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## **Department of Ecology Metals Data Review**

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**Addendum To:**

**Habitat Limiting Factors and Reconnaissance Assessment Report.**

**Green/Duwamish and Central Puget Sound Watersheds**

**Part II: Factors of Decline/Conditions**

**Chapter 1.2 Water Quality**

**June 2002**

Prepared for:

Green Duwamish Watershed Water Quality Assessment

Prepared by:



**King County**

Department of Natural Resources and Parks  
**Water and Land Resources Division**

Pam Elardo

Department of Ecology

(funded by King County through an interagency personnel agreement)

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# 1. Introduction

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This report is an addendum to the Water Quality Chapter (1.2) of the Green/Duwamish Habitat Limiting Factors and Reconnaissance Assessment (Kerwin and Nelson 2000). The Reconnaissance Report provided an assessment of the water quality conditions in the Green/Duwamish watershed based on data in the King County database. This addendum reviews additional data for metals from the Department of Ecology database in the Green/Duwamish watershed and compares it to the data and conclusions drawn in the original King County report. To be consistent with the original report, this summary reviews only the same four years of available data to ensure it accurately reflects existing and not historical conditions (i.e., 1996 through 1999).

The scope of this addendum includes an assessment of Ecology's metals data, which is limited to three occasions at one station in the Middle Green River (Station No. 09A190) and six occasions at one station near the mouth of Soos Creek (Station No. 09B090) during the period of interest.

## 2. Available Data

The metals data presented in this report were collected by the Washington State Department of Ecology (Ecology) (see Tables 1 and 2 below). The sample collection methodology for these data were not targeted to a specific flow condition or storm event. The data, therefore, may be considered representative of base flow conditions.

**Table 1. Metals data ( $\mu\text{g/L}$ ) from Ecology Station 09A190, Green River at Kanaskat.**

Date	Parameter	Value	Qual	Adjusted Value
04/22/96	Cadmium	0.02	U	0.01
08/19/96	Cadmium	0.02	U	0.01
04/21/97	Cadmium	0.02	U	0.01
04/22/96	Copper	0.05	U	0.025
08/19/96	Copper	0.05	U	0.025
04/21/97	Copper	0.05	U	0.025
04/22/96	Lead	0.02	U	0.01
08/19/96	Lead	0.02	U	0.01
04/21/97	Lead	0.02	U	0.01
04/22/96	Nickel	0.089		0.089
08/19/96	Nickel	0.1		0.1
04/21/97	Nickel	0.056		0.056
04/22/96	Zinc	2.3		2.3
08/19/96	Zinc	0.4	U	0.2
04/21/97	Zinc	0.4	U	0.2
08/19/96	Total Mercury	0.001	U	0.0005

All metals are Total unless otherwise noted.

“Adjusted Value” is the final value used for statistics and/or comparisons to standards. For data with no qualifiers, the “Adjusted Value” is equal to the original value. “U”-qualified data indicate the sample result was below the method detection limit. Therefore, for “U”-qualified data, one-half of the detection limit was used as the “Adjusted Value”.

**Table 2. Metals data ( $\mu\text{g/L}$ ) from Ecology Station 09B090, Big Soos Creek at Auburn (hardness data are in  $\text{mg/L}$ ).**

Date	Parameter	Value	Qual	Adjusted Value
10/21/98	Hardness	65		65
11/18/98	Hardness	55		55
12/16/98	Hardness	43		43
2/17/99	Hardness	44		44
4/21/99	Hardness	50		50
6/23/99	Hardness	52		52
	<i>Average Hardness</i>			<i>51.5</i>
10/21/98	Chromium	0.1	U	0.05
11/18/98	Chromium	0.39		0.39
12/16/98	Chromium	0.76		0.76
2/17/99	Chromium	0.22		0.22
4/21/99	Chromium	0.31		0.31
6/23/99	Chromium	0.2		0.2
10/21/98	Copper	0.4		0.4
11/18/98	Copper	2.4		2.4
12/16/98	Copper	1.7		1.7
2/17/99	Copper	0.8		0.8
4/21/99	Copper	1		1
6/23/99	Copper	0.9		0.9
10/21/98	Lead	0.1	U	0.05
11/18/98	Lead	0.2		0.2
12/16/98	Lead	0.4		0.4
2/17/99	Lead	0.2		0.2
4/21/99	Lead	0.2		0.2
6/23/99	Lead	0.2		0.2
10/21/98	Zinc	1	J	
11/18/98	Zinc	4.7	J	
12/16/98	Zinc	6.4	J	
2/17/99	Zinc	22.4	J	
4/21/99	Zinc	5.5		5.5
6/23/99	Zinc	2		2
10/21/98	Cadmium	0.1	U	0.05
11/18/98	Cadmium	0.1	U	0.05
12/16/98	Cadmium	0.1	U	0.05
2/17/99	Cadmium	0.1	U	0.05
4/21/99	Cadmium	0.1		0.1
6/23/99	Cadmium	0.1		0.1
10/21/98	Mercury, Total	0.003		0.003
11/18/98	Mercury, Total	0.002	J	
12/16/98	Mercury, Total	0.003		0.003
2/17/99	Mercury, Total	0.003		0.003
4/21/99	Mercury, Total	0.003		0.003
6/23/99	Mercury, Total	0.002		0.002
10/21/98	Cadmium, Dissolved	0.02	U	0.01
11/18/98	Cadmium, Dissolved	0.02	U	0.01
12/16/98	Cadmium, Dissolved	0.02	U	0.01

