

CANADA – BRITISH COLUMBIA

WATER QUALITY MONITORING AGREEMENT

WATER QUALITY ASSESSMENT OF Salmon River AT SALMON ARM (1985 – 2004)

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and
Environment Canada

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Environment Environnement
Canada Canada



Ministry of
Environment

EXECUTIVE SUMMARY

The Salmon River at Salmon Arm is located in the southern-interior portion of the province. Its headwaters originate about 15 km northeast from Salmon Lake. Some of the river's flow is diverted into Salmon Lake; much of that flow returns to the river via McInnis Creek, the outlet from Salmon Lake. From the confluence with McInnis Creek, the Salmon River flows northeast to Falkland, then southeast and east to Glenemma, and finally north to Salmon Arm before entering Shuswap Lake. The total length and drainage area of the Salmon River are approximately 120 km and 1510 km², respectively.

The Salmon River is an important tributary of Shuswap Lake, which drains into the South Thompson River. In addition to supporting anadromous salmonids, resident fish species and other aquatic organisms, the Salmon River and its tributaries provide important sources of raw water for domestic water supplies, irrigation, and livestock watering. Recreation and aesthetics also represent important uses of the aquatic environment, both of which generate social and economic benefits to area residents.

Concerns related to environmental quality conditions in the Salmon River are primarily associated with non-point source contaminant discharges. Such contaminants arise from a variety of land use activities, including forest management, agriculture and urban development. Contaminants of concern in the watershed include suspended solids, turbidity, ammonia, phosphorus, nitrogen, metals and fecal coliforms. In addition, water withdrawals from the river and nearby infiltration galleries have resulted in decreased stream flows and associated effects on water temperatures and other habitat features in the river.

CONCLUSIONS

- Flows fluctuate throughout the year, but peak in the May-June period on a yearly basis. Low flows seem to be consistent through most of the other months of the year.

- Water temperatures and dissolved oxygen often exceed water quality objectives, especially during the hot summer periods.
- Several metals exceeded guidelines or water quality objectives on occasion; however, these seemed to be correlated with turbidity and were likely in particulate form and not biologically available. Such metals included: aluminum, cobalt, chromium, copper, iron, lead, silver, and zinc. Cadmium also often exceeded guidelines, and was not always related to turbidity, which means that it could potentially be more available to aquatic life. This has just become evident over the past couple of years since the cadmium detection limit has decreased; cadmium will continue to be monitored at these low levels to track this potential concern.
- Colour values and fecal coliforms and E. Coli often exceeded guidelines for drinking water at the source; however, these were related to turbidity events and complete treatment of the source water would be needed prior to use for drinking.
- Arsenic values may be showing a slight increase in concentration through the period of record. This may be due to a larger groundwater contribution to the flow.
- Lithium and extractable silicon were showing distinct decreases in concentrations over time.

RECOMMENDATIONS

- We recommend monitoring be continued for the Salmon River at Salmon Arm to track the possible increases in variables, and guideline exceedences that have been identified in this report.
- Either trivalent and hexavalent forms of chromium should be measured in the future, or alternately, guidelines be developed for total chromium values.
- A statistical analysis of the data for arsenic, lithium, and silicon should be conducted to confirm whether the identified trends are real.

Water quality indicators that are important for future monitoring are:

- flow, water temperature, specific conductivity, pH, turbidity, hardness, and dissolved oxygen,
- appropriate forms of metals for comparison to their respective guidelines, and
- other variables related to drinking water such as colour, fecal coliforms and E. Coli.

ACKNOWLEDGEMENTS

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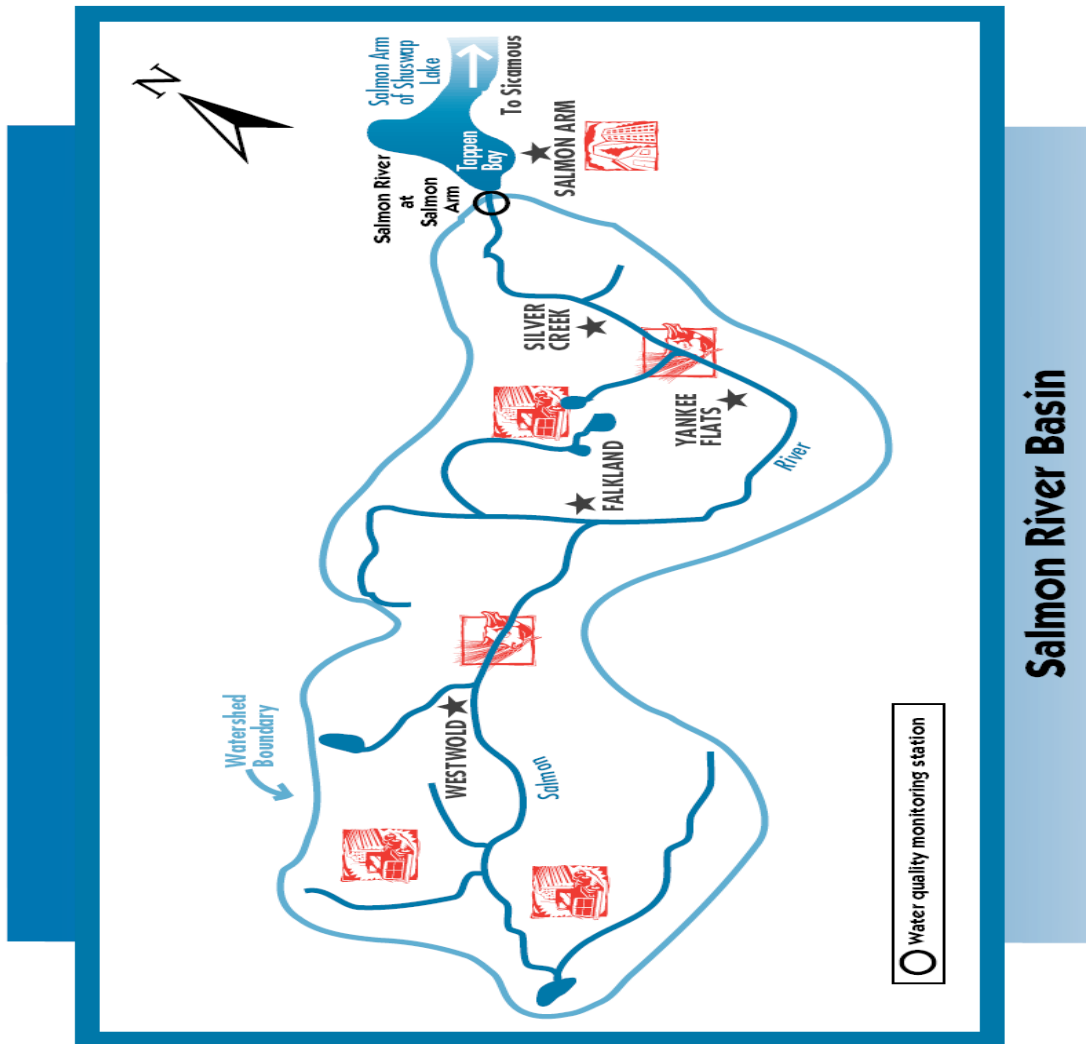
Introduction

The Salmon River, near Salmon Arm B.C., is located in the southern-interior portion of the province (Figure 1). Its headwaters originate in the vicinity of Tahaetkun and Bouleau Mountains, south of Westwold and northeast of Merritt. The river's headwaters are located in Monte Hills Provincial Forest, some 15 km northeast from Salmon Lake. Some of the river's flow is diverted into Salmon Lake; much of that flow returns to the river via McInnis Creek, the outlet from Salmon Lake. From the confluence with McInnis Creek, the Salmon River flows northeast to Falkland, then southeast and east to Glenemma, and finally north to Salmon Arm before entering Shuswap Lake. The total length and drainage area of the Salmon River are approximately 120 km and 1510 km², respectively.

The Salmon River is an important tributary of Shuswap Lake, which drains into the South Thompson River. In addition to supporting anadromous salmonids, resident fish species and other aquatic organisms, the Salmon River and its tributaries provide important sources of raw water for domestic water supplies, irrigation, and livestock watering. Recreation and aesthetics also represent important uses of the aquatic environment, both of which generate social and economic benefits to area residents.

Concerns related to environmental quality conditions in the Salmon River are primarily associated with non-point source contaminant discharges. Such contaminants arise from a variety of land use activities, including forest management, agriculture and urban development. Contaminants of concern in the watershed include suspended solids, turbidity, ammonia, phosphorus, nitrogen, metals and fecal coliforms. In addition, water withdrawals from the river and nearby infiltration galleries have resulted in decreased stream flows and associated effects on water temperatures and other habitat features in the river.

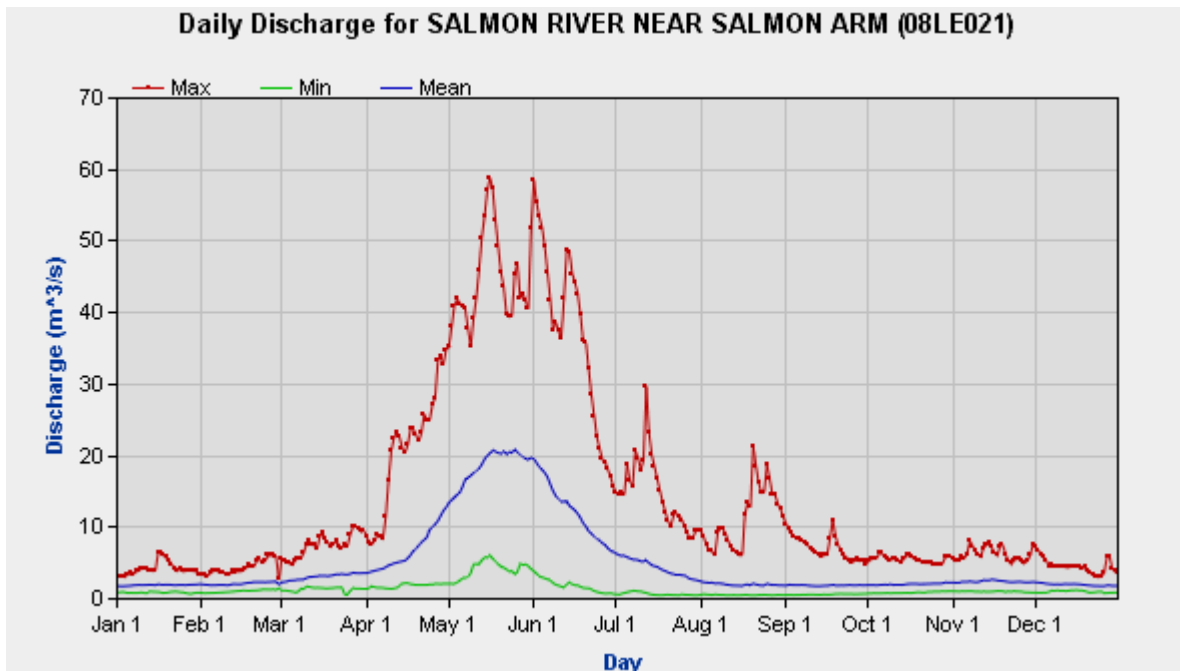
FIGURE 1: Salmon River at Salmon Arm



This report discusses water quality data collected by the provincial and federal governments between 1985 and 2004 from a station on Salmon River near its mouth at Salmon Arm. Data for the Salmon River at Salmon Arm have been collected on a frequency of about once every two weeks. As well, twice per year, two additional samples are collected in order to ensure that there are two periods when weekly samples are collected during five consecutive weeks. In addition, quality assurance samples (blanks and replicates) are collected six times per year.

The federal data are stored under ENVIRODAT station number BC08LE0004 and the BC Environment station E206092. The water quality variables are plotted in Figures 3 to 79. Water Survey of Canada operates a flow gauge at the same site (site number BC08LE021). Flow data from 1911 to 2004 are graphed in Figure 2.

FIGURE 2: Water Survey of Canada Flow Data for Salmon River near Salmon Arm



WATER QUALITY ASSESSMENT

The state of the water quality was assessed by comparing the values to B.C.'s approved and working guidelines for water quality (B.C. Ministry of Environment, Lands and Parks, 2001), and by looking for any obvious trends in the data. Any levels or apparent trends that were found to be deleterious or potentially deleterious to sensitive water uses, including drinking water, aquatic life, wildlife, recreation, irrigation, and livestock watering were noted in the following variable-by-variable discussion.

The following water quality indicators are not discussed as they met all water quality guidelines and showed no clearly visible trends: phenolphthalein alkalinity, ammonia, barium, bromide, nitrite, total nitrogen, fixed non-filterable residue, fixed filterable residue, non-filterable residue, extractable silicon, and tin.

The following water quality indicators seemed to fluctuate through the year according to turbidity concentrations, but were below guideline values and had no other trends: antimony, beryllium, bismuth, dissolved organic carbon, gallium, lanthanum, manganese, nickel, total phosphorus, rubidium, thallium, and vanadium.

Other water quality indicators seemed to fluctuate through the year according to the specific conductivity of the water. For dissolved forms of many of these indicators, they would be a part of the measured conductivity, and this is to be expected. These types of indicators that were not measured above guideline values included: alkalinity, ammonia, boron, dissolved inorganic carbon, calcium, chloride, potassium, magnesium, molybdenum, nitrate, total dissolved nitrogen, pH, sodium, hardness, strontium, sulphate, and uranium.

Flows (Figure 2): fluctuate throughout the year, but peak in the May-June period on a yearly basis. Mean flows throughout the year are about 2 m³/s; although mean peak flows are about 20 m³/s. Absolute peak flows have been as high as 60 m³/s.

Aluminum (Figure 3): values exceed the drinking water guideline; however, values have fluctuated with turbidity, are likely in particulate form, and not biologically available. There does not appear to be any trend in values during the period of record.

Arsenic (Figure 8): values have been below guidelines but seem to be increasing in value during the period of record. When we used a linear regression, we found that there was a weak correlation of values increasing through time ($R^2 = 0.05$). Total arsenic values also seem to increase with turbidity, meaning that higher values are likely in particulate form and not biologically available.

Cadmium (Figures 18 and 19): values seemed to fluctuate with turbidity, which means that higher values would be associated with particulate matter and would likely not be biologically available. Although values seem to be getting lower through the period of record, this is likely more a phenomenon related to decreasing detection limits and improved analytical capabilities through time, rather than a real decrease in concentration. Lower cadmium values, and their detection limits, during the 2003-2004 period also coincided with lower turbidity concentrations. Additional data need to be collected to determine whether turbidity and cadmium are in fact beginning to decline.

Cyanide (Figure 21): values generally were well below the maximum and 30-day average guidelines for weak-acid dissociable cyanide. One exception was a total cyanide value in October 2004. Since data for only one year have been collected, additional sampling is required before any trends might become evident.

Cobalt (Figure 22): values seemed to be correlated with turbidity, which means that higher cobalt values are associated with particulate matter and not likely biologically available. The occasional individual value has exceeded the BC guideline of 4 µg/L for the 30-day mean concentration; however, all individual values were well below the guideline for maximum concentrations of 110 µg/L. Lower cobalt values in 2003-2004 coincided with lower turbidity concentrations. Additional data need to be collected to determine whether turbidity and cobalt are in fact beginning to decline.

Colour: apparent colour (Figure 23) values from 1988 until 1998 seemed to fluctuate with turbidity and regularly exceeded the drinking water guideline of 15 TCU for true colour; however, this is to be expected since true colour is measured on a filtered sample (i.e., turbidity removed). True colour values (Figure 24) began to be measured in 1997 and were lower than apparent colour values, as expected; however, values seem to fluctuate with turbidity and regularly exceeded the drinking water guideline.

Chromium (Figure 25): values in the 1990's exceeded the guideline for trivalent chromium and hexavalent chromium; however, since the year 2000, only the guideline for hexavalent chromium has been exceeded. Values seem to fluctuate with turbidity

values, meaning that the higher chromium values are likely in particulate form and not biologically available. There is a very weak trend identified using a linear regression ($R^2 = 0.017$) of decreasing concentrations through time; however, this is likely related to lower turbidity concentrations in the post-2000 period. We recommend that either trivalent and hexavalent forms of chromium be measured in the future or guidelines be developed for total chromium values.

Copper (Figures 26 and 27): values generally met the guidelines (hardness-dependent) for maximum and 30-day mean concentrations; however, when these were exceeded, turbidity values were also high. This means that the higher copper values are in particulate form and not likely biologically available. Higher values in the late 1980's were quite high due to widespread contamination because of the failure of preservative vial cap liners between 1986 and 1991.

E. Coli (Figure 28) and **Fecal Coliforms** (Figure 31): regularly exceeded the water quality guideline and short and long-term water quality objectives, respectively, for drinking water sources. High fecal coliforms seem to be correlated with high turbidity concentrations. Drinking water taken from the Salmon River would require complete treatment.

Fluoride (Figure 29): values were measured only between 1988 and 1999. Values generally met the aquatic life guideline of 0.3 µg/L. High fluoride values coincided with periods of high specific conductivity and low river flows, suggesting that the fluoride was a result of groundwater contributions to the base flow of the river.

Iron (Figure 30): values regularly exceeded the guideline for the protection of aquatic life and drinking water supplies (aesthetics) of 300 µg/L. High iron values were correlated with high turbidity concentrations, meaning that the iron was in particulate form and not biologically available. It would also be removed in water treatment processes for drinking water supplies. Peak iron values since 2000 seem to be lower than during the previous decade; however, these lower values are likely the result of lower turbidity values during that period.

Hardness (Figure 33): values were strongly correlated with specific conductivity and low river flows, suggesting that the hardness was a result of groundwater contributions to the base flow of the river. Values throughout the year were generally higher than the 100 mg/L level for drinking water supplies.

Lead (Figure 36): values seem to correlate with turbidity, meaning that high lead values are in particulate form and not likely biologically available. Values were generally below all guidelines for aquatic life and drinking water supplies, with only two individual values exceeding the lowest BC 30-day mean guideline of 4.5 µg/L. Analytical detection limits for lead were reduced in 2003 from the 0.2 µg/L level, which means that in future years, trends to lower values might be suspected; however, the lower detection limits may be responsible for such observations.

Lithium (Figure 37): values have shown a strong decline during the period of record ($R^2 = 0.31$) but have always been below the BC guideline to protect aquatic life of 67 µg/L. Values also seem to be correlated with high specific conductivity and low flows, meaning that the lower values are likely associated with a groundwater contribution to base river flow.

Dissolved Oxygen (Figure 48): values seem to fluctuate with conductivity, which is not surprising in that conductivity peaks occur when there are low flows in the colder months of the year, and under normal situations, dissolved oxygen concentrations rise at colder temperatures. Only one value was slightly below the 8 mg/L water quality objective.

Selenium (Figure 56): values on occasion exceeded the guideline to protect aquatic life of 1 µg/L. Selenium values seemed to be correlated with specific conductivity with highest values occurring during low flow conditions.

Silica and Silicon (Figure 58): Values for extractable silicon have decreased considerably over the period from 1999 until 2002, with a linear regression having a R^2 value of 0.23.

Silver (Figures 59 and 60): values on occasion exceeded the BC aquatic life guideline of 0.1 µg/L, but this usually happened when detection limits were at that level. The detection limit for silver was reduced to 0.001 µg/L in early 2003, and no values have exceeded the guideline since that time. Data from that latter period seem to fluctuate with turbidity concentrations, meaning that the higher silver values are related to particulate and not likely biologically available.

Water Temperature (Figure 65): varies with flow and the time of year. Temperatures have exceeded objective levels especially during the hot summer periods.

