Deschutes River Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Upper Watershed Allocations

Discussion with the Deschutes TMDL Advisory Group
April 15, 2010

The full text of the October 2008 Technical Review Draft for the Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Water Quality Study Findings, can be found on the internet at:

http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/technical_reports/DeschutesBudd_TMDL_extrev1_1008.pdf

Additional information on the Deschutes TMDL is available on the Internet at:

http://www.ecy.wa.gov/programs/wq/tmdl/deschutes/index.html

Upper watershed begins at SR 507 (RM 20.5) and extends to headwaters.

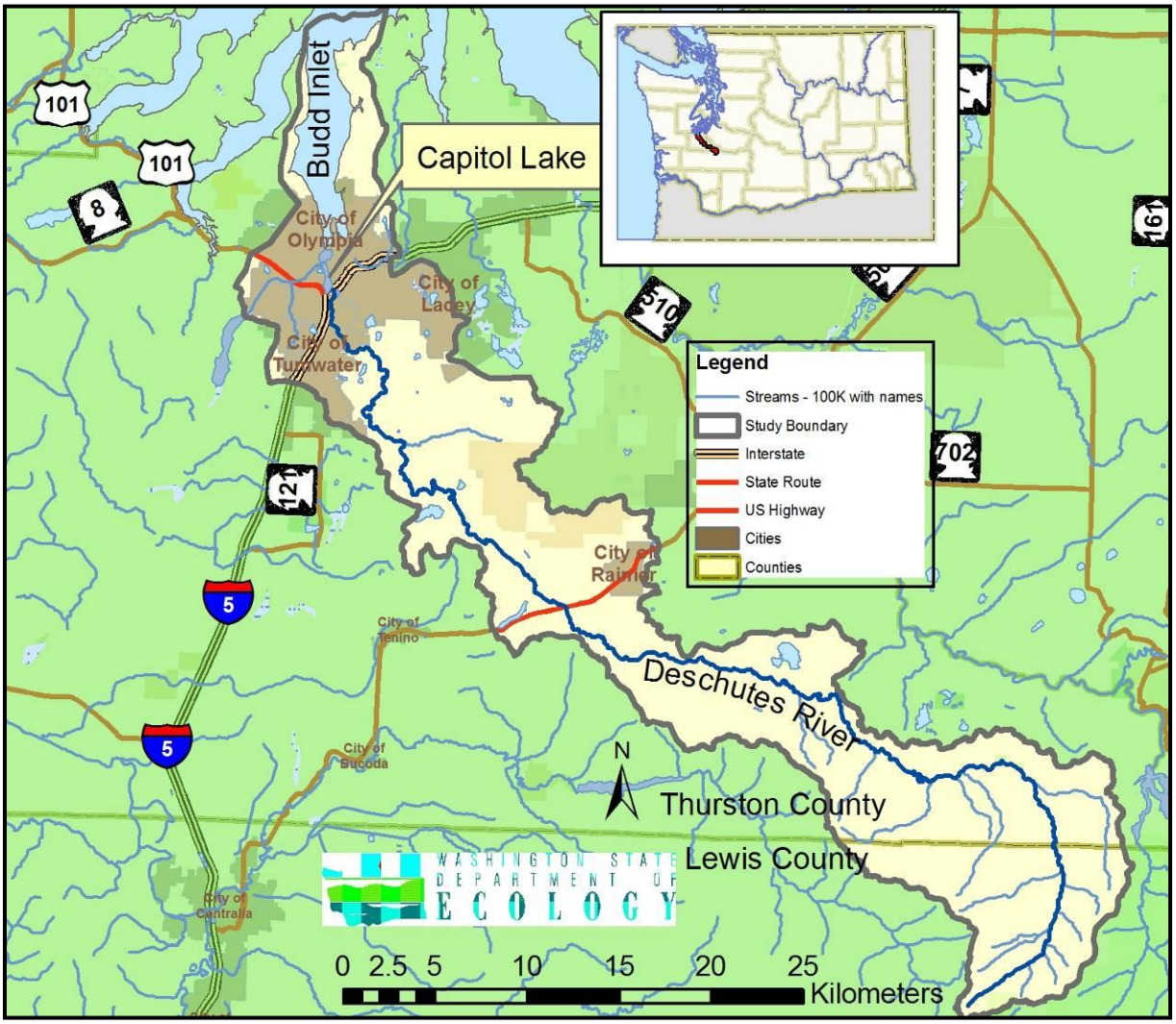

Figure 1. Deschutes River, Capitol Lake, and Budd Inlet TMDL study area.

Parameter: Fecal Coliform Bacteria

Target reductions may be either in terms of concentration, or load, or both. This TMDL is expressed in terms of fecal coliform concentration as allowed under 40 CFR 130.2(I) as "other appropriate measures."

Load Targets

Station	Count	Water Quality Standards Part 1				Water Quality Standards Part 2					Overall	
		Geomean	WQS Part 1	Meets?	% Reduction	% > WQS Part 2	WQS Part 2	Meets?	90%ile	% Reduction	Meets?	% Reduction
Deschutes River												
13-DES-28.6	12	56.1	100	meets		8.3%	200	meets	213		meets	
13-DES-20.5	10	89.2	100	meets		20.0%	200	**fails**	544	63%	**fails Part 2**	63%
Tributaries to Deschutes River												
13-HUC-00.3	10	10.0	100	meets		0.0%	200	meets	73		meets	