Date	Parameter	Value	Qual	Adjusted Value
2/17/99	Cadmium, Dissolved	0.02	U	0.01
4/21/99	Cadmium, Dissolved	0.02		0.02
6/23/99	Cadmium, Dissolved	0.02		0.02
10/21/98	Copper, Dissolved	0.33		0.33
11/18/98	Copper, Dissolved	1.36		1.36
12/16/98	Copper, Dissolved	1.02		1.02
2/17/99	Copper, Dissolved	0.601		0.601
4/21/99	Copper, Dissolved	0.513		0.513
6/23/99	Copper, Dissolved	0.44		0.44
10/21/98	Lead, Dissolved	0.02	U	0.01
11/18/98	Lead, Dissolved	0.07		0.07
12/16/98	Lead, Dissolved	0.17		0.17
2/17/99	Lead, Dissolved	0.049		0.049
4/21/99	Lead, Dissolved	0.034		0.034
6/23/99	Lead, Dissolved	0.024		0.024
10/21/98	Nickel, Dissolved	0.37		0.37
11/18/98	Nickel, Dissolved	0.83		0.83
12/16/98	Nickel, Dissolved	0.671		0.671
2/17/99	Nickel, Dissolved	0.546		0.546
4/21/99	Nickel, Dissolved	0.49		0.49
6/23/99	Nickel, Dissolved	0.47		0.47
10/21/98	Zinc, Dissolved	0.48		0.48
11/18/98	Zinc, Dissolved	1.5		1.5
12/16/98	Zinc, Dissolved	2.59		2.59
2/17/99	Zinc, Dissolved	3.3		3.3
4/21/99	Zinc, Dissolved	1.5		1.5
6/23/99	Zinc, Dissolved	1.6		1.6
10/21/98	Arsenic, Total	0.91		0.91
11/18/98	Arsenic, Total	1.2		1.2
12/16/98	Arsenic, Total	0.79		0.79
2/17/99	Arsenic, Total	0.59		0.59
4/21/99	Arsenic, Total	0.71		0.71
6/23/99	Arsenic, Total	1		1

All metals are Total unless otherwise noted.

“Adjusted Value” is the final value used for statistics and/or comparisons to standards. For data with no qualifiers, the “Adjusted Value” is equal to the original value. “U”-qualified data indicate the sample result was below the method detection limit. Therefore, for “U”-qualified data, one-half of the detection limit was used as the “Adjusted Value”. “J”-qualified data indicate an estimated value that is not considered representative of the sample. Therefore, no “Adjusted Value” is given for “J”-qualified data.

### 3. Findings

Ecology's available metals data are consistent with the data presented by King County in the Reconnaissance Report Water Quality Chapter (Kerwin and Nelson 2000). Review of the Ecology data shows concurrence with the County's conclusion that metals are not likely to be a contributing factor of decline for salmonids at the locations analyzed. No data in the tables above display a violation of the acute or chronic state water quality criteria. The applicable state water quality standards for metals from Chapter 173-201A WAC are given in Table 3.

**Table 3: State water quality standards for metals (hardness = 51.5 mg/L).**

Parameter	Freshwater Criteria (µg/L)	
	Acute	Chronic
Arsenic, dissolved	360	190
Cadmium, dissolved *	1.8	0.63
Chromium (VI), dissolved	15	10
Chromium (III), total*	319	103
Copper, dissolved *	9.1	6.4
Lead, dissolved *	31.1	1.2
Mercury, total		0.012
Nickel, dissolved *	807	89.7
Zinc, dissolved *	65.2	59.6

\* These criteria are hardness dependent.