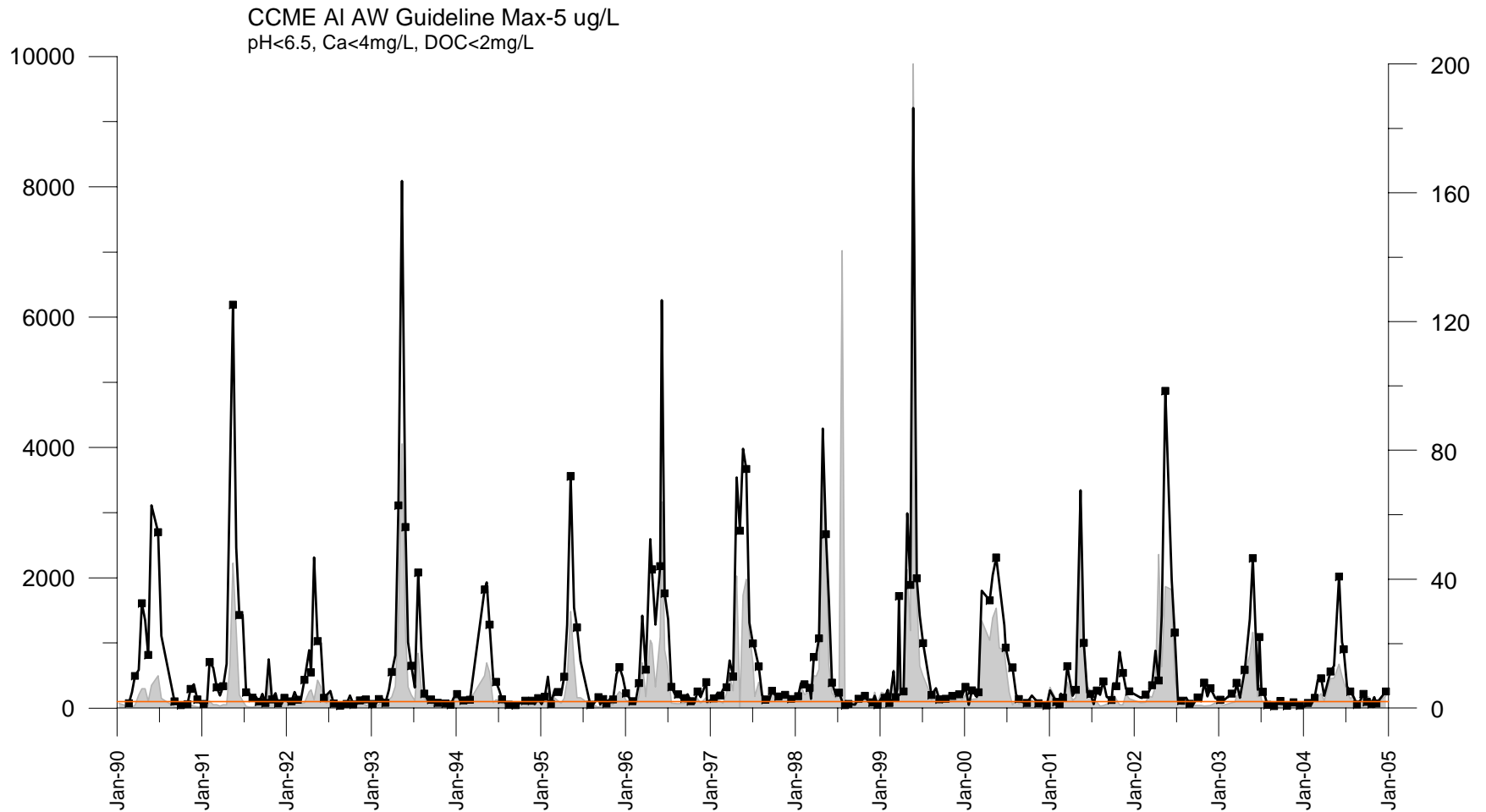
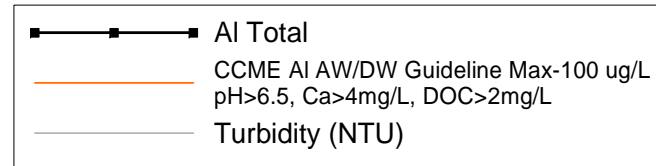
Zinc (Figures 71 and 72): values fluctuate with turbidity, which means that high values are associated with particulate matter and not likely biologically available. Occasional values exceed aquatic life guidelines that are hardness-dependent.

REFERENCES

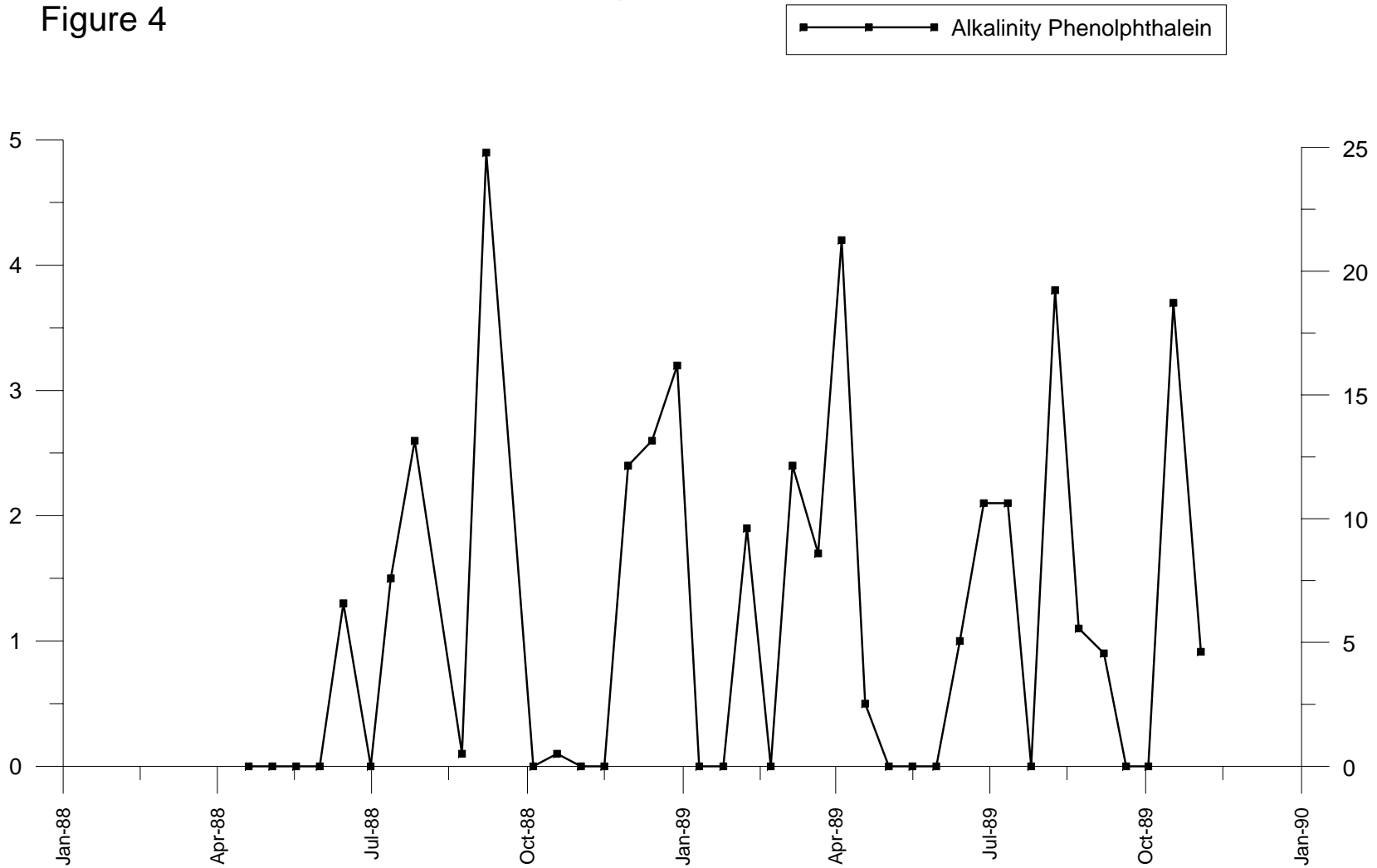
BC Ministry of Water, Lands and Air Protection. 2001. A Compendium of Working Water Quality Guidelines for British Columbia. N. K. Nagpal, L. W. Pommen, and. L. G. Swain. Victoria, B.C. <http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html>

BC Ministry of Water, Lands and Air Protection. 2001. British Columbia Approved Water Quality Guidelines (Criteria) 1998 Edition. Updated: August 24, 2001. http://www.env.gov.bc.ca/wat/wq/BCguidelines/approv_wq_guide/approved.html

Salmon River at Hwy 1 Bridge Aluminum Total (ug/L) Figure 3



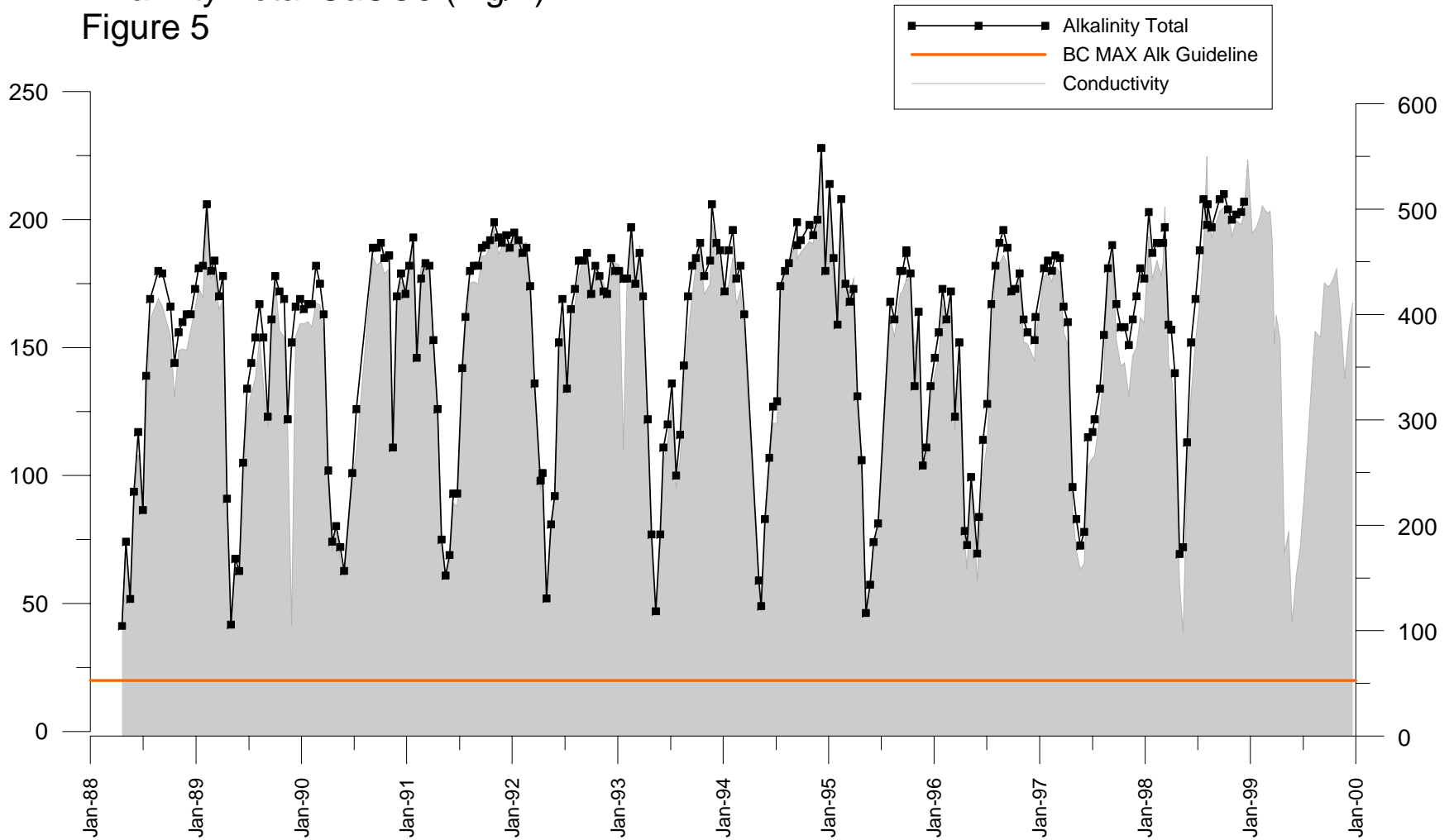
Salmon River at Hwy 1 Bridge
Alkalinity Phenolphthalein CACO3 (mg/L)
Figure 4



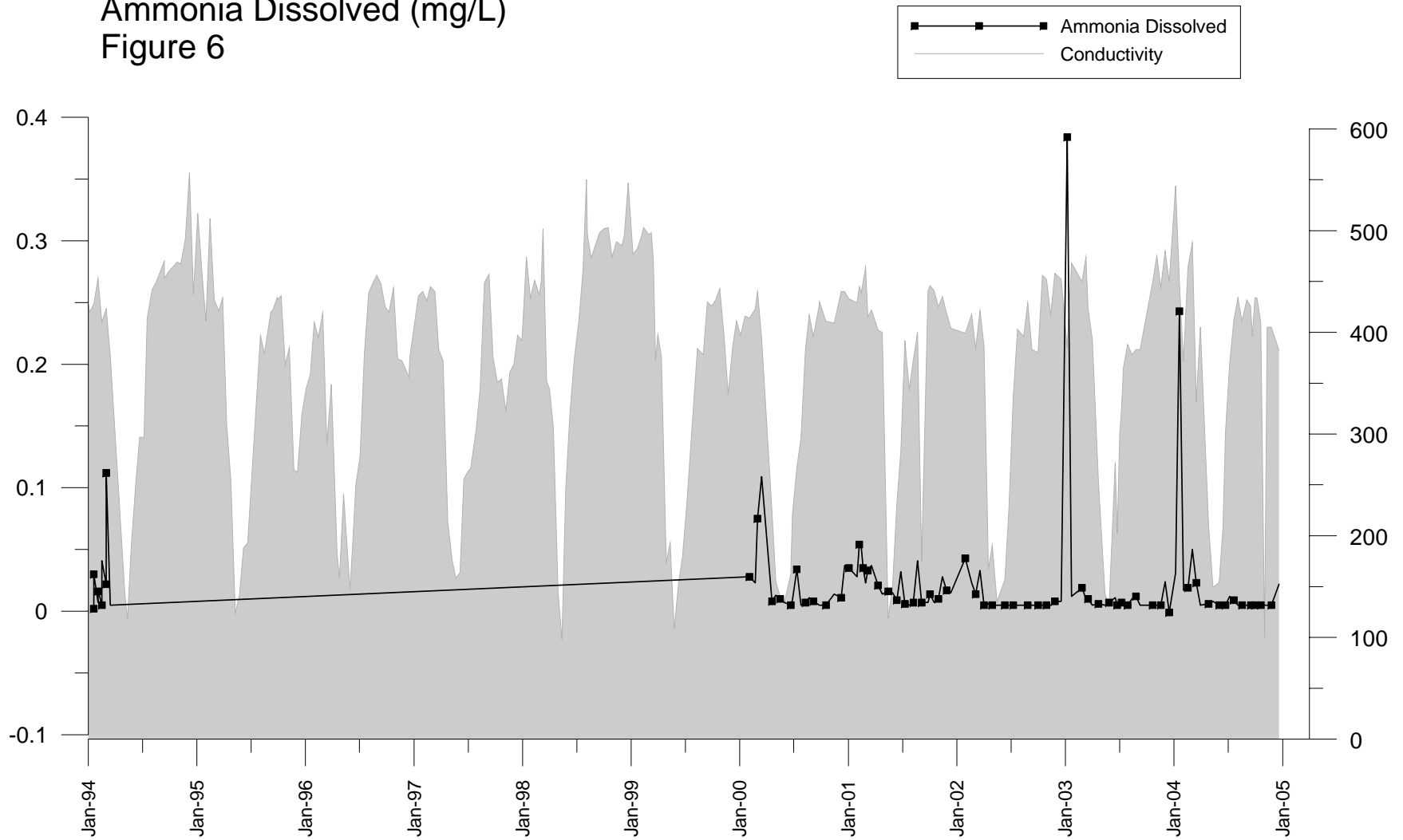
Salmon River at Hwy 1 Bridge

Alkalinity Total CaCO3 (mg/L)

Figure 5

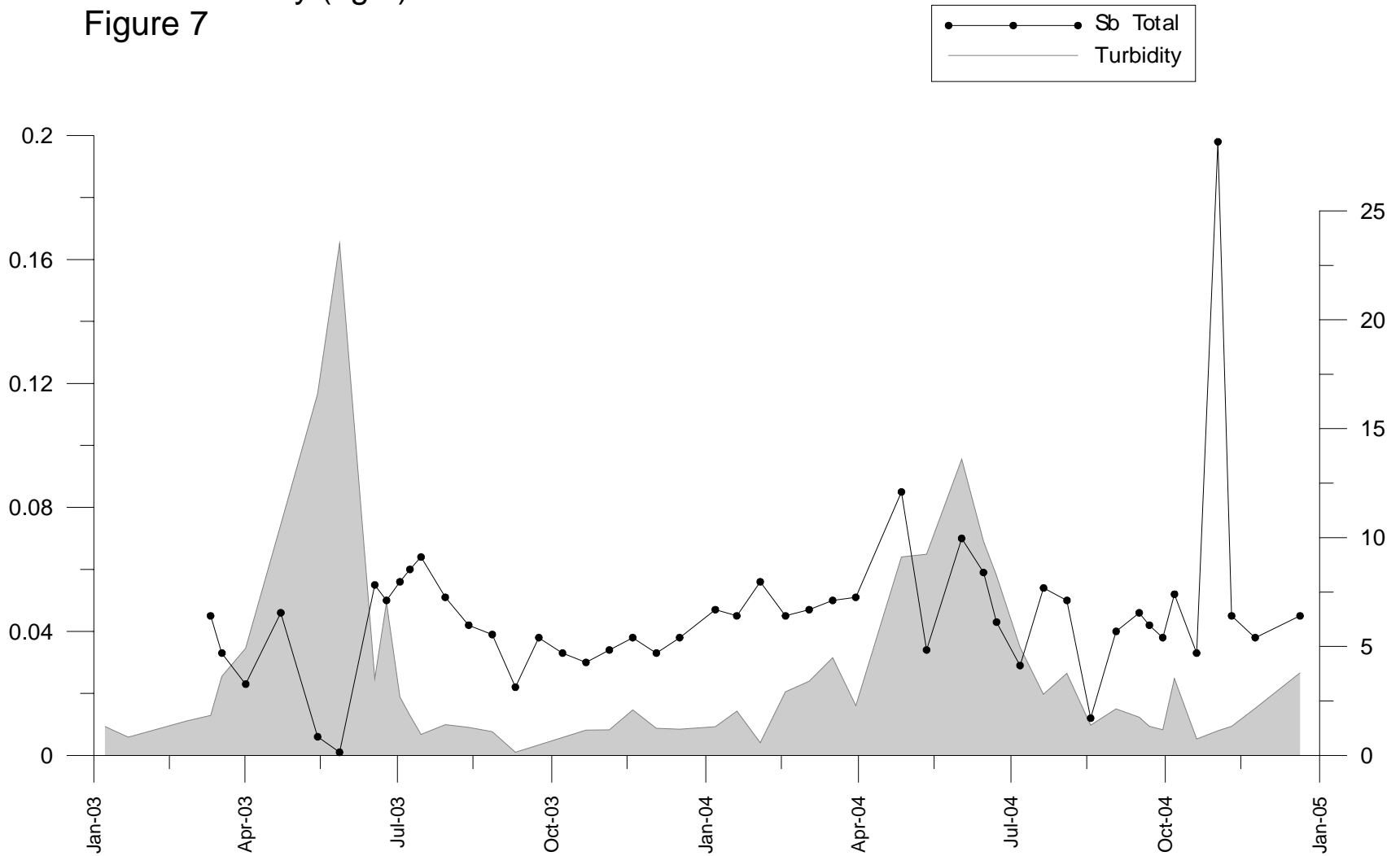


Salmon River at Hwy 1 Bridge
Ammonia Dissolved (mg/L)
Figure 6



Salmon River at Hwy 1 Bridge

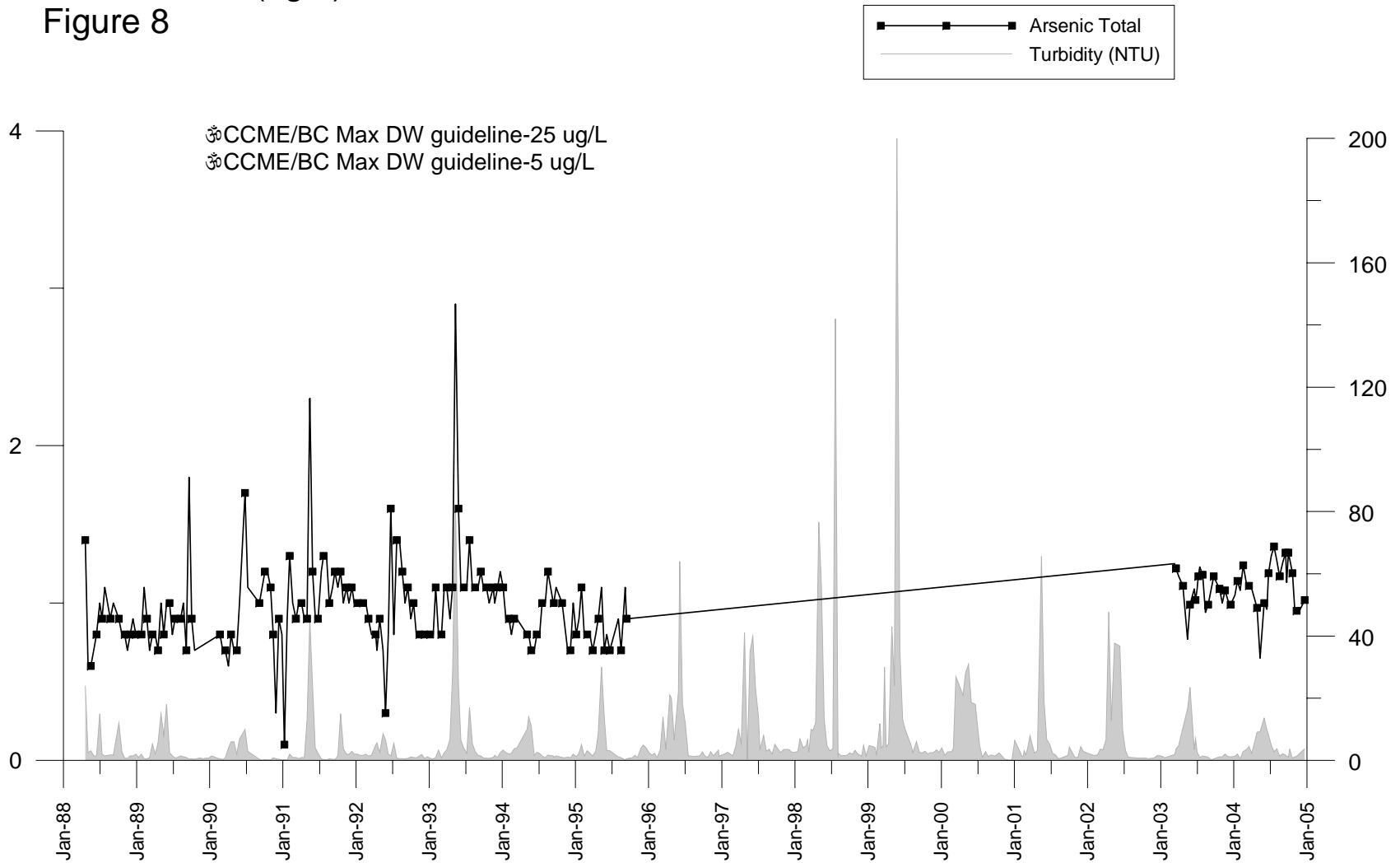
Total Antimony (ug/L)
Figure 7



Salmon River at Hwy 1 Bridge

Arsenic Total (ug/L)