13-REI-00.9	16	102.4	100	**fails**	2%	18.8%	200	**fails**	620	68%	**fails both**	68%

Modified from Table 1. Target reductions necessary to achieve water quality standards within the Deschutes River, Capitol Lake, and Budd Inlet watersheds during the growing season (May through September).

Station	Count	Water Quality Standards Part 1				Water Quality Standards Part 2					Overall	
		Geomean	WQS Part 1	Meets?	% Reduction	% > WQS Part 2	WQS Part 2	Meets?	90%ile	% Reduction	Meets?	% Reduction
Deschutes River												
13-DES-28.6	18	8.1	100	meets		0.0%	200	meets	**50**		meets	
13-DES-20.5	14	6.5	100	meets		0.0%	200	meets	22		meets	
Tributaries to Deschutes River												
13-HUC-00.3	14	1.3	100	meets		0.0%	200	meets	3		meets	
13-REI-00.9	18	24.8	100	meets		5.6%	200	meets	160		meets	

Modified from Table 2. Target reductions necessary to achieve water quality standards within the Deschutes River, Capitol Lake, and Budd Inlet watersheds during the non-growing season (October through April).

Wasteload Targets

None recommended. Facilities covered by the Sand and Gravel General Permit are not expected to contribute significant sources of fecal coliform bacteria. No additional permit requirements are recommended beyond the good housekeeping practices outlined in the current permit.

Parameter: Temperature

Loading capacities for temperature in the Deschutes River watershed are expressed as solar radiation heat loads based on system potential vegetation.

