



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
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MEMORANDUM

SUBJECT: Puget Lowlands Reference Sites

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TO: Jennifer Wu,
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It is the objective of the Clean Water Act - to "restore and maintain the chemical, physical and biological integrity of the Nation's waters". The presence and numbers of the different types of benthic macroinvertebrates provide accurate information about the health of a stream and watershed. We used the Puget Lowlands ecoregion Index of Biotic Integrity (B-IBI) to assess stream health using macroinvertebrates.

In addition, substrate is an important feature of stream habitat. It provides cover and protection for juvenile fish, habitat for macroinvertebrates and habitat for spawning salmon. However, excess supplies of fine sediments can decrease both the abundance and quality of this habitat by filling spaces between gravels, cobbles and boulders. We assessed the percentage of the substrate composed of the combination of "fines" (particles smaller than 0.6mm in diameter) and "sand" (particles between 0.6 and 2mm) categories.

Unlike most water column variables neither macroinvertebrates nor fine sediment has numeric water quality criteria. However, they are both covered by Washington's narrative water quality criteria. To interpret and assess B-IBI and percent sand/fines at a site (such as Clarks creek), they must be compared to a benchmark or estimate of what one would expect to find if little human impact has occurred.

Ecoregions are areas of relative ecosystem homogeneity. They are based on soils, geology, elevation and other factors. Classification of waterbodies by ecoregion allows comparison of waterbodies with similar biological expectations. Clarks creek is in the Puget Lowlands ecoregion.

The reference condition represents streams that have the smallest amount of human caused stressors and it establishes the basis for detecting stream impairment. In a given ecoregion, reference sites are selected using a mixture of landscape, chemical and physical metrics, to represent streams that have been minimally exposed to human

influences. To develop the reference condition for an ecoregion, data is collected at several reference sites, and then it is combined to represent the range of expectations for streams that are least disturbed by human influences in the ecoregion (in this case the Puget Lowlands ecoregion). Then, other sites in the same ecoregion, such as Clarks creek, can be compared to the reference condition.

For our analysis, we were looking for reference sites in the Puget Lowland ecoregion that were minimally disturbed and that had a consistent data set for B-IBI and percent sand/fines. The data that we evaluated were collecting using the Status and Trends Monitoring for Watershed Health and Salmon Recovery: Field Data Collection Protocol (Ecology, 2009). The data was all collected under Quality Assurance Project Plans (QAPP). The reference sites that were used to develop the reference condition were: Big Beef Creek, Chuckanut Creek, Coal Creek, Coulter Creek tributary, Crandall Creek tributary, Dewatto River, Oyster Creek, and Surveyor Creek. We then used the range of data from all of these sites, not any one specific site, to compare to Clarks creek.

Site Description	Data collection year	Percent Fines (%)	Percent Sand and Fines (%)	Overall BIBI Score	% Urban in Watershed (upstream of sampling point)
Big Beef Creek	2009	3.5	12.1	no data	6.65
Big Beef Creek	2010	8.7	21.2	38	6.65
Chuckanut Creek	2009	4.3	16.5	no data	5.28
Chuckanut Creek	2010	2.6	23.4	no data	5.28
Chuckanut Creek	2011	0	15.2	no data	5.28
Chuckanut Creek	2012	no data	no data	38	5.28
Coal Creek	2009	26.5	27.8	44	0.96
Coal Creek	2009	21.7	44.3	44	1.02
Coal Creek	2010	13.9	28.3	38	1.13
Coal Creek	2011	0	17.3	38	0.96
Coal Creek	2012	no data	no data	46	0.96
Coulter Creek tributary	2009	32.9	36.4	40	1.11
Crandall Creek tributary	2009	8.4	36.6	44	0.32
Dewatto River	2009	13	14.3	no data	0.50
Dewatto River	2010	9.1	14.7	no data	0.50
Dewatto River	2011	1.8	8.6	42	0.50
Griffin Creek	2010	2.2	12.6	no data	0.21
Griffin Creek	2011	1.3	10.4	38	0.21
Griffin Creek	2012	no data	no data	38	0.21
Oyster Creek	2009	1.3	1.3	no data	0.21
Oyster Creek	2010	6.9	11.7	38	0.00
Surveyor Creek	2009	19	28.6	40	0.58