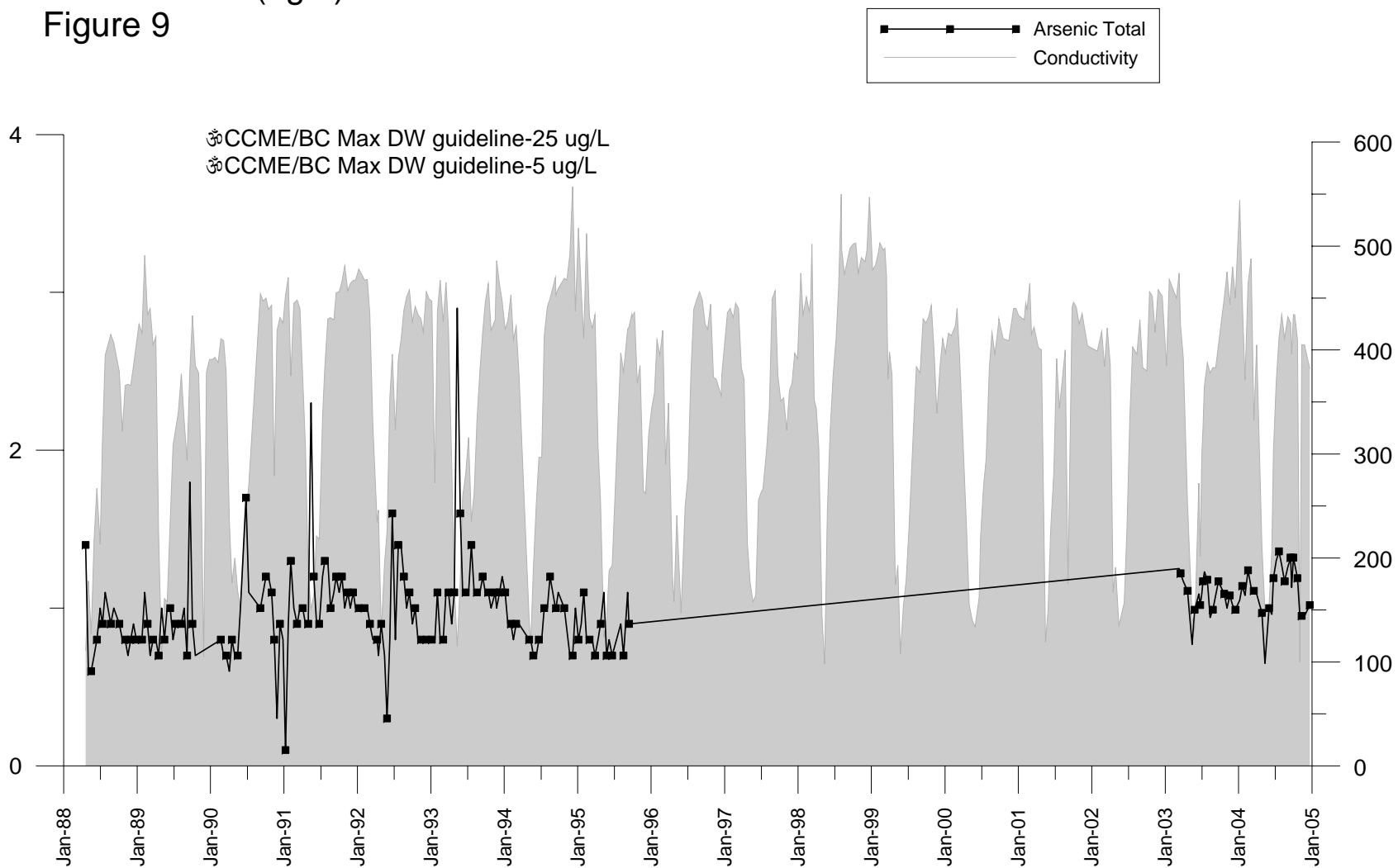
Figure 8



Salmon River at Hwy 1 Bridge

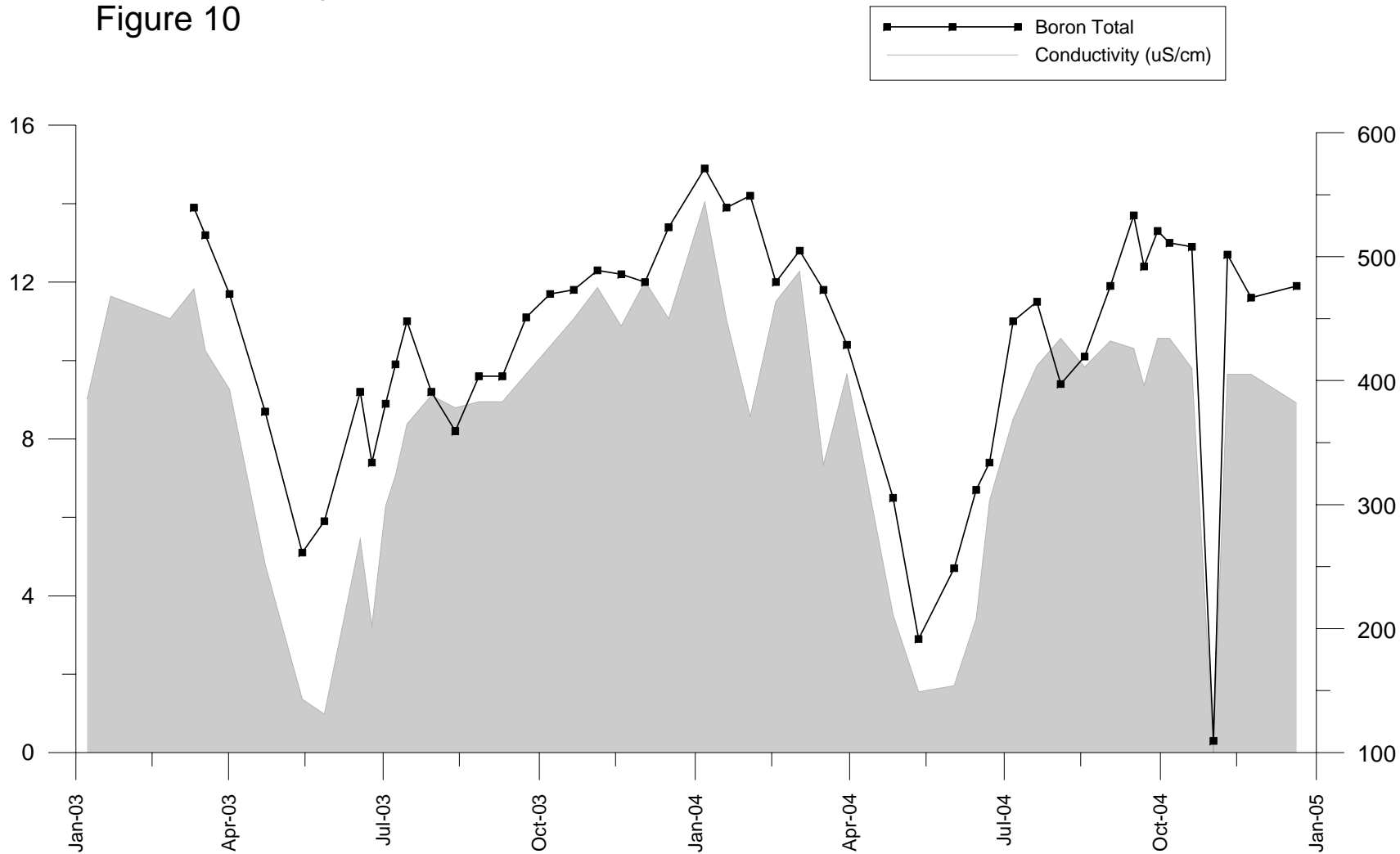
Arsenic Total (ug/L)

Figure 9



Salmon River at Hwy 1 Bridge

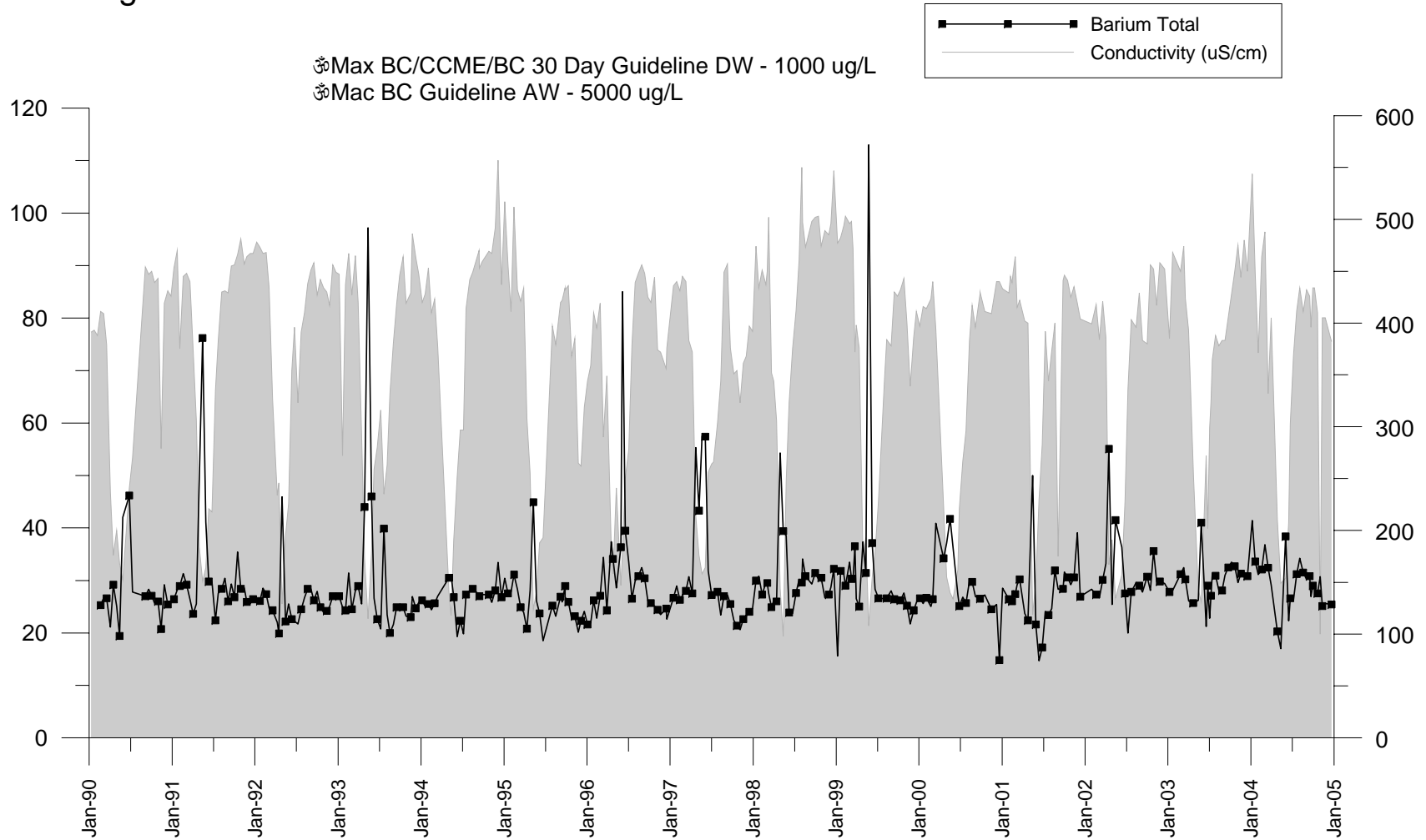
Boron Total (ug/L)
Figure 10



Salmon River at Hwy 1 Bridge

Barium Total (ug/L)

Figure 11

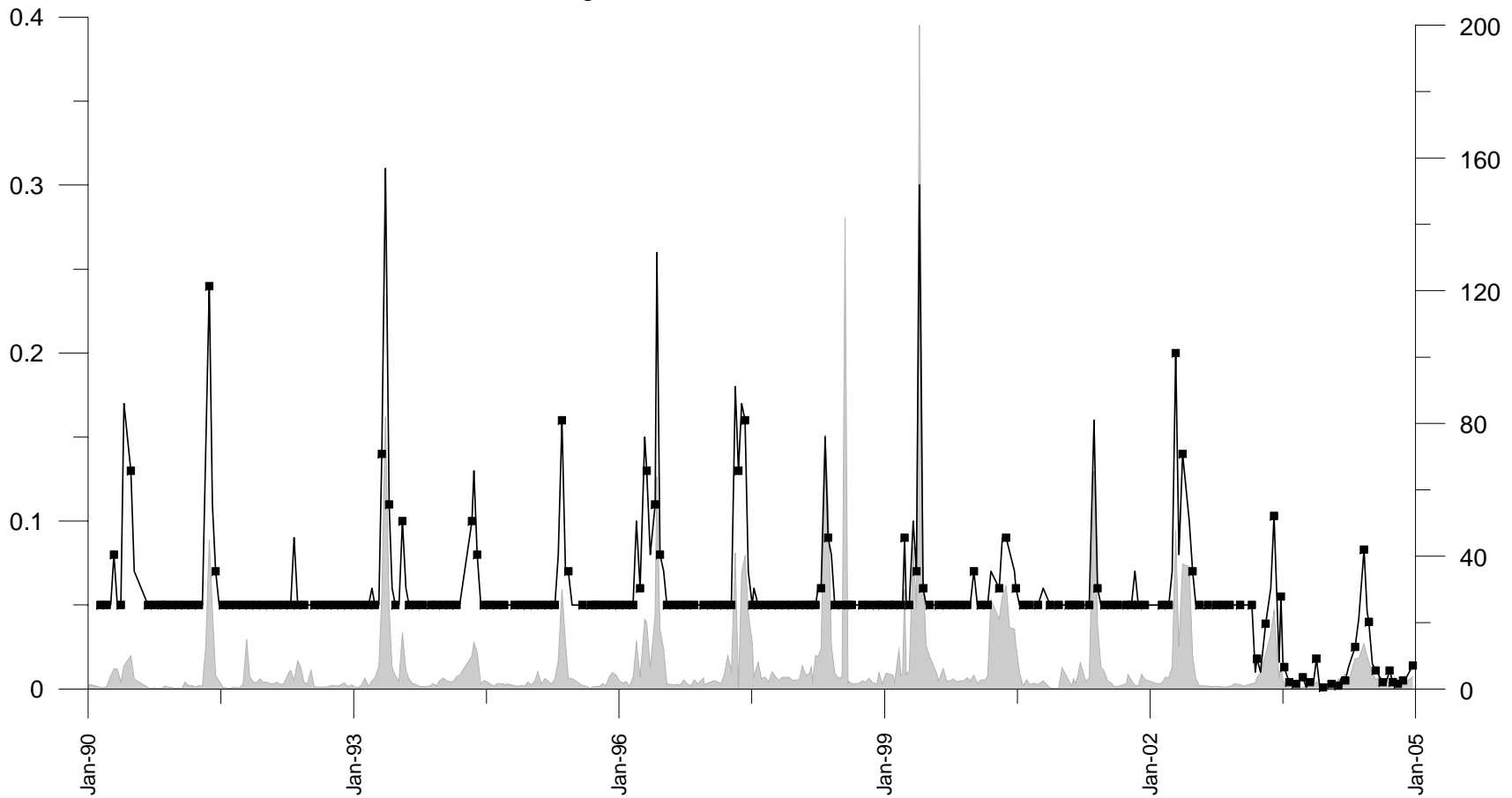
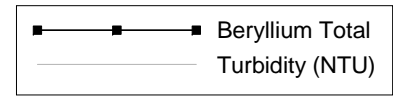


Salmon River at Hwy 1 Bridge

Beryllium Total (ug/L)