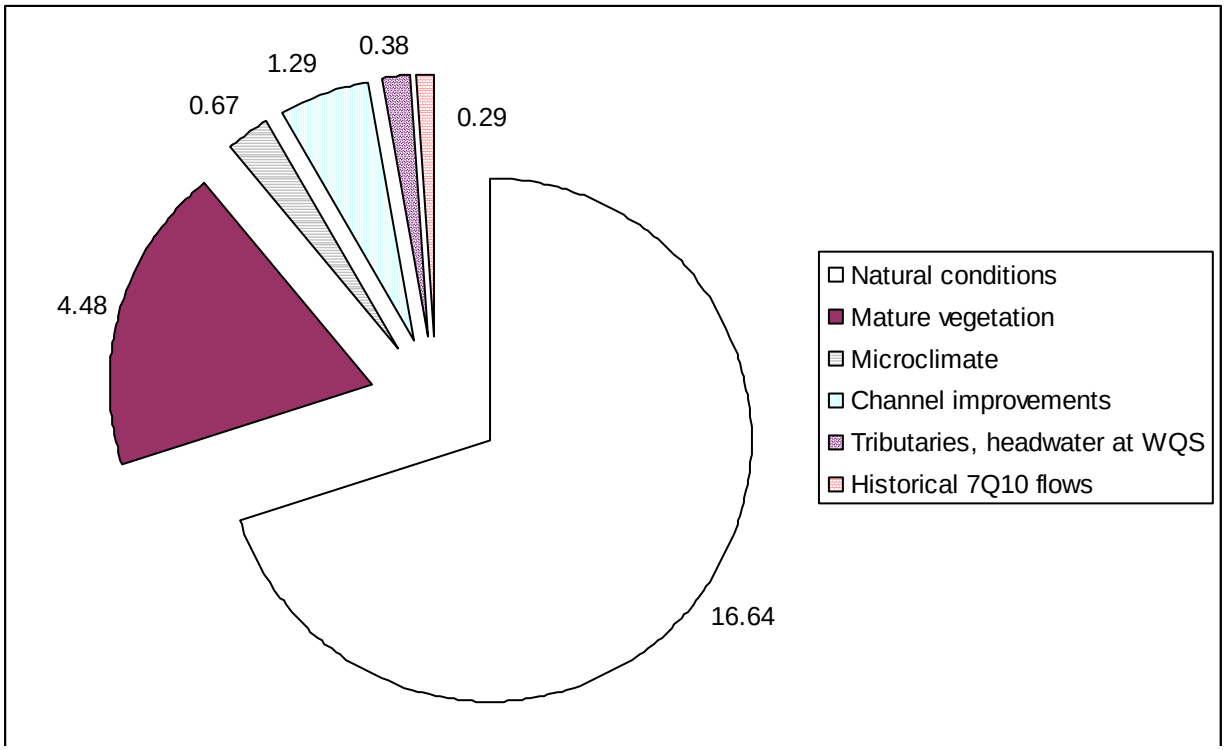

Figure 2. Temperature improvements (system-wide average Tmax ºC) associated with various management strategies.

Load Targets

Deschutes River km	Station	Description	7DADmax		WQS	Meets WQS?	Target (ºC)	Load target
			2003 (ºC)	2004 (ºC)				
3.7	13-THU-00.1	Thurston Creek at 3000 Rd.	16.72		16.0	no	16.0	Full mature riparian shade
4.4	13-JOH-00.1	Johnson Creek at 3000 Rd.	17.14		16.0	no	16.0	Full mature riparian shade
5.8	13-HUC-00.3	Huckleberry Creek at 3000 Rd.	15.62		16.0	yes		*
6	13-MIT-00.2	Mitchell Creek at 3000 Rd.	17.34		16.0	no	16.0	Full mature riparian shade
11.2	13-FAL-00.3	Fall Creek at 1000 Rd.	15.13		16.0	yes		
28.1	13-REI-00.9	Reichel Creek at Vail Loop Rd.	19.01		16.0	no	16.0	Full mature riparian shade
31.5	13-DES-22.7spr	Spring near Deschutes River 860 Rd.		11.81	16.0	yes		
35.8	13-SP1-00.1	Spring outlet at Highway 507	15.65		16.0	yes		

Modified from Table 3. Conditions in tributaries to the Deschutes River, including temperature load allocations for streams that do not meet the water quality standards.

