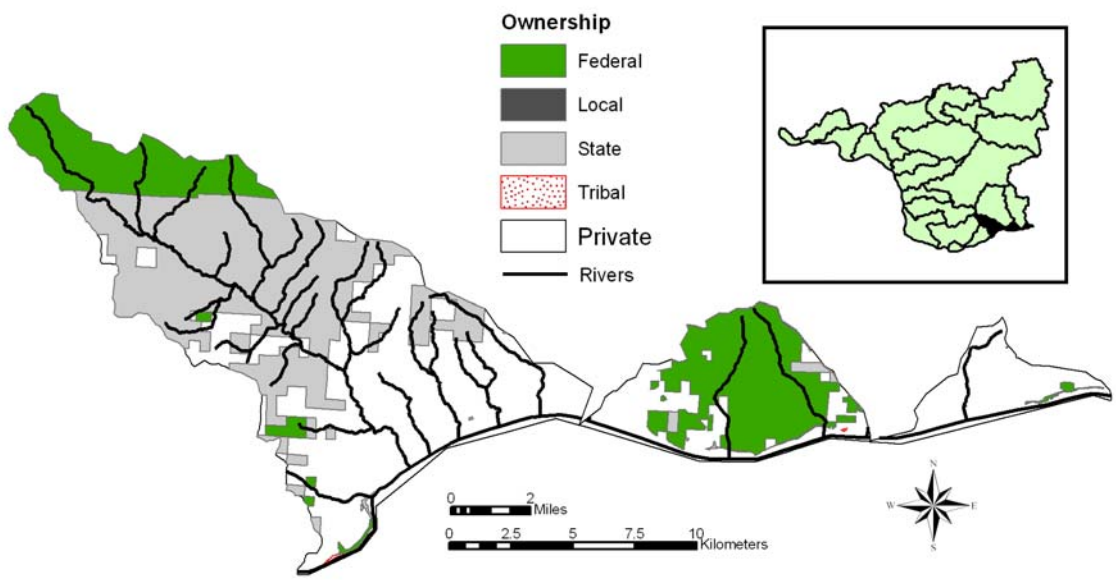

Figure 18-2. Landownership within the Columbia Gorge tributaries basin. Data is WDNR data that was obtained from the Interior Columbia Basin Ecosystem Management Project (ICBEMP).