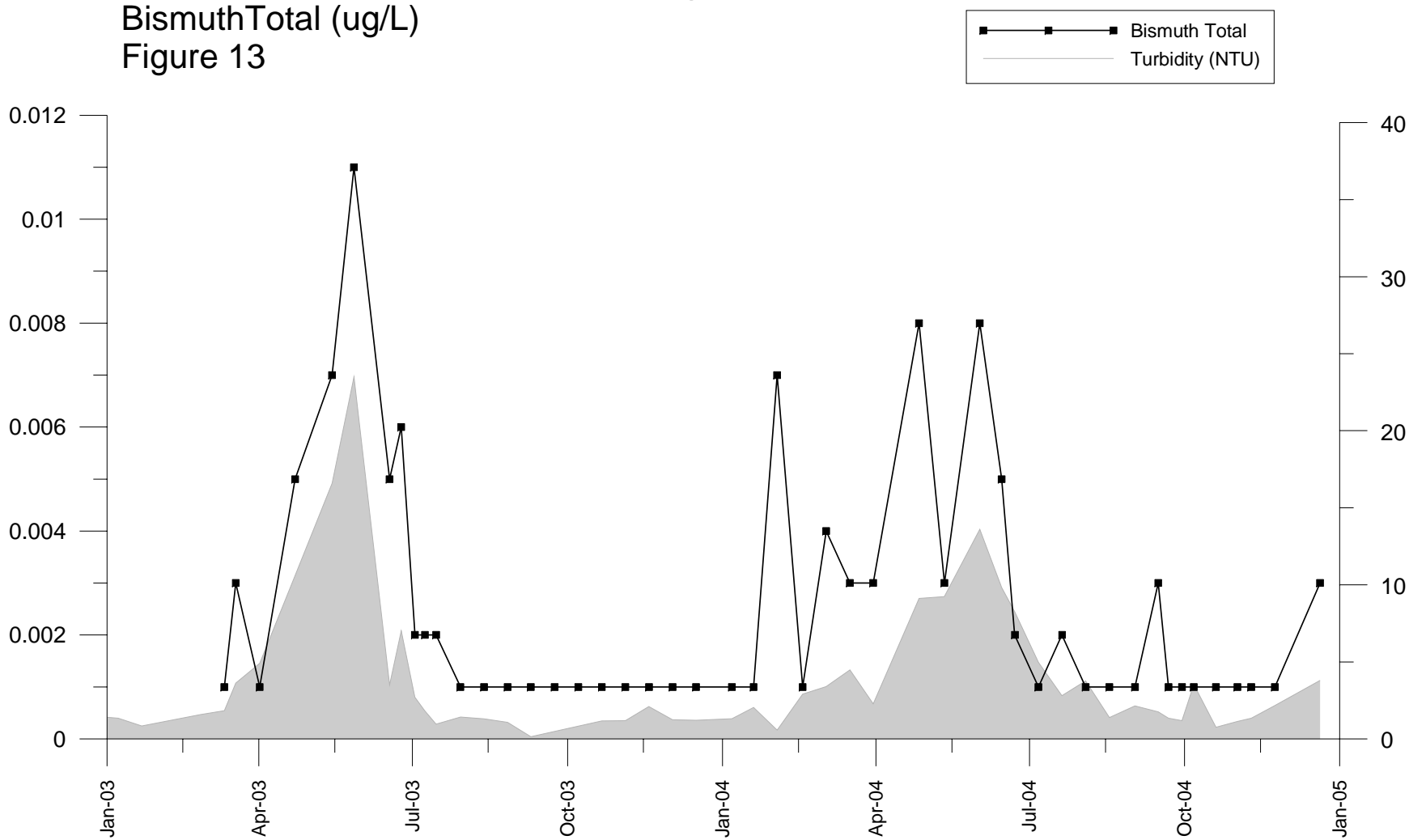
Figure 12

☼ BC Max AW Guideline - 5.3 ug/L
☼ CCME DW Guideline - 4 ug/L



Salmon River at Hwy 1 Bridge

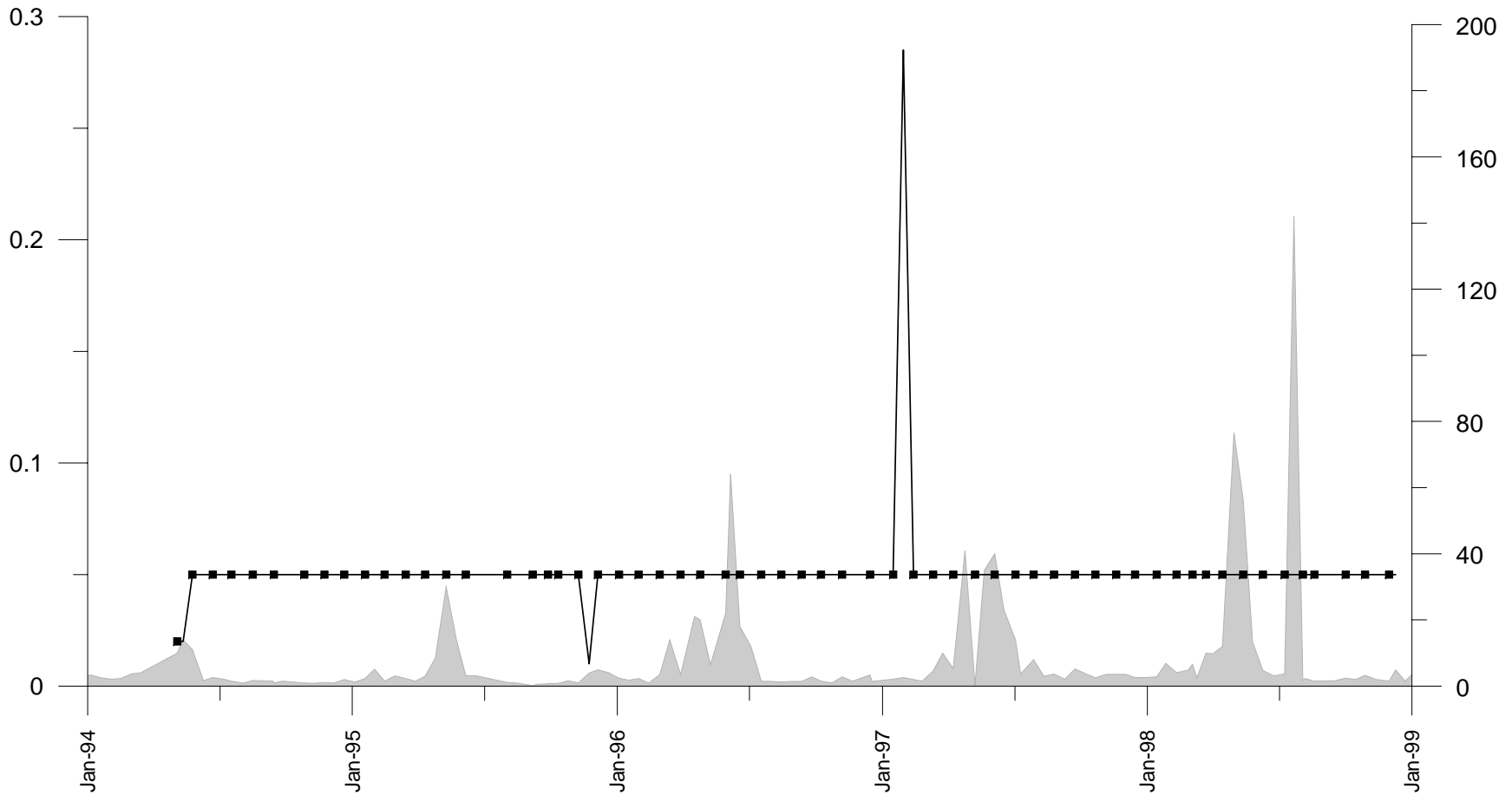
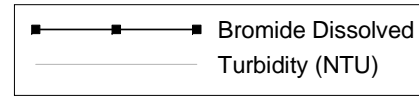
BismuthTotal (ug/L)
Figure 13



Salmon River at Hwy 1 Bridge

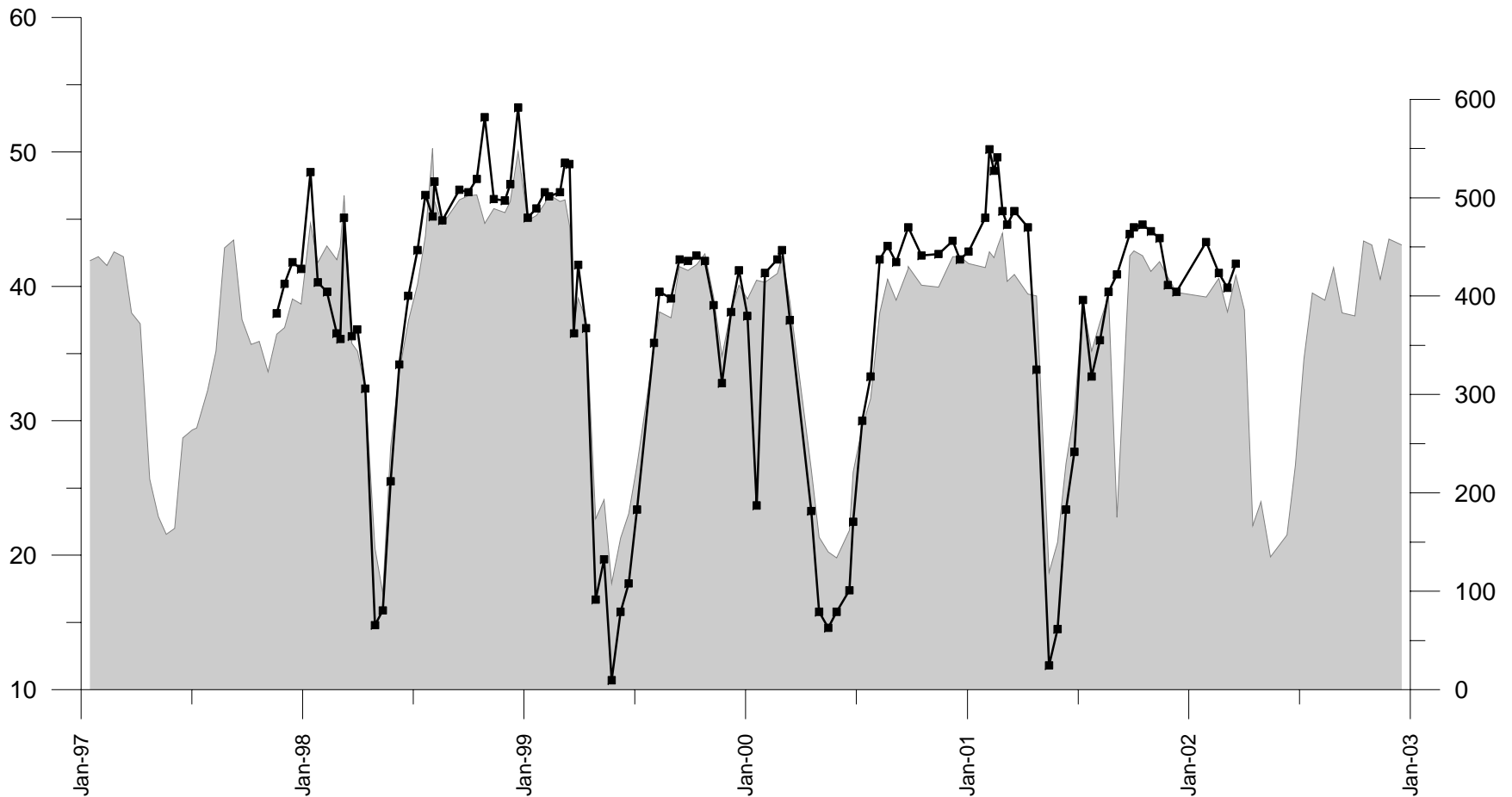
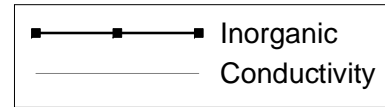
Bromide Dissolved (ug/L)

Figure 14



Salmon River at Hwy 1 Bridge

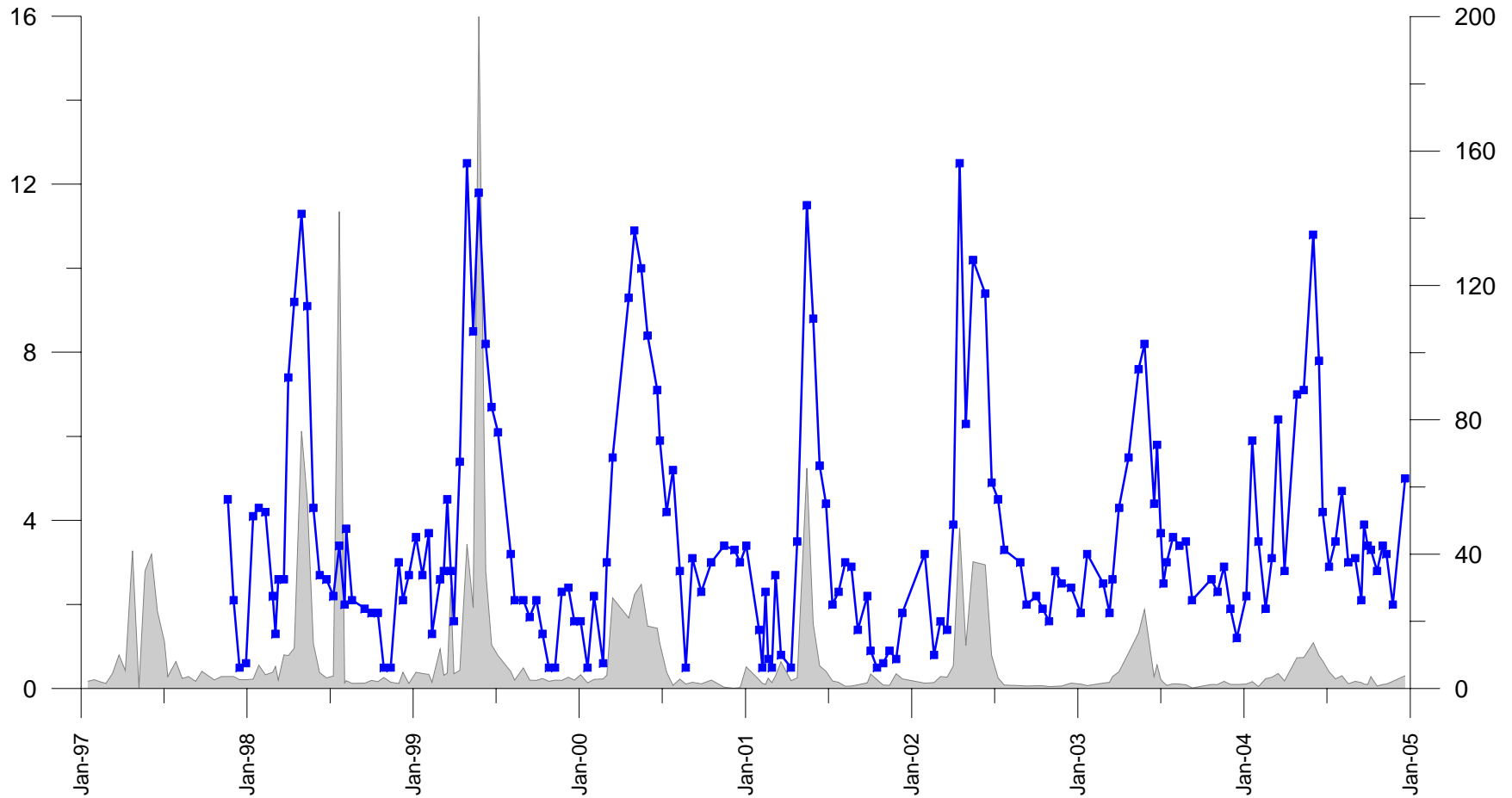
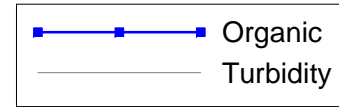
Carbon Dissolved Inorganic (mg/L)
Figure 15



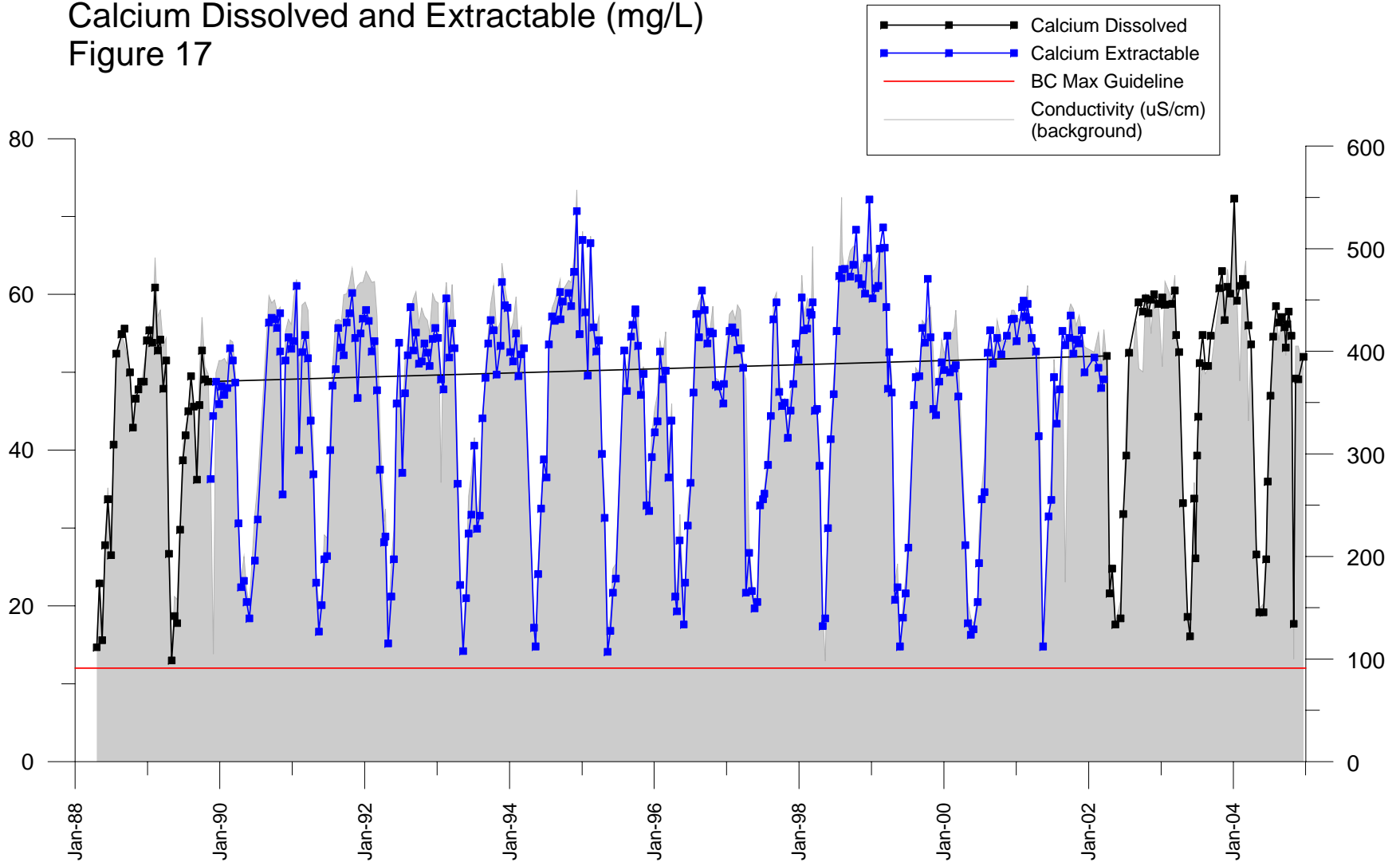
Salmon River at Hwy 1 Bridge

Carbon Dissolved Organic (mg/L)

Figure 16



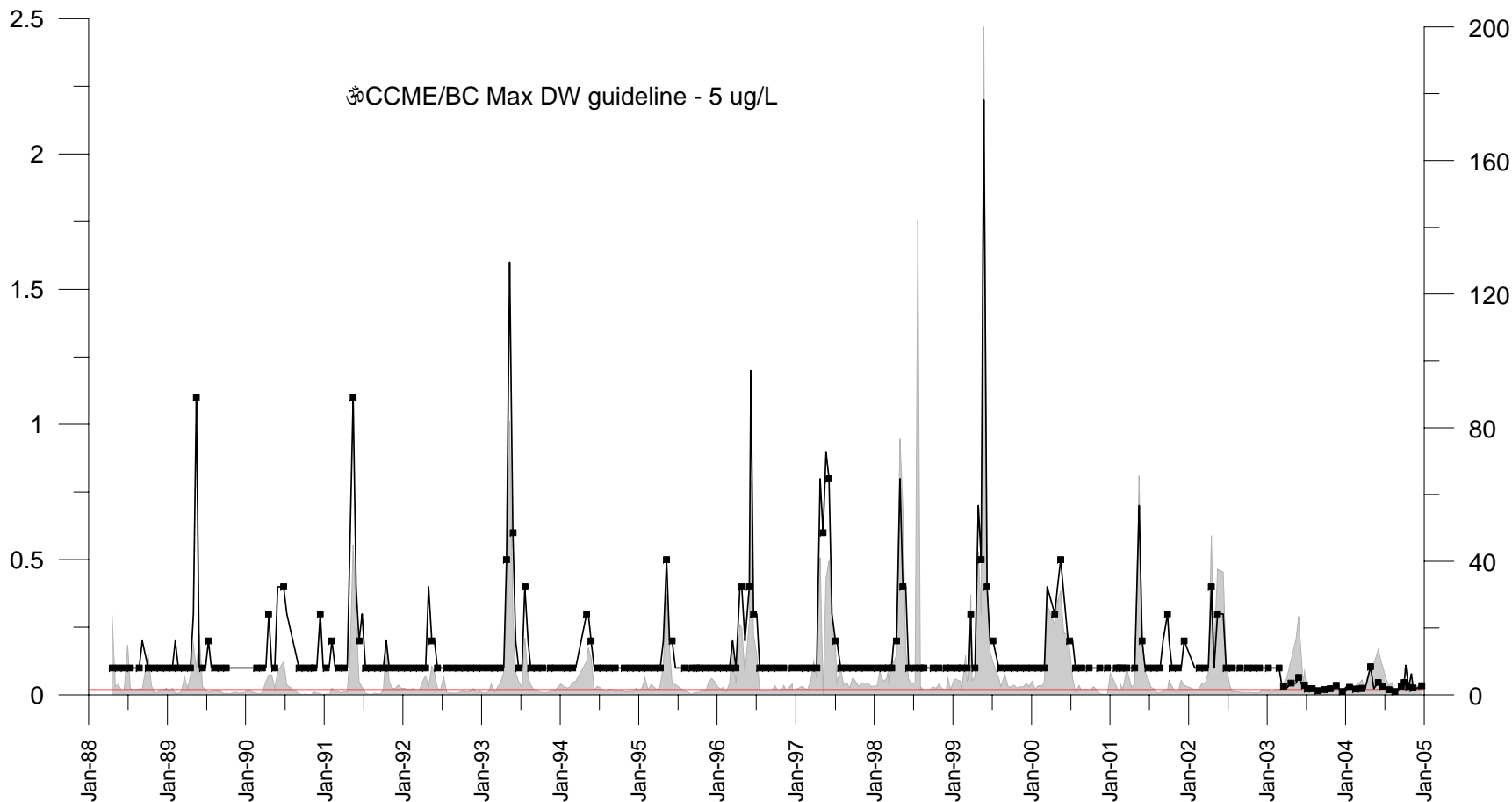
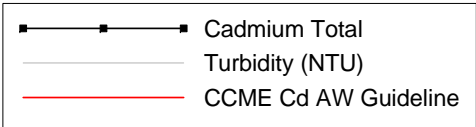
Salmon River at Hwy 1 Bridge Calcium Dissolved and Extractable (mg/L) Figure 17