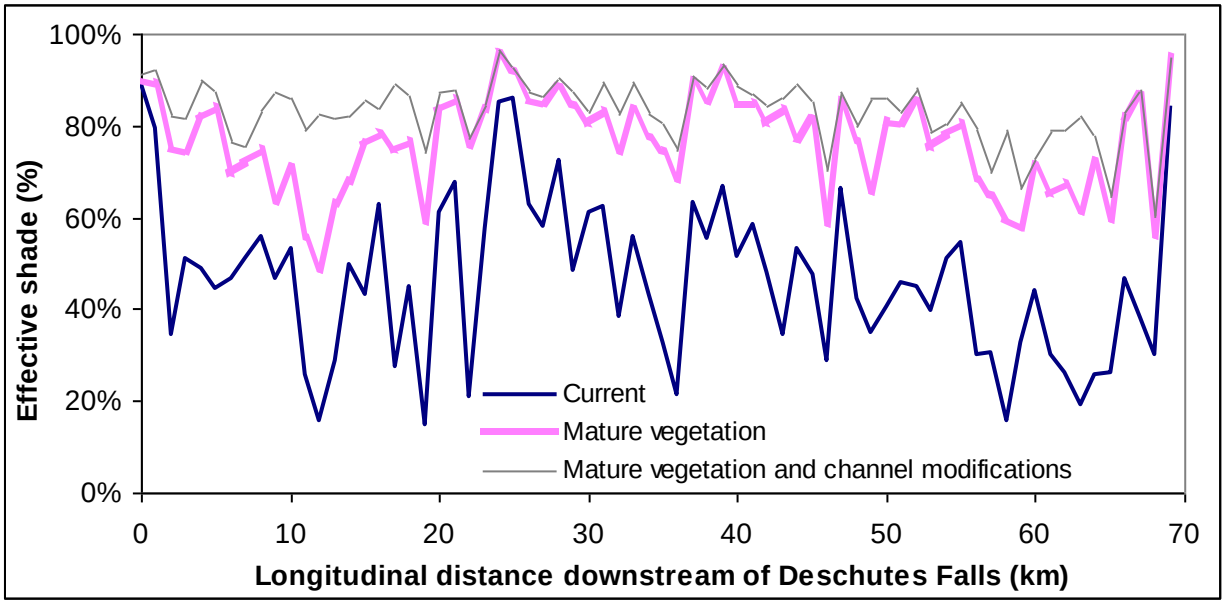

Figure 3. Effective shade targets for the Deschutes River with full mature riparian shade and with supplemental channel modifications.