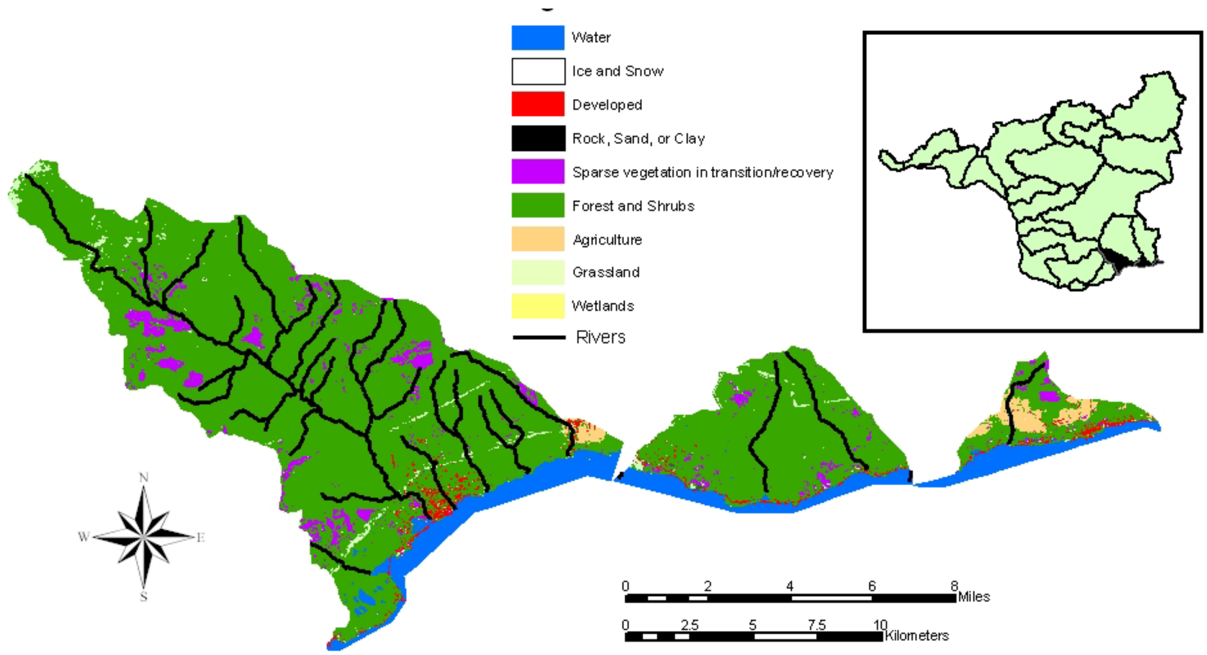

Figure 18-3. Land cover within the Columbia Gorge tributaries basin. Data was obtained from the USGS National Land Cover Dataset (NLCD).

18.2 Focal Fish Species

Small numbers of fall chinook and steelhead use the lowermost portions of the large tributaries in this subbasin. These chinook and steelhead are subcomponents of populations of adjacent large systems.

18.3 Potentially Manageable Impacts

The Potentially Manageable Impacts have not been assessed for the Columbia Gorge Tributaries subbasin.

18.4 Hatchery Programs

There are no hatchery programs in the Columbia Gorge Tributaries subbasin.

18.5 Fish Habitat Conditions

18.5.1 Passage Obstructions

Several passage barriers were identified in the 1999 Limiting Factors Analysis for WRIA 29 (WCC 1999). Lower Rock Creek Falls at river mile (RM) 1 is a natural barrier that restricts passage to all anadromous species. Foster creek, which flows into the western part of Rock Creek Cove, has a culvert and a dam/pond that restrict passage. A natural cascade blocks passage in Carson Creek approximately 100 feet from its mouth. Collins Creek (Columbia RM 157.9) has a culvert under the railroad that may create a passage problem. Passage at the mouth of Dog Creek may be limited due to sediment buildup.

18.5.2 Stream Flow

Annual high flows in the Rock Creek basin typically occur in winter months, related to rain and rain-on-snow events. Based on WDNR classifications, approximately 49% of the basin is in the rain-dominated zone, 44% is in the rain-on-snow zone, and the remainder is in the snow-dominated zone. Coffin (USFS 2000) notes that in reality more of the basin may be within the rain-on-snow zone due to the funneling of cold air masses through the Gorge from the east during winter. There are no streamflow records available for the Rock Creek basin; however, Welch et al. (2002) used streamflow records from the Wind River basin to estimate Rock Creek flows. High flows were estimated at near 280 cu ft per sec (cfs) for December and April, and below 40 cfs in September.

Many of the smaller stream systems have either very low perennial flow, seasonal flow, or ephemeral flow. Information is lacking on specific hydrologic characteristics of these streams.

Information on changes to runoff conditions is only available for the Rock Creek basin. Approximately 30% of the basin is in early successional or non-forest conditions, potentially increasing the amount of snowfall accumulation and melt rates, which can increase peak flow volumes. High road densities is the basin may also have altered runoff conditions. The upper Rock Creek, Spring Creek, and lower Rock Creek basins all have road densities of over 4 mi/mi^2. An analysis of the relative risk of increased peak flows was assessed by the USFS using vegetation condition, road density, and elevation. Based on the results, two of the nine watersheds, upper Rock Creek and Spring Creek, were identified as being susceptible to an increase in peak flows (USFS 2000). Using an analysis developed by the Washington Department of Natural Resources, which models flows using USGS Regional Regression

Equations, current peak flows in the various watersheds were estimated to be 1 to 13 percent higher than those expected under fully forested conditions (USFS 2000).

Information is lacking on runoff conditions for other streams within the subbasin. In general, forest vegetation is younger than historical conditions or has been removed completely. Many of the streams, in particular Carson Creek, have suffered from a dramatic increase in percent of basin area with impervious surfaces, likely increasing runoff rates and peak flow volumes. The Carson / Nelson Creek basin also has a very high road density of 5.25 mi/mi^2.