However, broad conclusions about water quality cannot be drawn for the available metals data. There are considerable spatial and temporal data gaps in the Ecology database, as well as in the King County database. Overall, the current data do not conclusively characterize the Green River and tributaries for metals. The Reconnaissance Report also noted there are significant data gaps for metals.

## **4. Metals on the 303(d) list**

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The recent data for metals in the Green River system do not support the current listing of metals on the 1998 303(d) list. The Department of Ecology is pursuing a sampling verification program for metals throughout the state of Washington to de-list or verify certain 303(d)-listed waterbodies for metals. Information about Ecology's sampling verification program in the form of a memo is included as an appendix to this addendum (Johnson 2001).

## **5. References**

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- Johnson, A. 2001. Recommendations to De-list or Verify Certain 303(d) Waterbodies for Metals Excursions in Water. Memo to Alison Becket, June 4, 2001.
- Kerwin, J. and Nelson, T. S. (Eds.). 2000. Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island). Washington Conservation Commission and the King County Department of Natural Resources. Seattle, WA.

## APPENDIX A

June 4, 2001

**TO:** Alison Beckett, Water Quality Program

**FROM:** Art Johnson, Environmental Assessment Program

**SUBJECT: Recommendations to De-list or Verify Certain 303(d) Waterbodies for Metals Excursions in Water**

In light of our agreement with EPA, Northwest Environmental Advocates, and Northwest Environmental Defense Center on a cleanup schedule for 303(d) listed waterbodies, EAP has been reviewing the 1998 list to determine the best approach for addressing these pollution problems.

During the course of this review, 45 metals listings for 11 rivers and streams were identified where newer water quality data justify their removal from the 303(d) list or where further sampling should be conducted to verify old or questionable data on which the listing is based (Table 1). The reasoning behind these recommendations is described in more detail below.

People considering these recommendations should be aware that metals data collected in the 1980s (and more recently in some instances) were often subject to contamination in the field or laboratory (see, for example, Windom, 1991). Newer data can be more accurate when clean sampling techniques and low-level analytical methods are used. EAP has made several efforts to verify 303(d) metals listings based on older data (Hopkins, 1995; Johnson and Hopkins, 1991; Johnson, 2000). In each of these, no evidence was found that state standards were being exceeded.

1. **WA-07-1160 / Skykomish River / Cu, Pb, Ag** - These listings are based on a single composite effluent sample from the Monroe WWTP where calculations indicated water quality standards could be exceeded at the edge of the dilution zone (Golding, 1996). In the opinion of NWRO, this sample is not representative of current effluent quality (Kevin Fitzpatrick, Ecology-NWRO, personal communication).

Verification sampling is recommended for these listings. [Note to readers of QAPP: This recommendation is currently being reconsidered. If verification sampling is ultimately recommended, it will be the subject of a separate QAPP.]

2. **WA-07-1020, 1050 / Snohomish River / Cu, Hg** - These listings are for Ecology station 07A090 (Snohomish River @ Snohomish - Cu) and USGS station 07A111 (Snohomish River near Monroe – Cu, Hg). The Ecology data are from 1982 - 1984; the USGS data appear to be from the 1980s but exact dates are uncertain.

EAP has more recent Cu data for the station at Snohomish (Table 2). In 12 samples collected over a three-year period between October 1995 and August 1997, dissolved Cu concentrations ranged from 0.43 - 0.94 ug/L. The chronic state standard for the minimum hardness measured at this station (11 mg/L) is 1.7 ug/L. Therefore, it appears there is sufficient data to justify removing the Cu listing for the Snohomish River @ Snohomish.

No new data are available for the Snohomish River further upstream near Monroe. Sampling is recommended to verify the Cu and Hg listings for this station.

3. **WA-08-1095 / Bear-Evans / Creek Hg** - The mercury listing for METRO station 0484 on this creek appears to be due to a reporting error (Jonathan Frodge, King County, personal communication). Sediment samples were apparently included in the database without the matrix code (which identifies the sample matrix, i.e., water, sediment, tissue, etc.). I reviewed all of King County's Hg in water data for station 0484 from Jan 1, 1988, to the present (the last five years of data are in Table 3). No samples have had Hg detected.

The Bear-Evans Creek Hg listing should be removed.

4. **WA-08-1130 / May Creek / Cu, Pb, Zn** - May Creek is listed for Cu, Pb, and Zn excursions at several sites sampled by METRO in 1994. However, the dissolved concentrations which exceeded the standards were calculated values, not measured directly (King County, 1994).