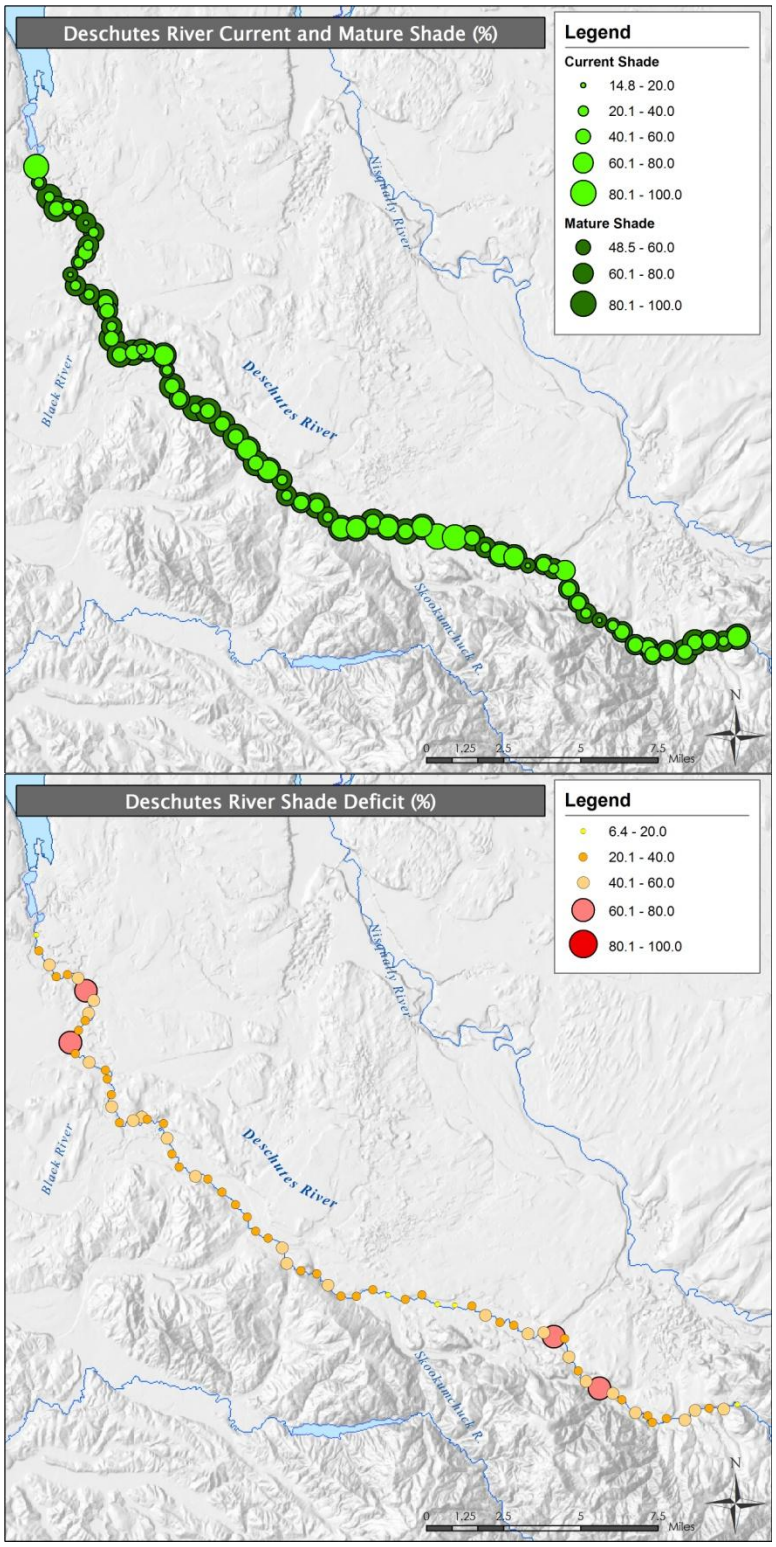

Figure 4. Shade from current and mature vegetation (top) and shade deficit (bottom) along the Deschutes River.

Wasteload Targets

None recommended.

Additional Temperature Considerations

In addition to the numeric load targets for effective shade in the Deschutes River watershed, the following narratives and management activities are recommended:

- Load targets are included in this TMDL for non-federal forest lands in accordance with Section M-2 of the Forests and Fish Report (USFWS et al., 1999). Consistent with the Forests and Fish Agreement, implementation of the load targets established in this TMDL for private and state forestlands will be accomplished via implementation of the revised forest practices regulations.
- These targets apply to the entire Deschutes River watershed, including the areas within the United States Forest Service (USFS) boundary.
- Tributaries also should achieve full mature riparian vegetation.
- For areas that are not managed by the USFS or in accordance with the Forests and Fish Agreement, such as private non-forest areas, voluntary programs to increase riparian vegetation should be developed. For example, riparian buffers or conservation easements may be sponsored by the U.S. Department of Agriculture, Natural Resources and Conservation Service, Conservation Reserve Enhancement Program. In particular, the area between RK12 and RK20 should be targeted for riparian and channel restoration.
- Instream flows and water withdrawals are managed through alternative regulatory structures and are not established in TMDLs. The designation of historical 7Q10 flows as the natural condition does not imply setting a minimum instream flow based on the analyses included in this report. However, stream temperature is affected by instream flow. Continued decreases in summer baseflows will have a detrimental effect on water temperatures in the Deschutes River, and enhancing baseflow by any means possible would decrease peak water temperatures in the river. Future projects that have the potential to increase groundwater or surface water inflows to streams in the watershed should be encouraged and have the potential to decrease peak water temperatures.
- Management activities that would decrease the load of sediment to the Deschutes River would benefit water temperature, due to the eventual improvement in channel characteristics. See the Fine Sediment TMDL for additional recommendations.
- While mature riparian vegetation eventually would provide large woody debris (LWD) to the channel, short-term restoration strategies should include increasing LWD abundance as one means to increase channel complexity. Increasing complexity would increase Manning's n, which modeling demonstrated would improve peak temperatures by enhancing hyporheic interactions even though higher residence time would increase time exposed to solar radiation.