An assessment of the adequacy of low flows for fish was evaluated using the toe-width method on lower Rock Creek and Carson Creek in 1998. Spot flows measured from late August to early November on Rock Creek were well below optimum flows for salmon and steelhead spawning. Flows were approximately 70% of optimum for salmon and steelhead rearing. Flows in lower Carson Creek for the same time period were even further below optimum levels for spawning and rearing (Caldwell et al. 1999).

18.5.3 Water Quality

Limited water quality data is available throughout the subbasin, and is restricted primarily to Rock Creek. A one-day, spot sampling effort on Rock Creek recorded a temperature of 57ºF (14ºC) 2 miles downstream of the National Forest boundary and 70ºF (21ºC) at the mouth (USFS 2000). It was suggested that low shading or input of geothermal water might be causing high temperatures in the lower river. Another sampling effort, conducted by Fishman Environmental Services (1997), recorded 63ºF (17ºC) at the mouth of Rock Creek and 77ºF (25ºC) at the west end of Rock Cove. Investigators also noted that runoff from the surrounding urban area may be degrading water quality in Rock Cove. There may also be concerns related to the Skamania Lodge Golf Course and the County Dump that was located where the lodge now stands (Michaud 2002). The 1999 Limiting Factors Analysis noted that Nelson Creek, which flows through Stevenson and enters the Columbia at RM 151.5, suffers from water quality degradation related to road runoff and land development.

18.5.4 Key Habitat

Information gathered on the lower mile of Rock Creek as part of a Rock Cove assessment (Fishman Environmental Services 1997) noted that this reach is generally undisturbed by human activities.The habitat is mostly riffles with few pools, though there are side channels that provide rearing habitat. Information on in-stream habitat is lacking for Rock Creek from above the lower falls to the National Forest boundary. Above this, the USFS gathered habitat data in 1997. The survey revealed a pool frequency of 20 pools/mile, lower than reference levels but potentially a natural condition. Nearly half (45%) of the pools were deeper than 3 feet. A total of eight side channels and three braids were observed (USFS 2000).

18.5.5 Substrate & Sediment

Coarse bedload from landslides has been observed in the upper Rock Creek basin (WCC 1999). USFS stream survey data (1997) revealed less than 12% fines in reaches in the upper basin. Overall, in the upper basin, gravel/cobble substrates dominate the upper and lower sections and bedrock substrate dominates the middle section (USFS 2000).

The first mile of Rock Creek has been identified as having limited spawning gravels (Fishman Environmental Services 1997). Grant Lake Creek, which enters the Columbia at RM 158.4 and supports winter steelhead spawning, has sediment accumulations related to natural landslides in the upper basin (WCC 1999).

The same vegetation and road conditions that make a basin susceptible to peak flow alterations can also modify sediment transport dynamics. Rock Creek has high road densities in portions of the basin, especially in the upper basin, which also has many immature forest stands. These conditions may increase sediment production from hillslope sources and can increase delivery rates to stream channels. Stream turbidity and excess coarse bedload volumes have been attributed to landslides in the upper basin, especially along the Washington DNR 2000 Road (WCC 1999).

Sediment supply conditions were evaluated as part of IWA watershed process modeling, which is presented later in this chapter. The IWA indicated that 1 of the 9 subwatersheds rated "impaired" with respect to landscape conditions influencing sediment supply. Six subwatersheds were rated as "moderately impaired" and 2 were rated "functional". The greatest impairment was in the upper Rock Creek basin and is due to high road densities on steep, erodable slopes on WDNR lands.

Sediment production from private forest roads is expected to decline over the next 15 years as roads are updated to meet the new forest practices standards, which include ditchline disconnect from streams and culvert upgrades. The frequency of mass wasting events should also decline due to the new regulations, which require geotechnical review and mitigation measures to minimize the impact of forest practices activities on unstable slopes.