Salmon River at Hwy 1 Bridge

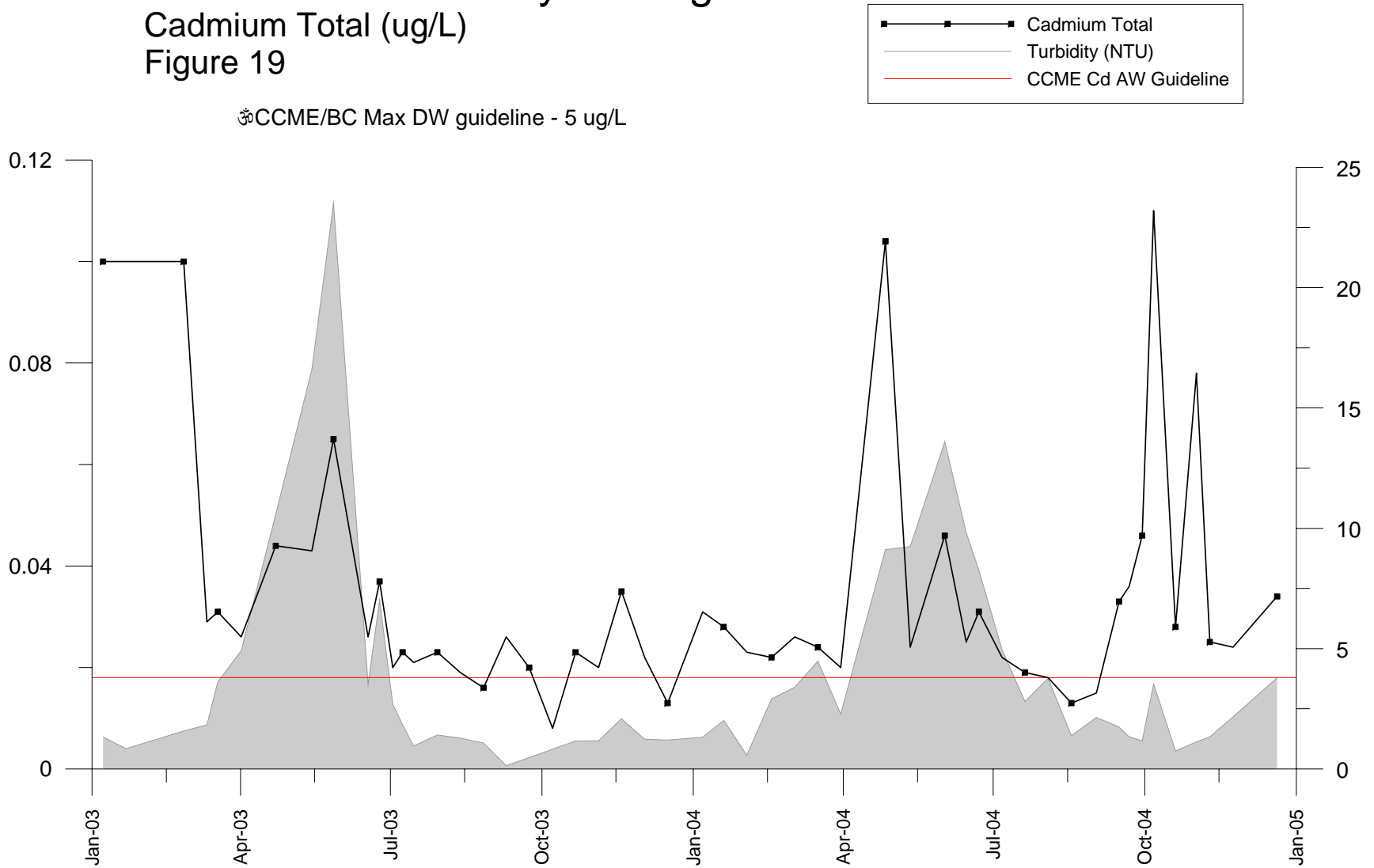
Cadmium Total (ug/L)

Figure 18



Salmon River at Hwy 1 Bridge Cadmium Total (ug/L) Figure 19

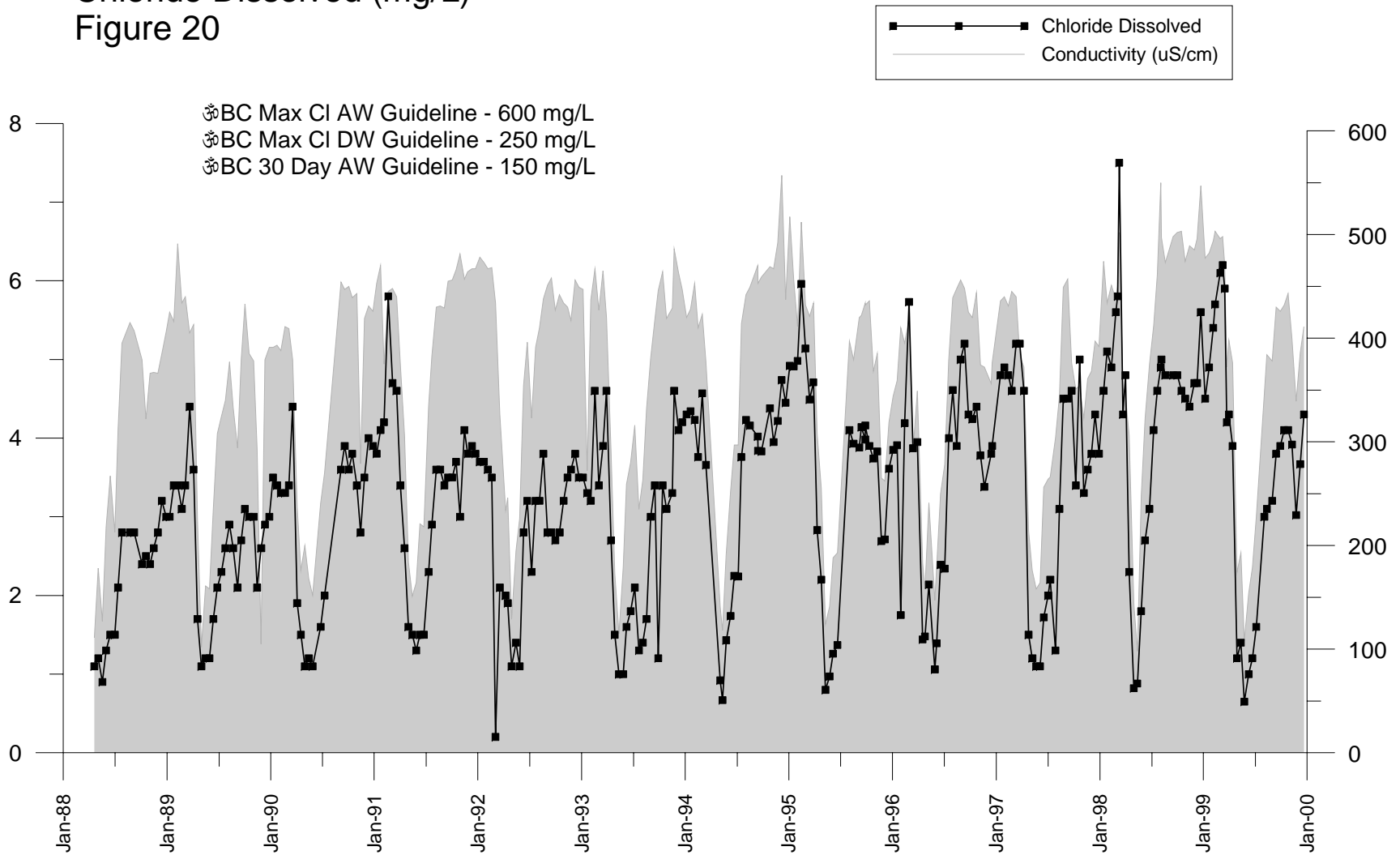
☞ CCME/BC Max DW guideline - 5 ug/L



Salmon River at Hwy 1 Bridge

Chloride Dissolved (mg/L)

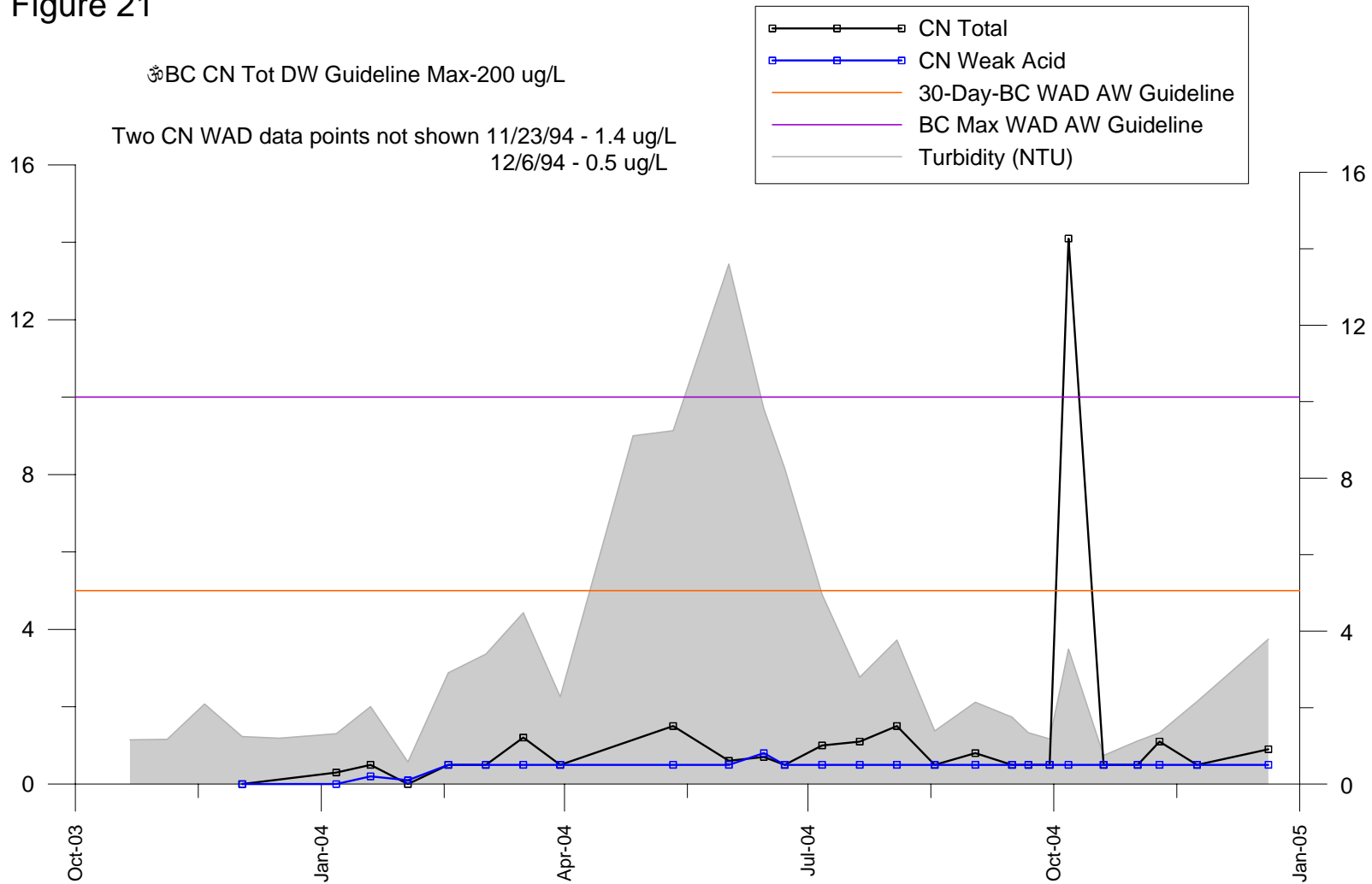
Figure 20



Salmon River at Hwy1 Bridge

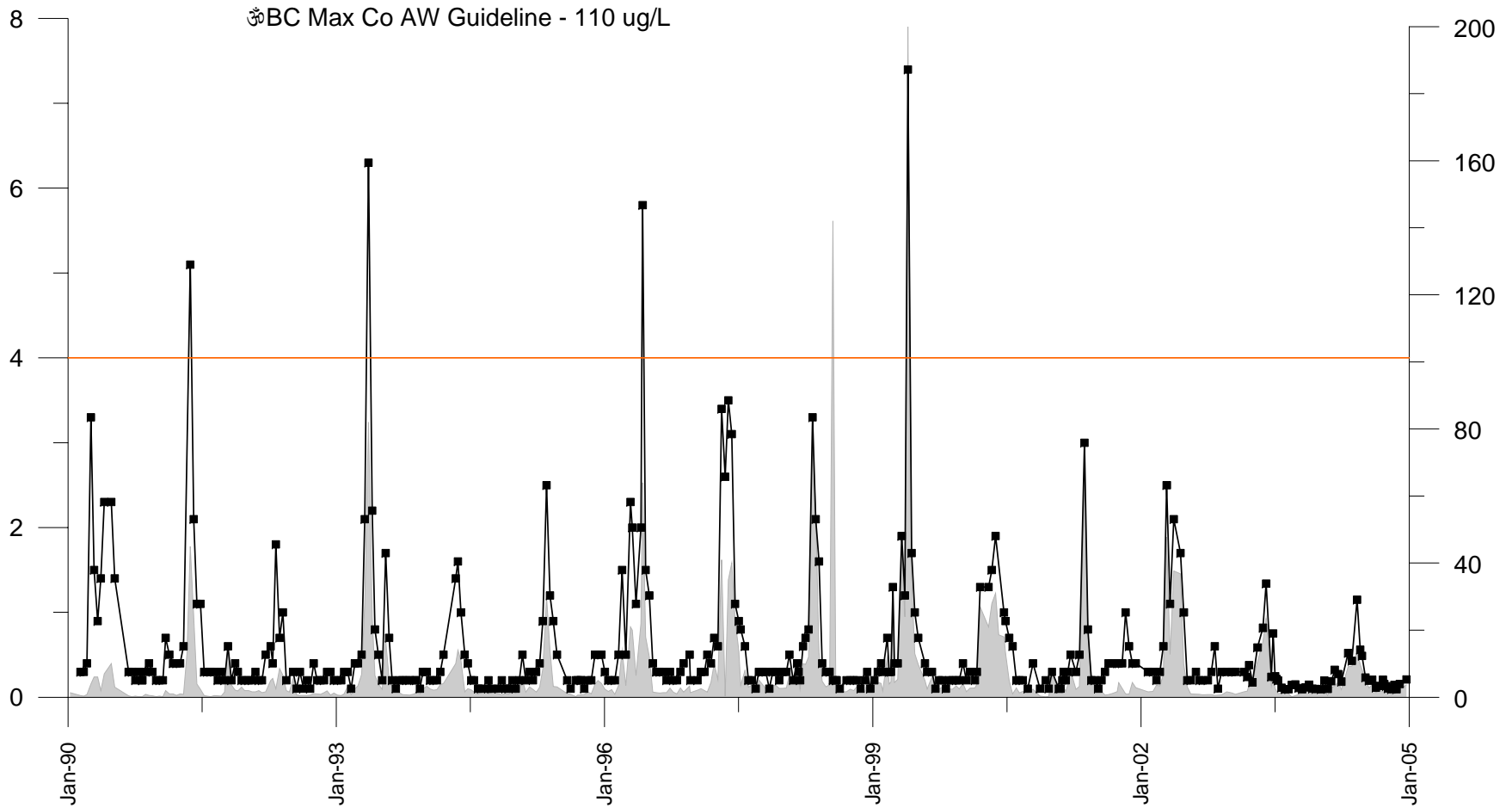
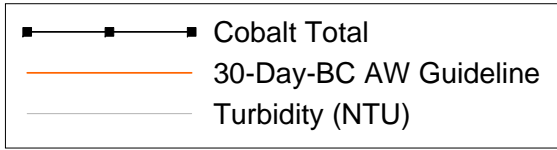
Cyanide Total and Weak Acid Dissociable (ug/L)

Figure 21



Salmon River at Hwy 1 Bridge

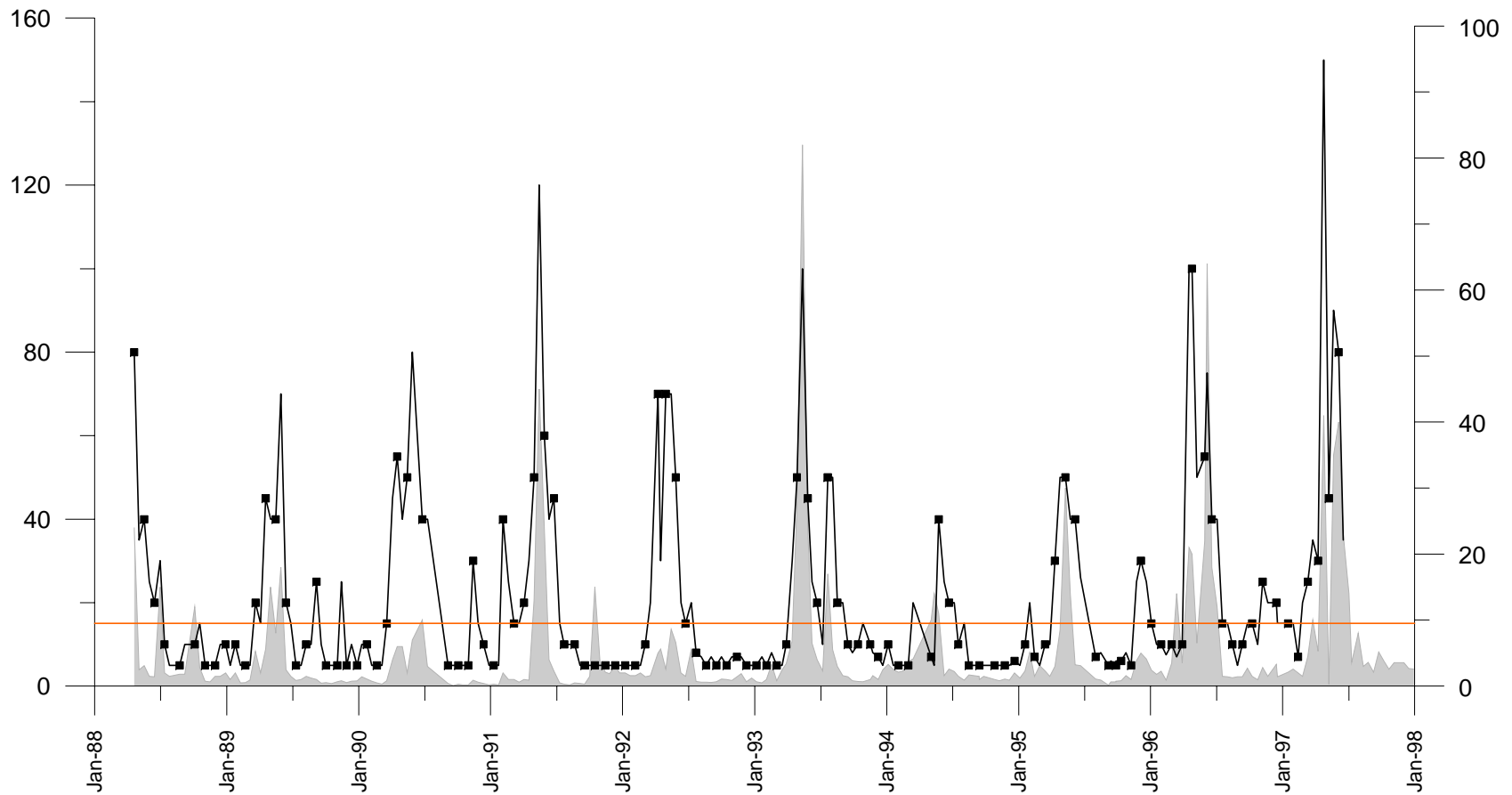
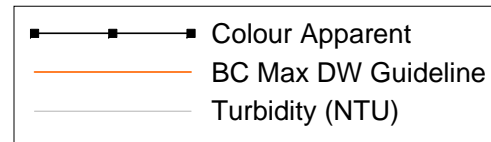
Cobalt Total (ug/L)
Figure 22



Salmon River at Hwy 1 Bridge

Colour Apparent (Colour Units)