- Existing hyporheic exchange flows and groundwater inflows significantly buffer the effect of solar radiation on water temperature. Factors that influence hyporheic exchange flow include the vertical hydraulic gradient between surface and subsurface waters as well as the hydraulic conductivity of the streambed sediments. Activities that reduce the hydraulic conductivity, such as accumulation of fine sediment, could increase stream temperatures. Management activities should reduce upland and channel erosion and avoid sedimentation of fine materials in the stream substrate. See the Fine Sediment TMDL for additional recommendations.
- Management activities that increase the amount of LWD in the Deschutes River system would assist in pool formation and will mitigate peak flows that wash out spawning gravels and contribute to channel downcutting and enhanced bank erosion. See the Fine Sediment TMDL for additional recommendations.

Parameters: Freshwater Dissolved Oxygen and pH

Loading capacities for DO and pH in the Deschutes River watershed are expressed as solar radiation heat loads based on system potential vegetation, in situ DO and pH in tributaries and the headwater, and nutrient inputs. Load targets are established in this TMDL to meet both the numeric threshold criteria and the allowances for human influences under conditions that are naturally lower in DO and higher in pH than those criteria.

Load Targets

Tributary	Target	
	DO min (mg/L)	pH min (SU)
Reichel	8.0	6.5

Modified from Table 4. Conditions in tributaries to the Deschutes River, including DO, pH, and nutrient load allocations for streams that do not meet the water quality standards for DO or pH.

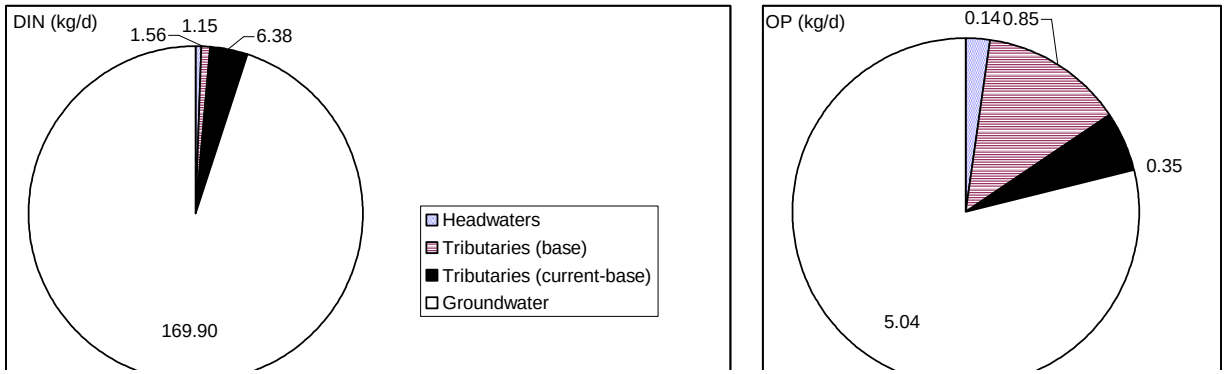

Figure 5. Nutrient load allocations (DIN and orthophosphate) under critical conditions for the Deschutes River.

Wasteload Targets

No numeric wasteload targets for nutrients were recommended for the Deschutes River DO and pH TMDLs for facilities covered by the stormwater general permits.