King County has more recent measurements of dissolved metals concentrations in May Creek at a station just east of I-410 (Table 4). Eight samples collected between May 1998 and December 1999 had maximum Cu, Pb, and Zn concentrations of 3.9, <0.5, and 5.6 ug/L, respectively. At the lowest hardness measured at this station (37 mg/L), the state chronic criteria are 4.8 ug/L for Cu, 0.84 ug/L for Pb, and 45 ug/L for Zn.

Because the listings were based on a theoretical calculation and recent direct measurements show no violations of standards, it is recommended that the May Creek Cu, Pb, and Zn listings be removed.

5. **WA-09-1020 / Green River / Cr** - Among the Green River listings is one excursion of the Cr standard at each of two Ecology ambient monitoring stations during 1987 – 1991. Ecology's ambient monitoring data for Cr prior to 1994 are suspect and have

been removed from the EAP data base (Dave Hallock, EAP, personal communication).

King County provided dissolved Cr data for two stations sampled on the Green River from May 1998 through December 1999 (Table 5). Fifteen samples have been analyzed and Cr has not been detected at or above 0.4 - 0.5 ug/L. The chronic water quality standard for the lowest hardness measured at these stations (17 ug/L) is 42 ug/L.

The Green River Cr listing should be removed.

6. **WA-09-1015 / Mill Creek / Cd, Cr, Cu, Hg, Zn** - These listings are based on 1984 - 1990 METRO and Ecology data for four stations in the lower 1.5 mile of the creek. A major pollution source, the Western Processing superfund site, is located in this reach but has since been cleaned up. The cleanup site is between the river mile 1.5 and 1.0 sampling stations listed in Table 1.

King County has recent metals data for river mile 1.0 downstream of Western Processing (station 0317 at S. 196<sup>th</sup> Street ) (Table 6). In six sets of samples collected from May 1998 to December 1999, the maximum dissolved Cd, Cr, Cu, and Zn concentrations were <0.2, 0.57, 3.4, and 23 ug/L, respectively. At the lowest hardness value measured (25 mg/L), the chronic state standards are 0.37, 57, 3.5, and 32 ug/L, respectively. Hg was not detected at or above 0.2 ug/L; the state chronic standard is 0.012 ug/L total recoverable and the acute standard is 2.1 ug/L dissolved. All samples were within standards for Cd, Cr, Cu, and Zn. The reporting limit for Hg was not low enough to compare to the chronic standard.

Landau Associates has done routine water quality monitoring in Mill Creek above and below the Western Processing site. The data collected since 1990 for Cd, Cr, Hg, Zn, hardness, and flow are in Table 7. The most significant improvements to water quality are thought to have occurred in the late 1980's when steps were taken to control surface water runoff from Western Processing (Bill Enkeboll, Landau Associates, personal communication). Landau station C1 is located immediately upstream of the Western Processing site; station C4 is 2500 feet downstream of the site.

In the early 1990s, some of Landau's results for dissolved Cd and dissolved Zn exceeded chronic water quality standards (e.g., Cd in 1993). However, in each of these instances the corresponding total Cd and Zn concentrations were much lower than in the dissolved sample suggesting contamination occurred in the filtration process. These data should be rejected. The remaining Landau data show no violations of the chronic standards for Cd, Cr, or Zn.

Upstream station C1: The maximum dissolved Cd concentration measured was 0.78 ug/L (1/15/90); at the corresponding hardness of 69 mg/L, the chronic standard is 0.78 ug/L. Dissolved Cr was below the reporting limit of 10 ug/L in all samples; at the lowest hardness value measured (34 mg/L), the chronic standard is 74 ug/L. Except for two samples collected in 1990, the maximum dissolved Zn concentration was 57 ug/L (12/2/96); at the corresponding hardness of 54 mg/L, the chronic standard is 62 ug/L.

Downstream station C4: The maximum dissolved Cd concentration measured was 0.65 ug/L (3/22/94); at the corresponding hardness of 59 mg/L, the chronic standard is 0.84 ug/L. Landau stopped analyzing dissolved Cd at station C4 in 1997. All but one of the total Cd results for 1997 – 2000 have been at or below the chronic standard for the dissolved fraction. Dissolved Cr was below the reporting limit of 10 ug/L in all samples; at the lowest hardness value measured (34 mg/L), the chronic standard is 74 ug/L. Except for two samples collected in 1990, the maximum dissolved Zn concentration was 54 ug/L (12/2/96); at the corresponding hardness of 44 mg/L, the chronic standard is 52 ug/L.