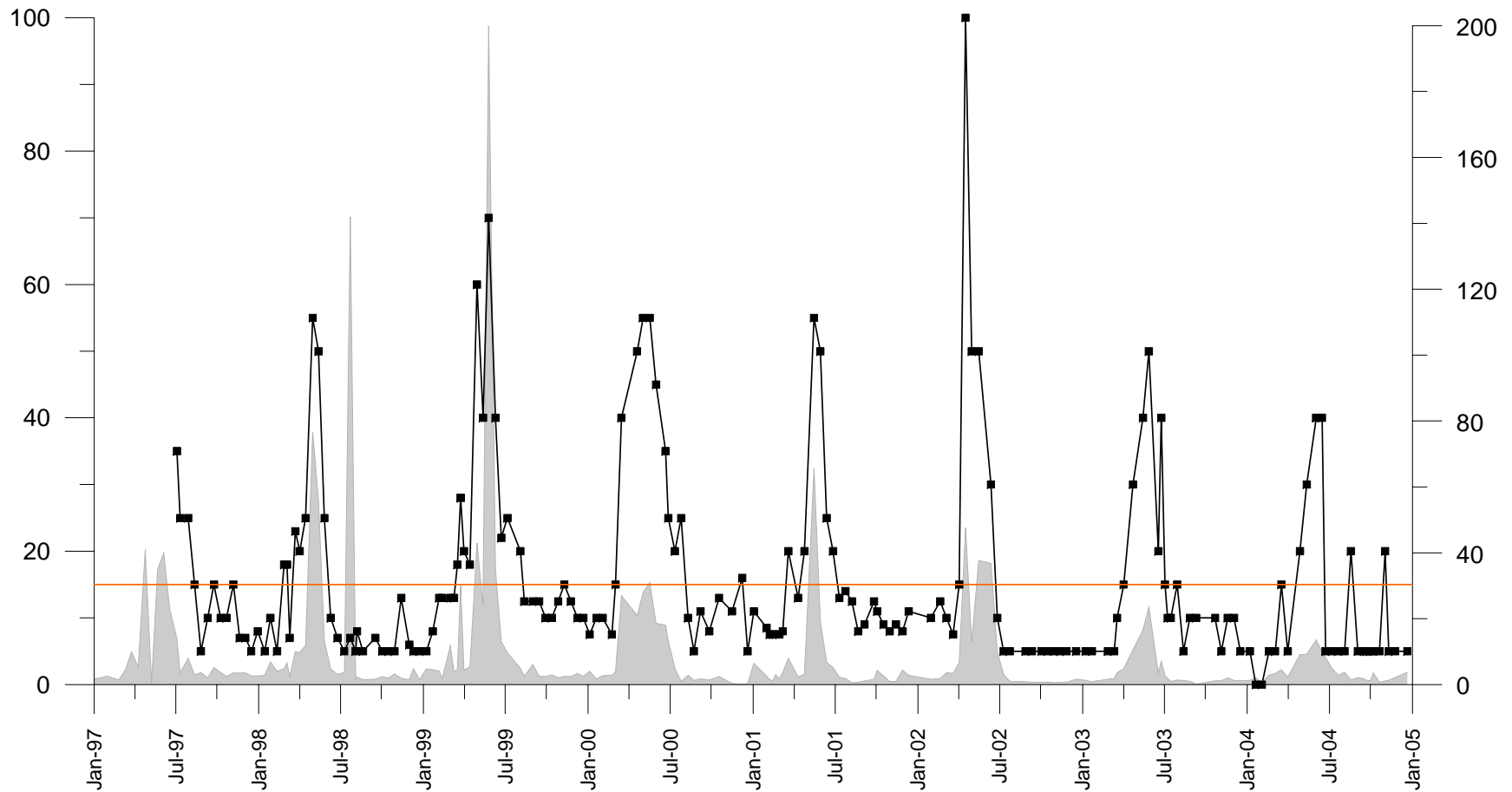
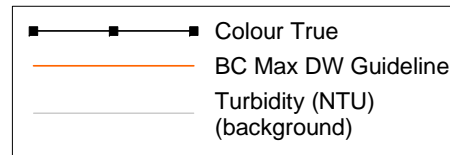
Figure 23



Salmon River at Hwy 1 Bridge

Colour True (Colour Units)

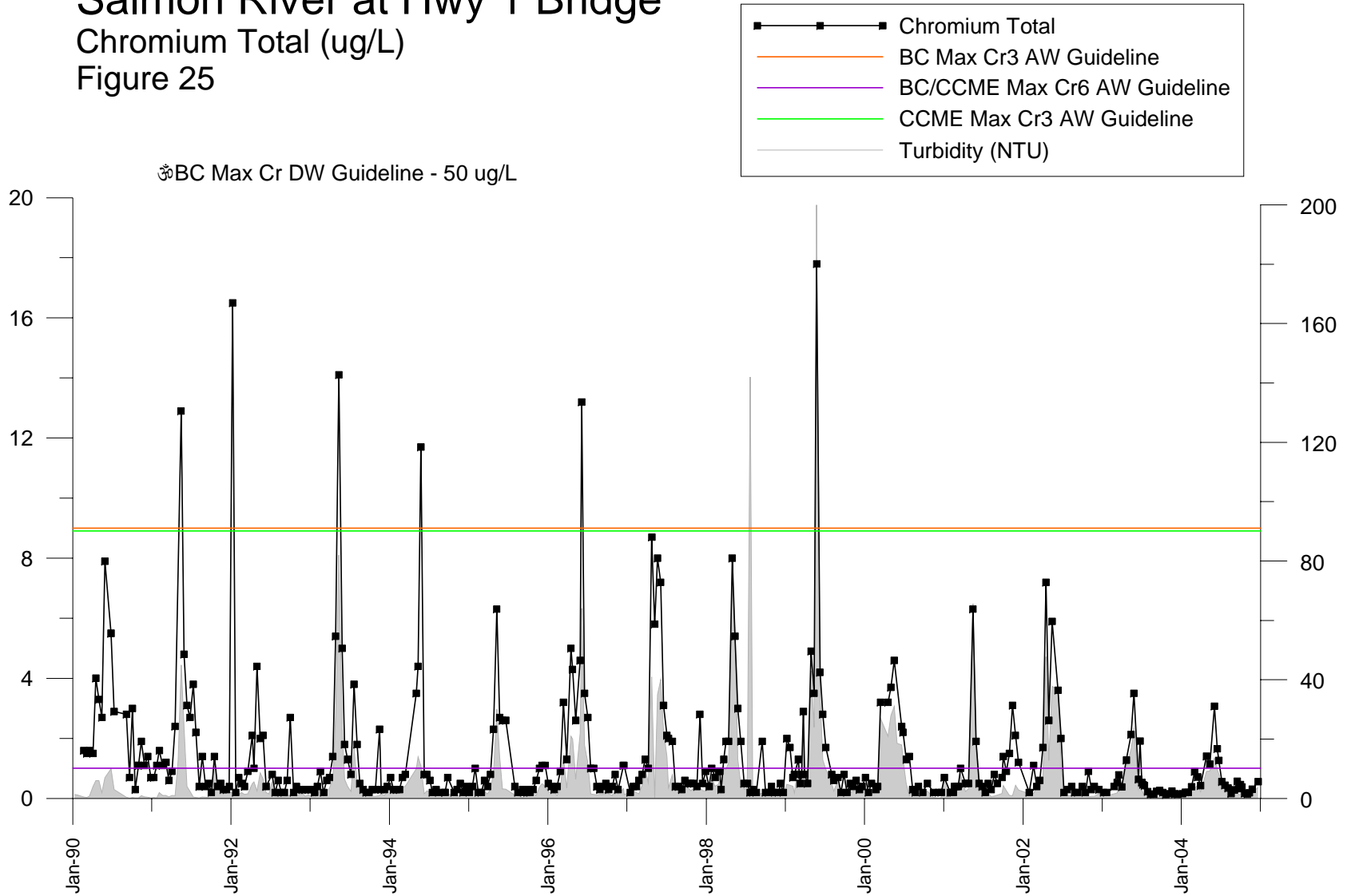
Figure 24



Salmon River at Hwy 1 Bridge

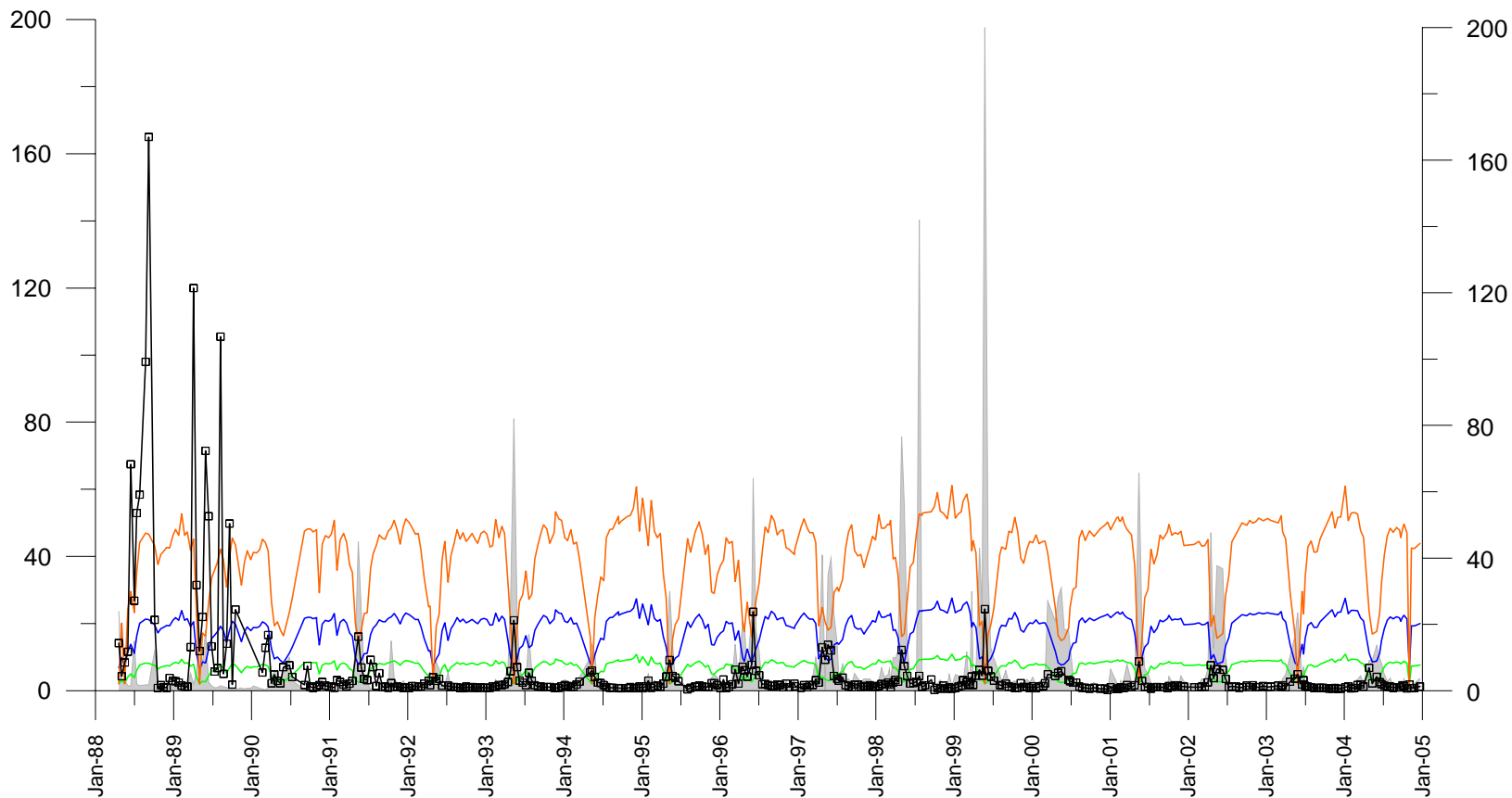
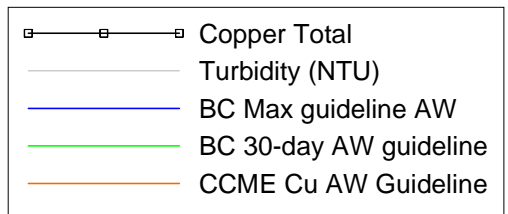
Chromium Total (ug/L)

Figure 25



Salmon River at Hwy 1 Bridge Copper Total (ug/L) Figure 26

BC Max DW Guideline - 500 ug/L

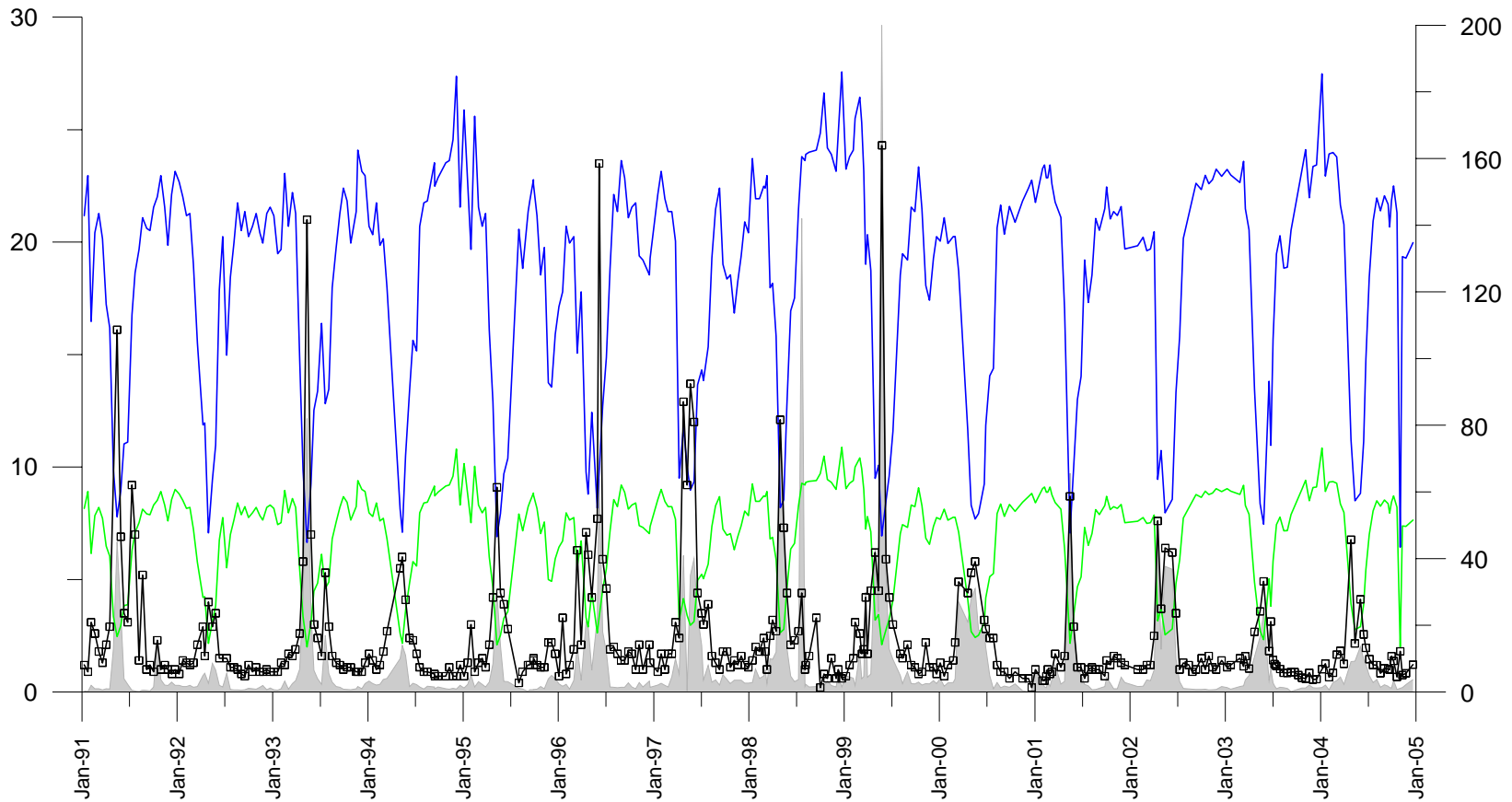
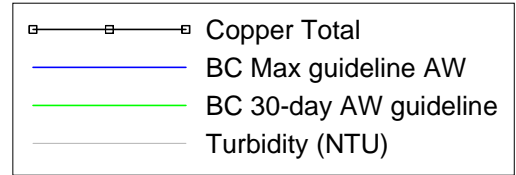


Salmon River at Hwy 1 Bridge

Copper Total (ug/L)

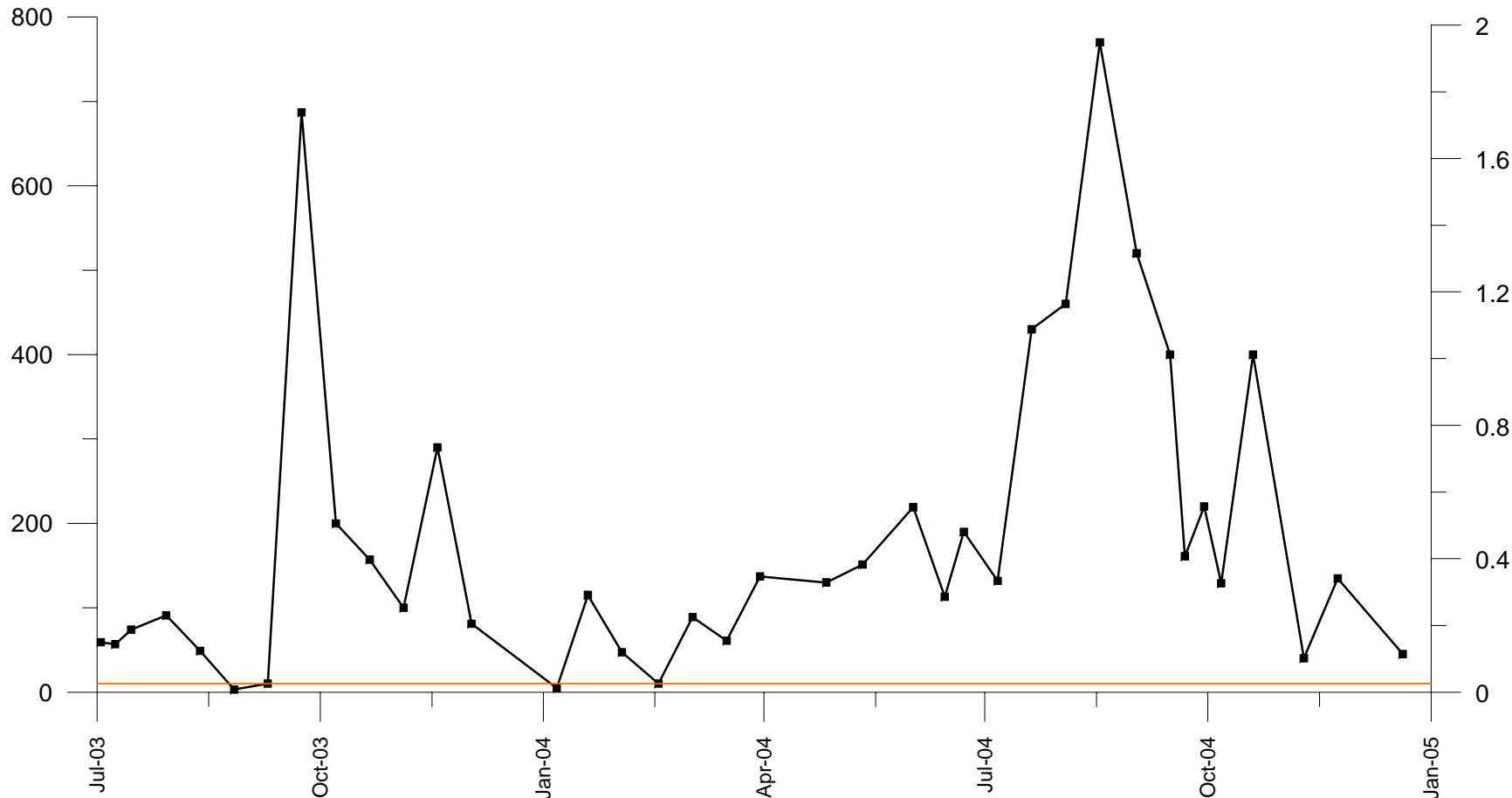
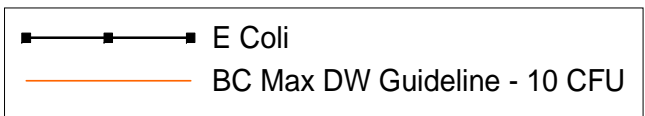
Figure 27