18.5.6 Woody Debris

Only limited information exists for instream LWD and most of it is restricted to the Rock Creek basin. A total of only 6.5 pieces of LWD per mile were measured in the 4.3 miles surveyed in upper Rock Creek in 1997. This is about 8% of the NMFS standard for Properly Functioning Condition (USFS 2000). Poor riparian conditions create lack of LWD recruitment potential.

18.5.7 Channel Stability

Information is lacking on bank stability conditions for most of the subbasin. The Limiting Factors Analysis identified landslides in the Rock Creek basin related to the WDNR 2000 road (WCC 1999). USFS surveys in 1997 measured high width-to-depth ratios (31:1 in the upper Rock Creek basin and 16:1 in the Rock Creek Headwaters basin), revealing potential problems with sediment accumulation and subsequent bank erosion. Overall streambank condition in Rock Creek was rated good to fair (USFS 2000).

18.5.8 Riparian Function

Specific information on riparian conditions is limited to data collected by the USFS as part of the Rock Creek Watershed Analysis. Fire, logging, and splash damming have impacted riparian forests in the Rock Creek basin. Of the riparian reserves, 28% are in early-seral vegetation, with the lower Rock Creek basin having 47% in early-seral conditions. However, it should be noted that hardwoods are included in these early-seral vegetation numbers though they may be well-established hardwoods that colonized riparian areas following the large Yacolt Burn in the early 1900s (USFS 2000). Riparian conditions in other subbasin streams are largely undocumented.

Riparian function is expected to improve over time on private forestlands. This is due to the requirements under the Washington State Forest Practices Rules (Washington Administrative Code Chapter 222). Riparian protection has increased dramatically today compared to past regulations and practices.

18.5.9 Floodplain Function

Most streams in the subbasin have very little natural floodplain habitat due to the steep valley walls of the Columbia Gorge. The Bonneville Pool now covers much of the floodplain habitats that did exist. Floodplain areas are limited to the lower reaches of channels and have been impacted primarily by transportation corridors and residential and industrial development. SR-14 and the Burlington Northern Railroad cross most of the streams in the basin, constricting floodplains and altering natural channel dynamics.

18.6 Fish/Habitat Assessments

No Fish/Habitat Assessments have been completed for the Columbia Gorge Tributaries subbasin.

18.7 Integrated Watershed Assessment (IWA)

The Columbia Gorge Tributaries Watershed includes 9 subwatersheds, comprised of the Rock Creek drainage and several other independent tributaries that flow into the Columbia River between Bonneville Dam and the Little White Salmon River. These smaller drainages include the Nelson – Carson Creek drainage, and the Dog Creek drainage. Just over 50% of the watershed is publicly owned, with over 70% public ownership in the upper subwatersheds of Rock Creek (30202-30204), but less than 15% in the Nelson – Carson subwatershed (30402) and the Ashes Lake subwatershed (30401). Much of the private land in these subwatersheds is within the Columbia River Gorge National Scenic Area.

18.7.1 Results and Discussion

IWA results were calculated only for sediment conditions for subwatersheds in the Columbia Gorge Tributaries watershed. Geospatial data was unavailable for assessing hydrologic and riparian conditions. IWA results are calculated at the local level (i.e., within subwatershed, not considering upstream effects) and the watershed level (i.e., integrating the effects of the entire upstream drainage area as well as local effects). A summary of the results is shown in Table 18-1. The local and watershed level results are also shown in Figures ? and ?, respectively.

Table 18-1. Summary of IWA results for the Columbia Gorge Tributaries watershed.

Process Condition	Total Number of Subwatersheds	Local Level Conditions*			Watershed Level Conditions**		
		Functional	Moderately Impaired	Impaired	Functional	Moderately Impaired	Impaired
Hydrology	—	—	—	—	—	—	—
Sediment	9	2	6	1	0	8	1
Riparian	—	—	—	—	NA	NA	NA

Notes:
*Conditions within the subwatershed, not considering upstream effects.
**Conditions within the subwatershed integrating the entire upstream drainage area.
— No result determined because of a lack of available data.
NA Not Applicable