Parameter: Fine Sediment

Load targets are the nonpoint source reductions needed in the system, and the targets are expressed as percent reduction from current conditions.

The aquatic life uses to be protected in the Deschutes River include core summer salmonid habitat upstream of Offut Lake and salmonid spawning outside the summer season, rearing, and migration downstream of the lake. In the case of fine sediment, the loading capacity is determined by in situ values compared against habitat quality criteria defined by suitability for salmonid aquatic life uses.

Percent fine sediments in gravels	Habitat quality
>17%	Poor
12 to 17%	Fair
<12%	Good

Table 5. Habitat quality associated with various levels of fine sediments (<0.85 mm). Source: Washington Forest Practices Board (1997), Table F-2.

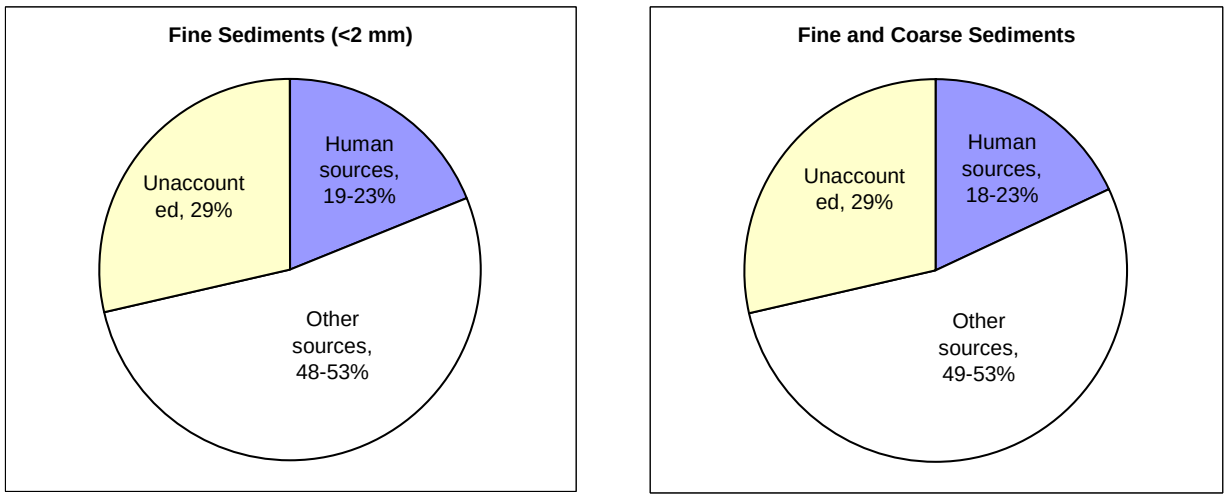

Figure 6. Fine sediments (<2mm) and all sediments by source from Raines (2007). Unaccounted sources represent the difference between loads to Capitol Lake determined from historical dredging and recent bathymetry and sediment inputs identified by Raines (2007).

Load Targets

Reach (River Kilometer)	Reach (Konovsky and Puhn, 2005)	1995 Levels	Current Levels	12% Target % Reduction	17% Target % Reduction
RK 12.2 to 18.7	19/WeyCo	15.4%	17.3%	-44%	-2%
RK 20.3 to 23.0	22/Lake Lawrence	22.5%	17.0%	-42%	0%

Modified from Table 6. Fine sediment load targets by reach for the Deschutes River watershed.

Wasteload Targets

Several facilities and geographic areas covered by general permits have the potential to contribute fine sediment to the system.

The Construction Stormwater General Permit requires that facilities discharging to waterbodies listed as impaired for fine sediment must conduct water quality sampling for turbidity.

The Sand and Gravel General Permit requires that facilities discharging to a 303(d)-listed waterbody cannot increase the loading of the listed pollutant, such as turbidity or fine sediment.