⊗ BC Max DW Guideline - 500 ug/L
⊗ CCME AW Guideline range 2 - 61.1 ug/L



Salmon River near Hwy1

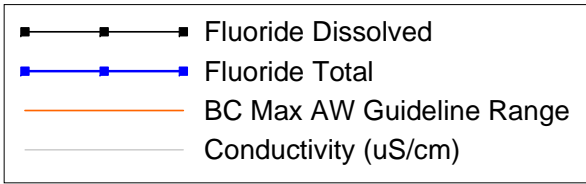
E Coli (CFU/100mL)
Figure 28



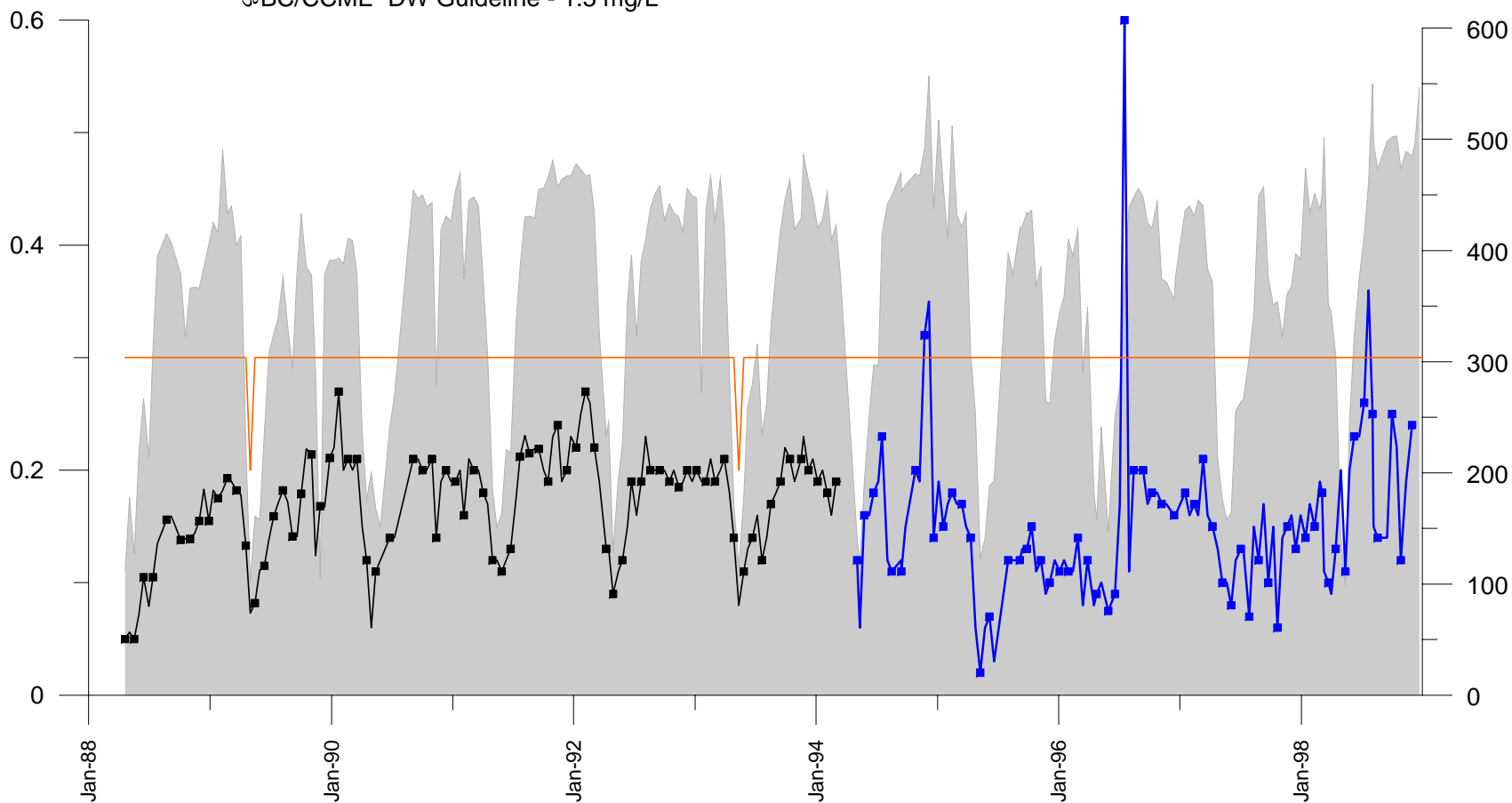
Salmon River at Hwy 1 Bridge

Fluoride Dissolved and Total (mg/L)

Figure 29

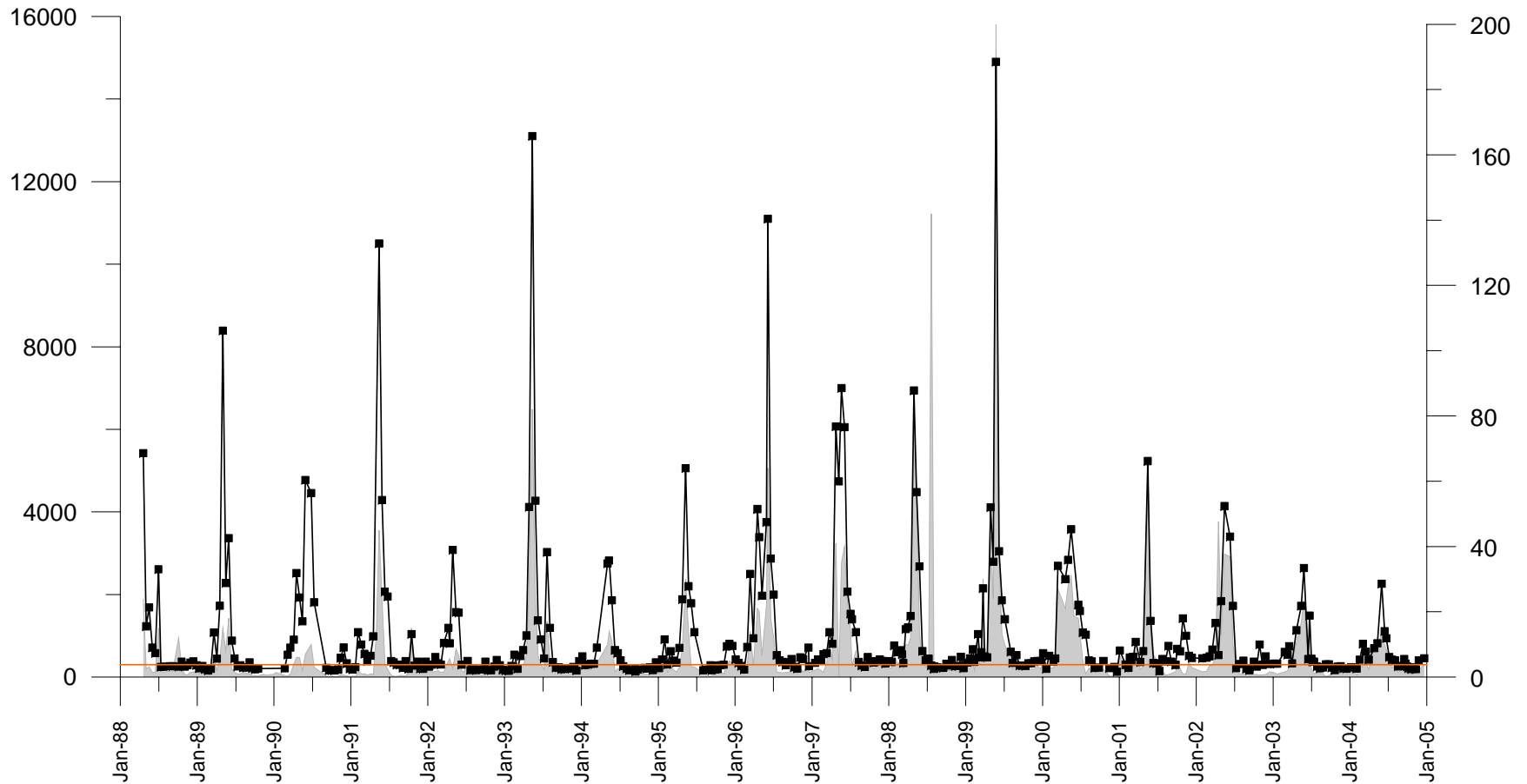
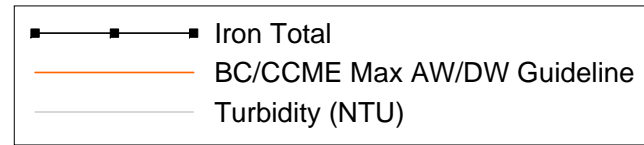


⊗ BC 30 Day DW Guideline - 1 mg/L
 ⊗ BC/CCME DW Guideline - 1.5 mg/L



Salmon River at Hwy 1 Bridge

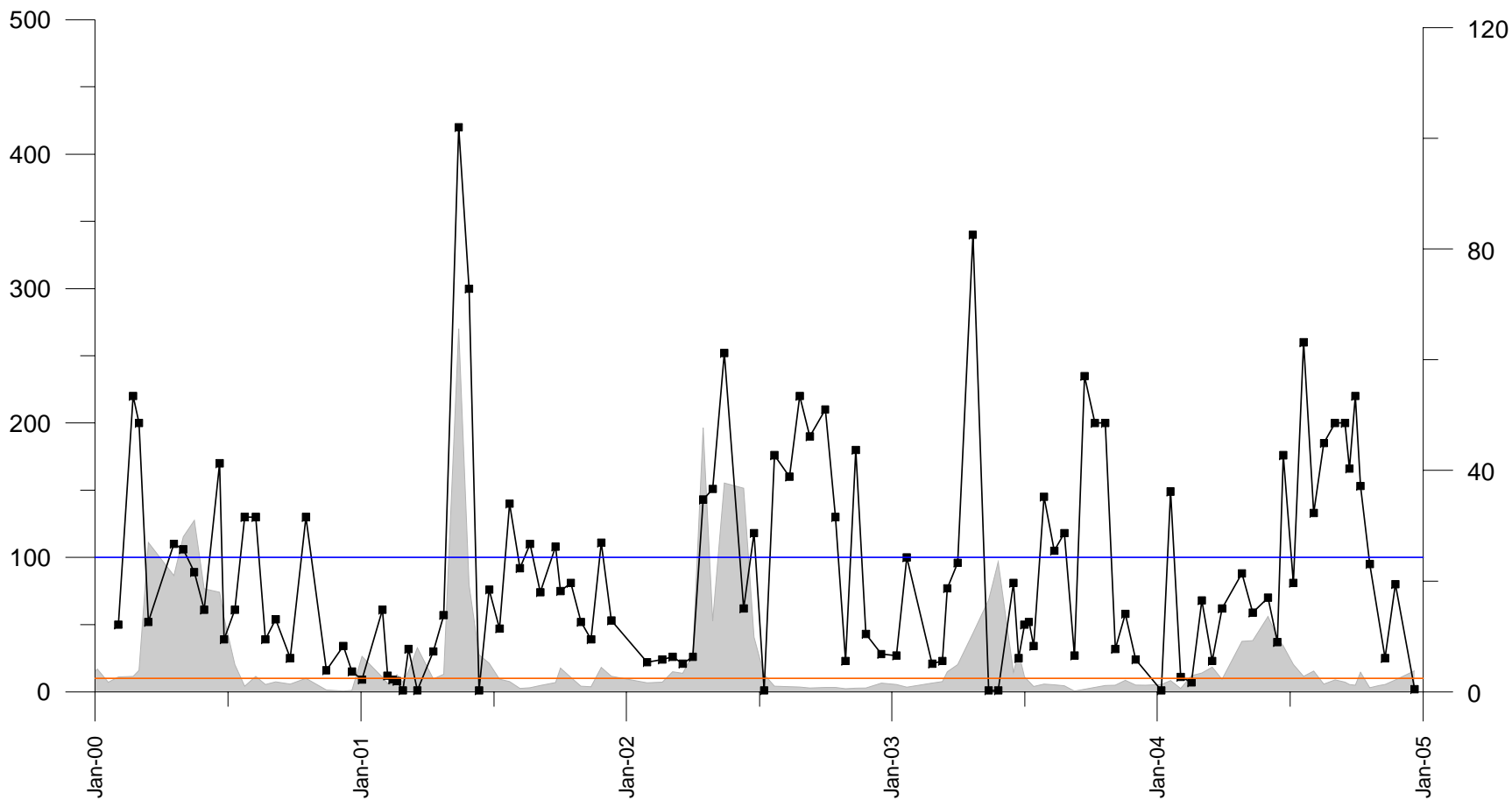
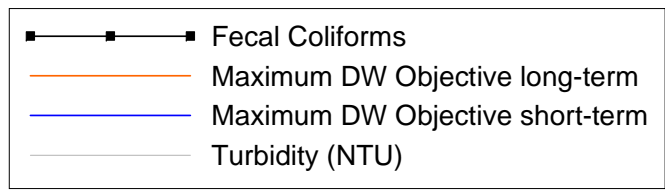
Iron Total (ug/L)
Figure 30



Salmon River at Hwy 1 Bridge

Fecal Coliforms (CFU/100mL)

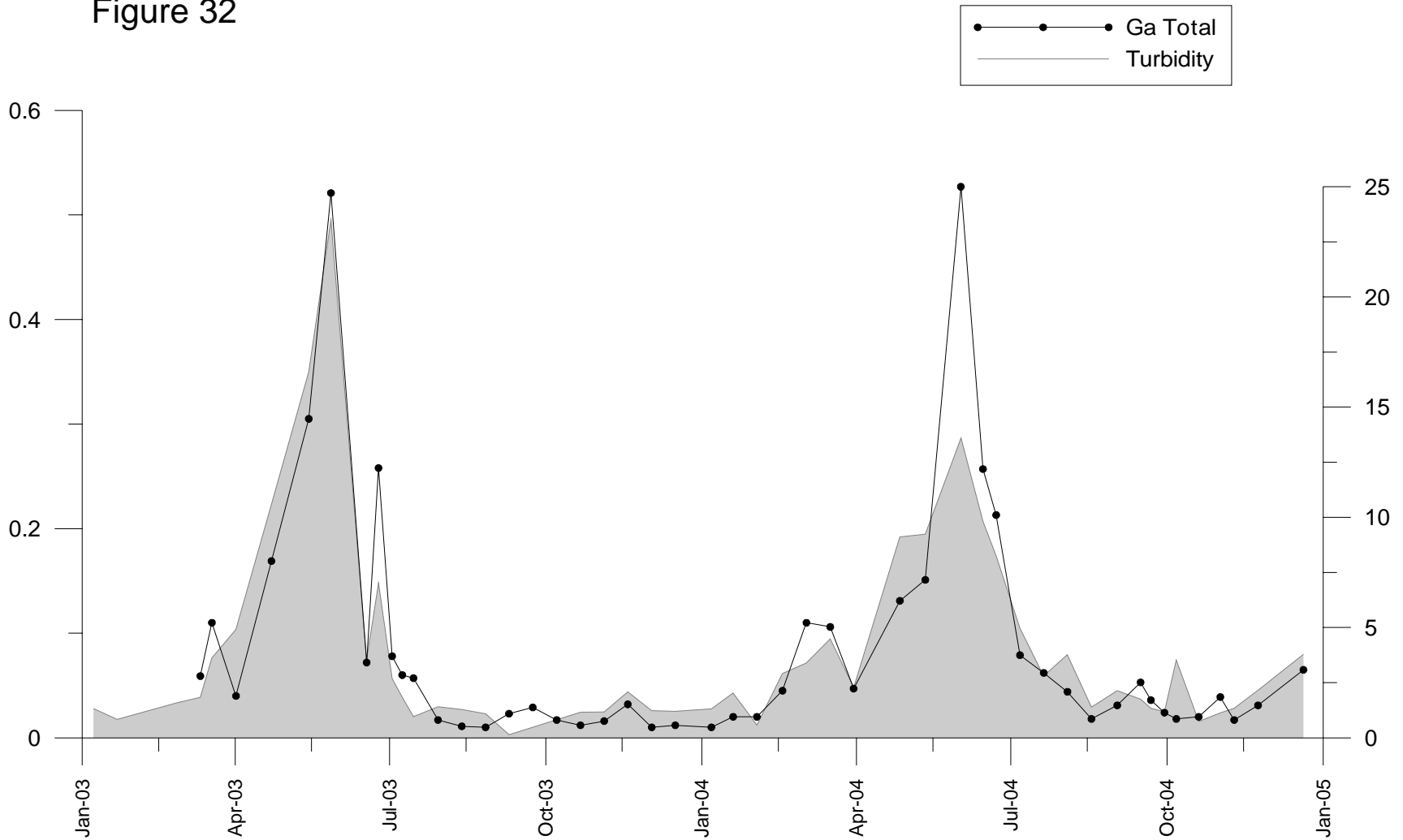
Figure 31



Salmon River at Hwy 1 Bridge

Total Gallium (ug/L)

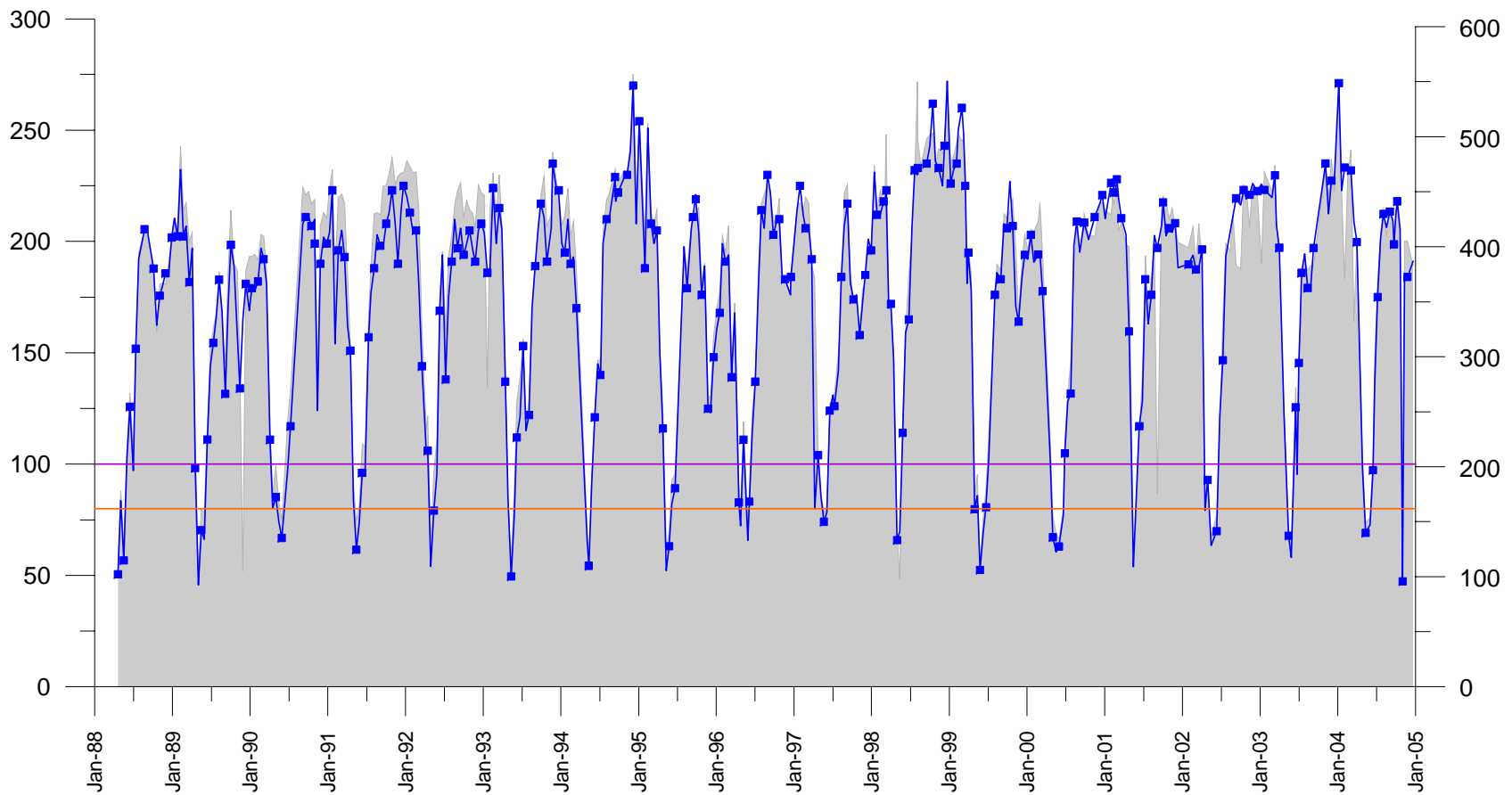
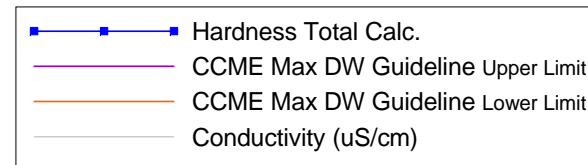
Figure 32