Landau's Hg data show the acute standard is being met. As with the King County data, Hg reporting limits were not low enough to compare to the chronic standard.

The King County and Landau Associates data show that Mill Creek is meeting standards for Cd, Cr, Cu, and Zn. Therefore, it is recommended that these listing be removed. There is a need for low-level Hg data on Mill Creek; verification sampling is recommended.

7. **WA-10-1087 / Wilkeson Creek / Cu** - This listing is based on a single composite effluent sample from Wilkeson WWTP where calculations indicated water quality standards could be exceeded at the edge of the dilution zone (Hoyle-Dodson, 1997). EAP recently conducted an intensive sampling program for Cu at Wilkeson WWTP that included the final effluent and Wilkeson Creek above and below the outfall (Golding and Johnson, 2001). In eight sets of samples collected between July and November 2000, no violations of the chronic state standard were found. Calculations showed there was no reasonable potential for the chronic standard to be exceeded under critical low flow conditions or for any of the sampling events.

The Cu listing for Wilkeson Creek should be removed.

8. **WA-34-1010 / Palouse River / Cr** - The Palouse River @ Hooper (Ecology station 34A070) is listed for five Cr excursions between 1987 and 1991. As previously mentioned, Ecology's Cr data prior to 1994 are suspect.

Verification sampling is recommended.

9. **WA-37-1010, 1040 / Lower Yakima River / Ag, Hg** - These listing are based on 1987 - 1990 USGS data showing two or three excursions for Ag and/or Hg in the main stem above Ahtanum Creek, above Satus Creek, and at Kiona (Fuhrer, 1996). Metals sampling by EAP in the upper Yakima River has shown that USGS metals data from this time period may be unreliable. Upper river 303(d) listings for Ag, Hg, and other metals do not appear to be justified (Johnson, 2000 - see WRIA 39 below).

USGS has obtained more recent Ag data for their station above Ahtanum Creek (Table 8); Hg was not analyzed. Of 16 samples obtained between May 1999 and January 2000, all had less than 1 ug/L dissolved Ag. The acute state standards for the two lowest hardness values measured at this site (38 and 50 mg/L) are 0.65 and 1.0 ug/L (there is no state chronic standard for Ag). Although these USGS results and previous upstream sampling by EAP suggest the Ag listings for the lower river may not be warranted, a lower detection limit will be required to demonstrate it.

Verification sampling is recommended for the lower Yakima Ag and Hg listings.

10. **WA-38-1010 / Naches River / Ag** - This listing for the Naches River near Yakima is also based on potentially unreliable USGS data reported in Fuhrer (1996).

Verification sampling is recommended.

11. **WA-39-1010, 1030 / Upper Yakima River / Ag, Cd, Cu, Hg** - The listings are for the Yakima River @ Cle Elum and @ Umtanum. Again, these conclusions are based on USGS 1987 - 1990 data. Ecology collected eighteen sets of mainstem samples and eighteen sets of tributary samples in this reach during March 1999 - January 2000 and found no violations of water quality standards for any of the listed metals (Johnson, 2000). Limited recent sampling by USGS in 1999 also showed no violations of the Ag, Cd, or Cu standards at Cle Elum or at Umtanum; Hg was not analyzed (Johnson, 2000).

The upper Yakima listings for Ag, Cd, Cu, and Hg should be removed.

12. **WA-54-1020 / Spokane River / Cr** - The Spokane River is listed for Cr, based on suspect 1989 - 91 Ecology data for a station at Riverside State Park (54A120).

Verification sampling is recommended.

In summary, I recommend that the following 303(d) listings be removed, based on new data or an error in the listing:

WA-07-1020 Snohomish River @ Snohomish - Cu  
WA-08-1095 Bear-Evans Creek - Hg  
WA-08-1130 May Creek - Cu, Pb, Zn  
WA-09-1020 Green River - Cr  
WA-09-1015 Mill Creek - Cd, Cr, Cu, Zn  
WA-10-1087 Wilkeson Creek - Cu  
WA-39-1010, 1030 Upper Yakima River - Ag, Cd, Cu, Hg

Verification sampling is recommended for the following listings:

WA-07-1160 Skykomish River @ Monroe - Cu, Pb, Ag  
WA-07-1050 Snohomish River near Monroe - Cu, Hg  
WA-09-1015 Springbrook Mill Creek - Hg  
WA-34-1010 Palouse River @ Hooper - Cr  
WA-37-1010, 1040 Lower Yakima River - Ag, Hg  
WA-38-1010 Naches River - Ag  
WA-54-1020 Spokane River @ Riverside State Park – Cr

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