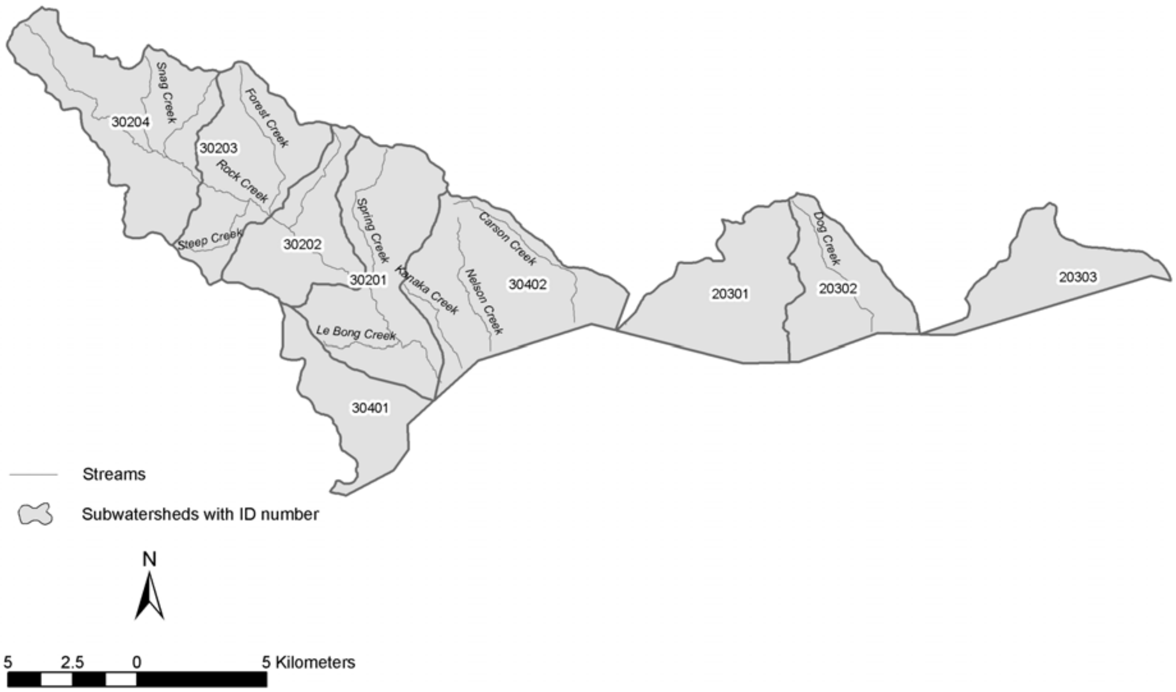

Figure 18-4. Map of the Columbia Gorge Tributaries showing the location of the IWA subwatersheds

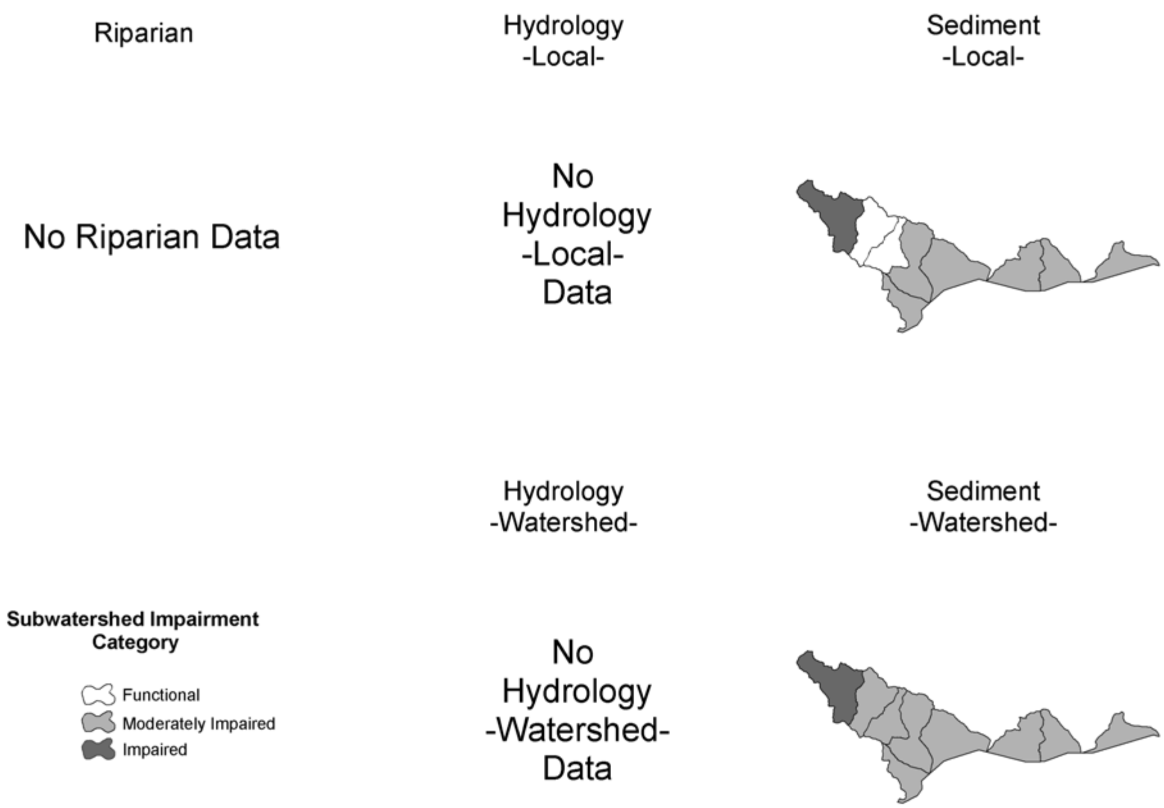

Figure 18-5. IWA subwatershed impairment ratings by category for the EF Lewis basin

18.7.1.1 Hydrology

IWA results were not developed for hydrologic conditions in the Columbia Gorge Tributaries watershed because of a lack of GIS based data for forest cover.

18.7.1.2 Sediment

Local sediment conditions are rated as impaired in one subwatershed, the headwaters of Rock Creek (30204). Impaired conditions in the Rock Creek headwaters are associated with high road densities in sensitive areas (steep, erodable slopes) on WDNR lands. IWA rates the upper and middle Rock Creek subwatersheds (30202 and 30203) as locally functional. When taking watershed level effects into account, the impaired sediment conditions in the Rock Creek headwaters causes degradation in these functional local level conditions, leading to rankings of moderately impaired for the upper and middle mainstem Rock Creek subwatersheds.

All other independent subwatersheds are terminal (i.e., no upstream subwatersheds) and are rated moderately impaired at both the local and watershed levels.

18.7.1.3 Riparian

IWA results were not developed for riparian conditions in the Columbia Gorge Tributaries watershed because of a lack of GIS based data for forest cover.

18.7.2 Predicted Future Trends

18.7.2.1 Hydrology

Public ownership in the upper portions of Rock Creek is high, and much of the lower subwatersheds are under federal management regulations as part of the Columbia River Gorge National Scenic Area. However, the drainage possesses high road densities in the headwaters and lower subwatersheds (greater than 3 mi/mi^2.), and there may be some additional development pressure between the cities of Stevenson and Carson, WA.

Although hydrologic conditions in the Columbia Gorge watershed could not be evaluated using the IWA analysis, overall, hydrologic conditions are expected to remain stable.

18.7.2.2 Sediment Supply

The extent of public lands ownership ranges broadly in these subwatersheds. Terminal, independent drainages have public ownership rates as low as 12%, whereas upper Rock Creek has over 95% of its total area in WDNR and USFS land. Because these subwatersheds all border the Columbia Gorge National Scenic Area, restrictive land use regulations will limit significant development or timber harvest. Given these conditions, the sediment conditions are predicted to trend stable over the next 20 years. Sediment conditions in Rock Creek will remain moderately impaired to impaired until headwaters sediment sources are addressed.

18.7.2.3 Riparian Condition

Streamside road densities exceed 1 mile/stream mile in lower Rock Creek (30201 and 30202), indicating that riparian recovery will be limited by the extent of existing roads.

Although riparian conditions could not be evaluated using the IWA analysis, overall, riparian conditions are expected to remain stable.

18.8 References

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