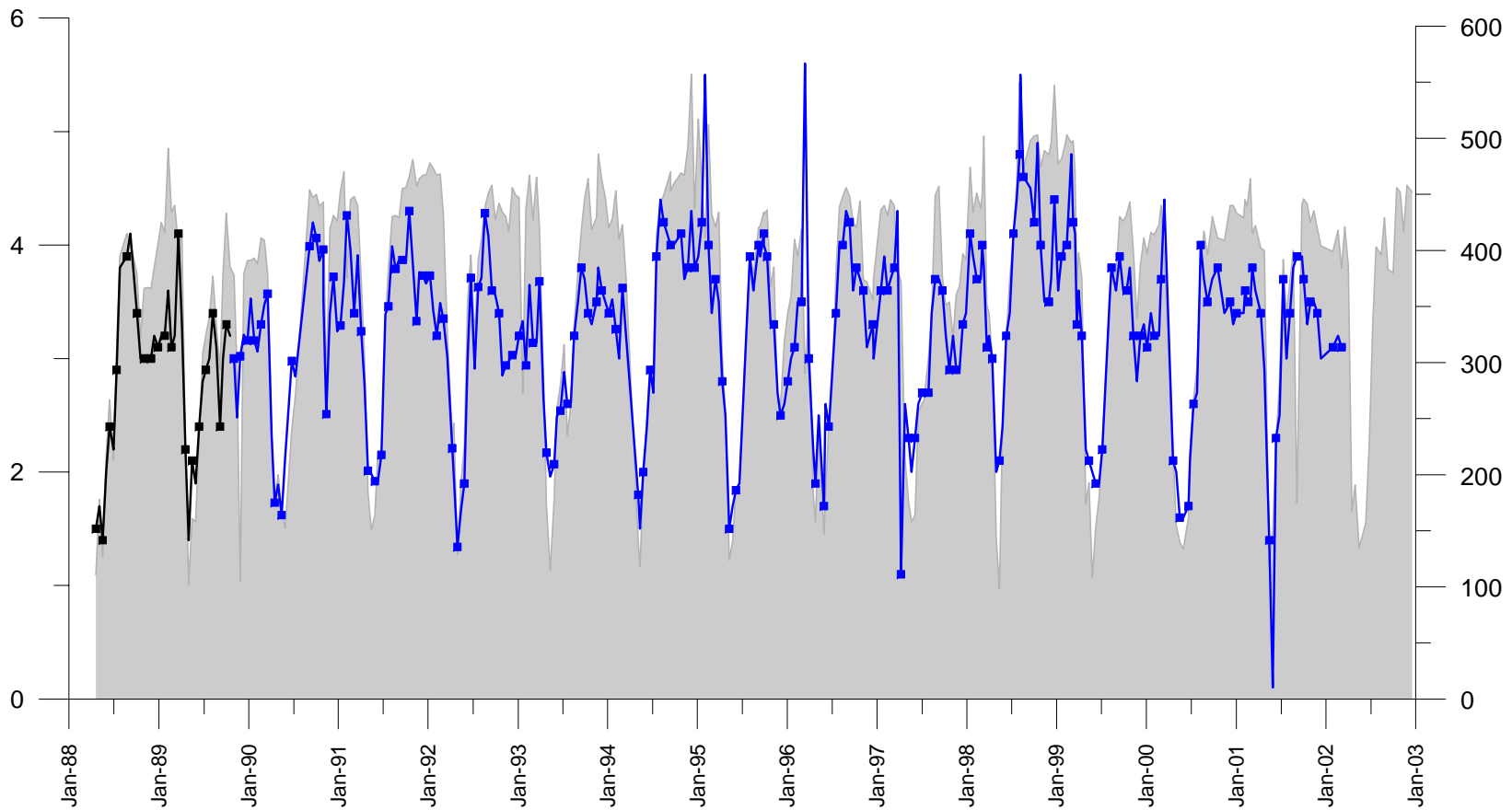
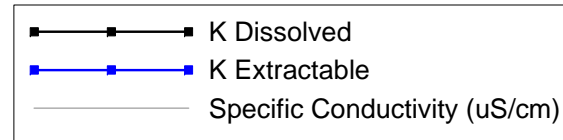
Salmon River at Hwy 1 Bridge

Hardness Total Calcd (CaCO3)

Figure 33

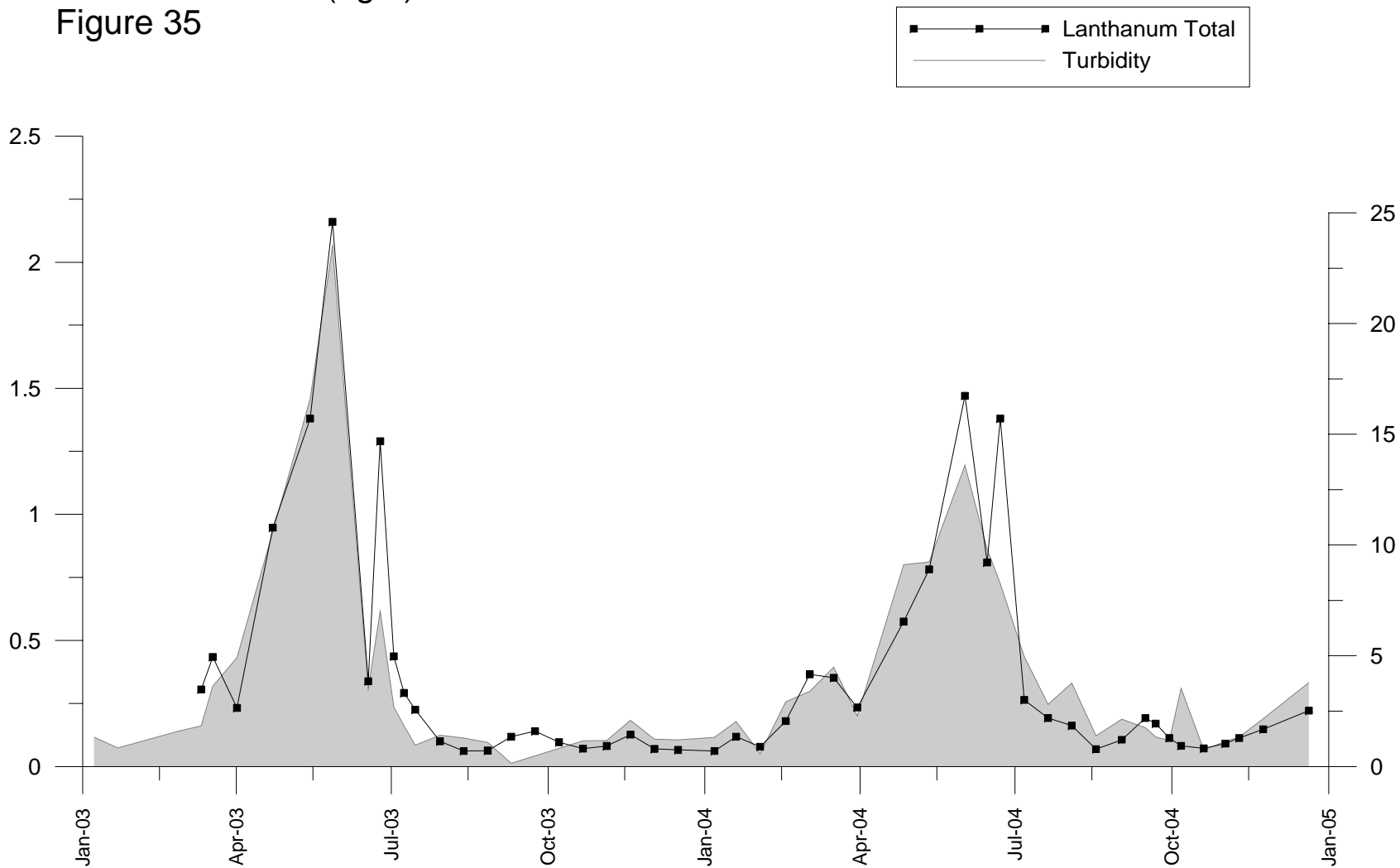


Salmon River at Hwy 1 Bridge
Potassium Dissolved and Extractable (mg/L)
Figure 34



Salmon River at Hwy 1 Bridge

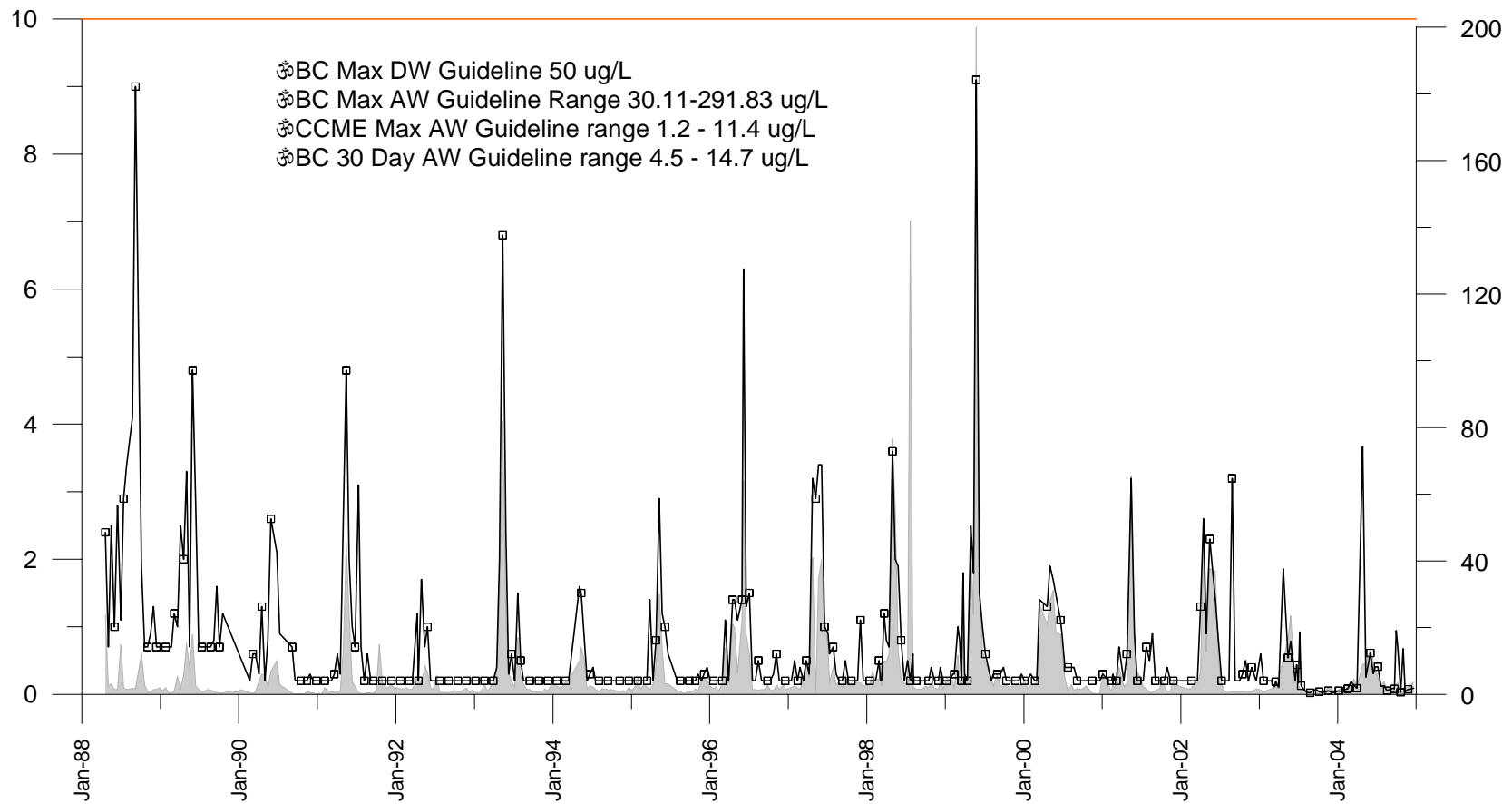
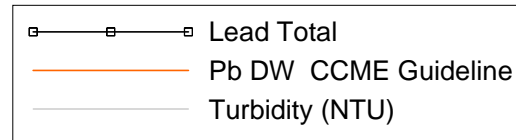
Lanthanum Total (ug/L)
Figure 35



Salmon River at Hwy 1 Bridge

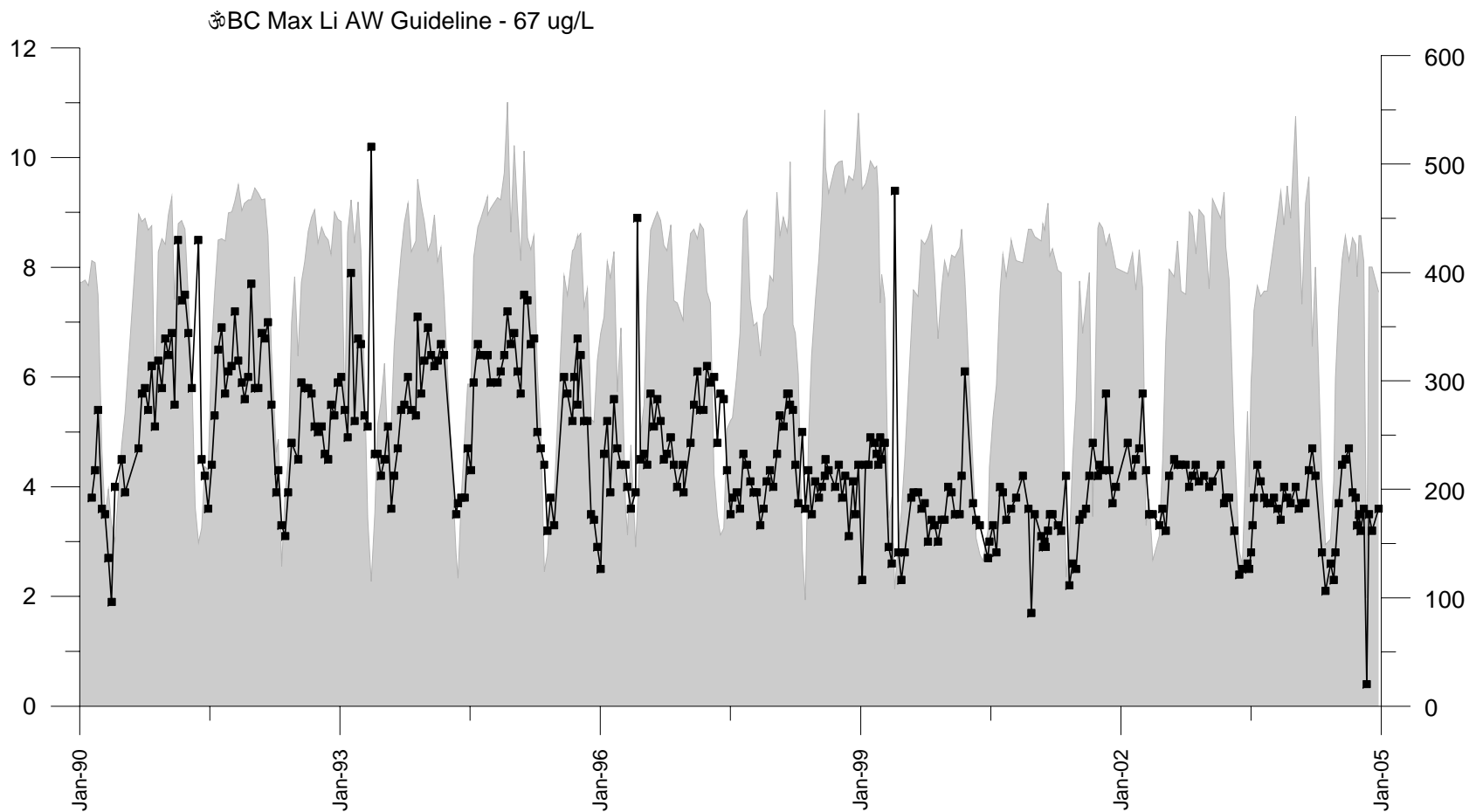
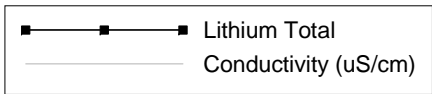
Lead Total (ug/L)

Figure 36



Salmon River at Hwy 1 Bridge

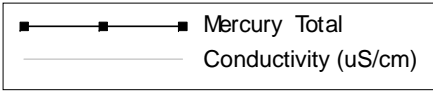
Lithium Total (ug/L)
Figure 37



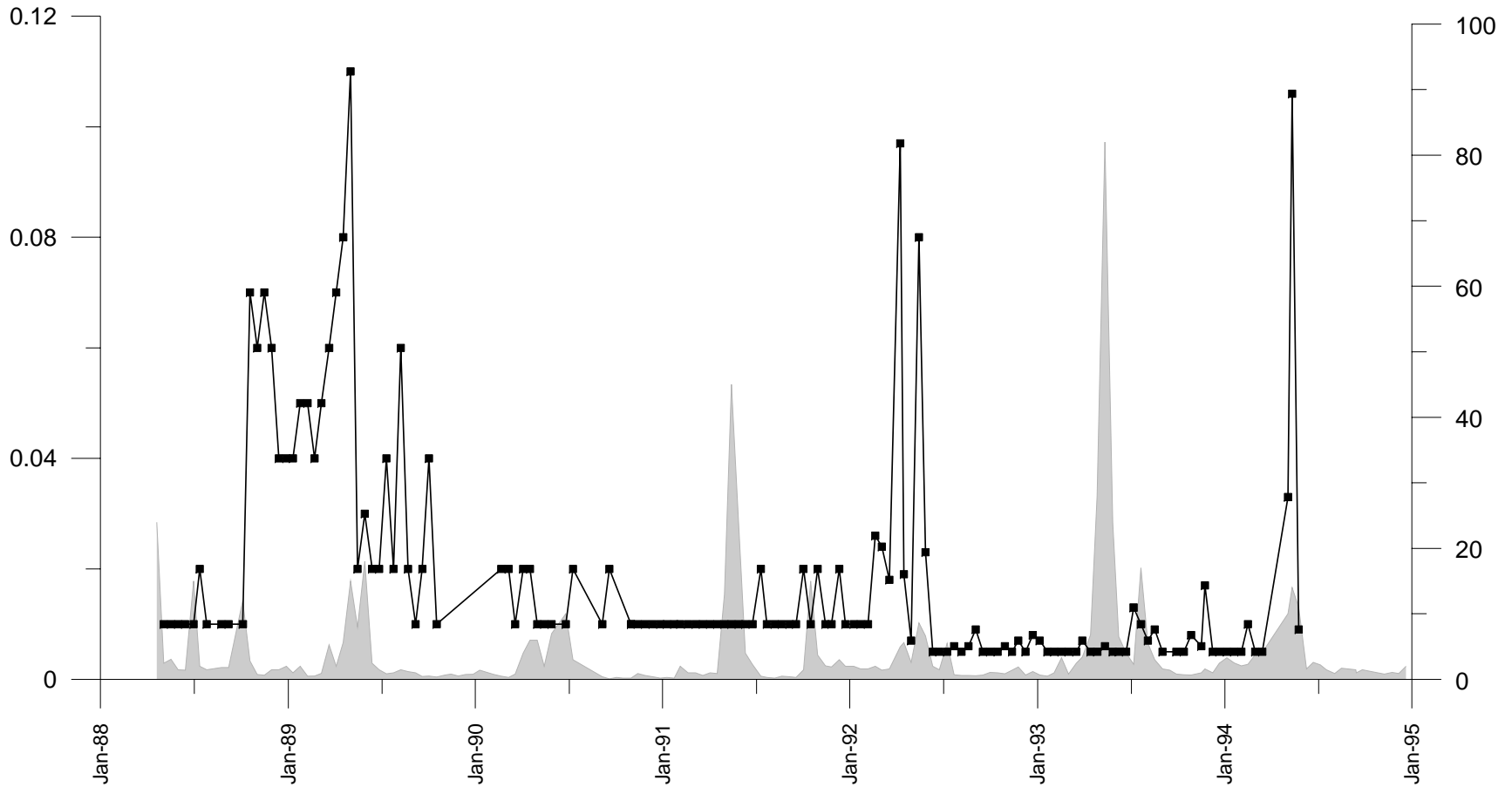
Salmon River at Hwy 1 Bridge

Mercury Total (ug/L)

Figure 38



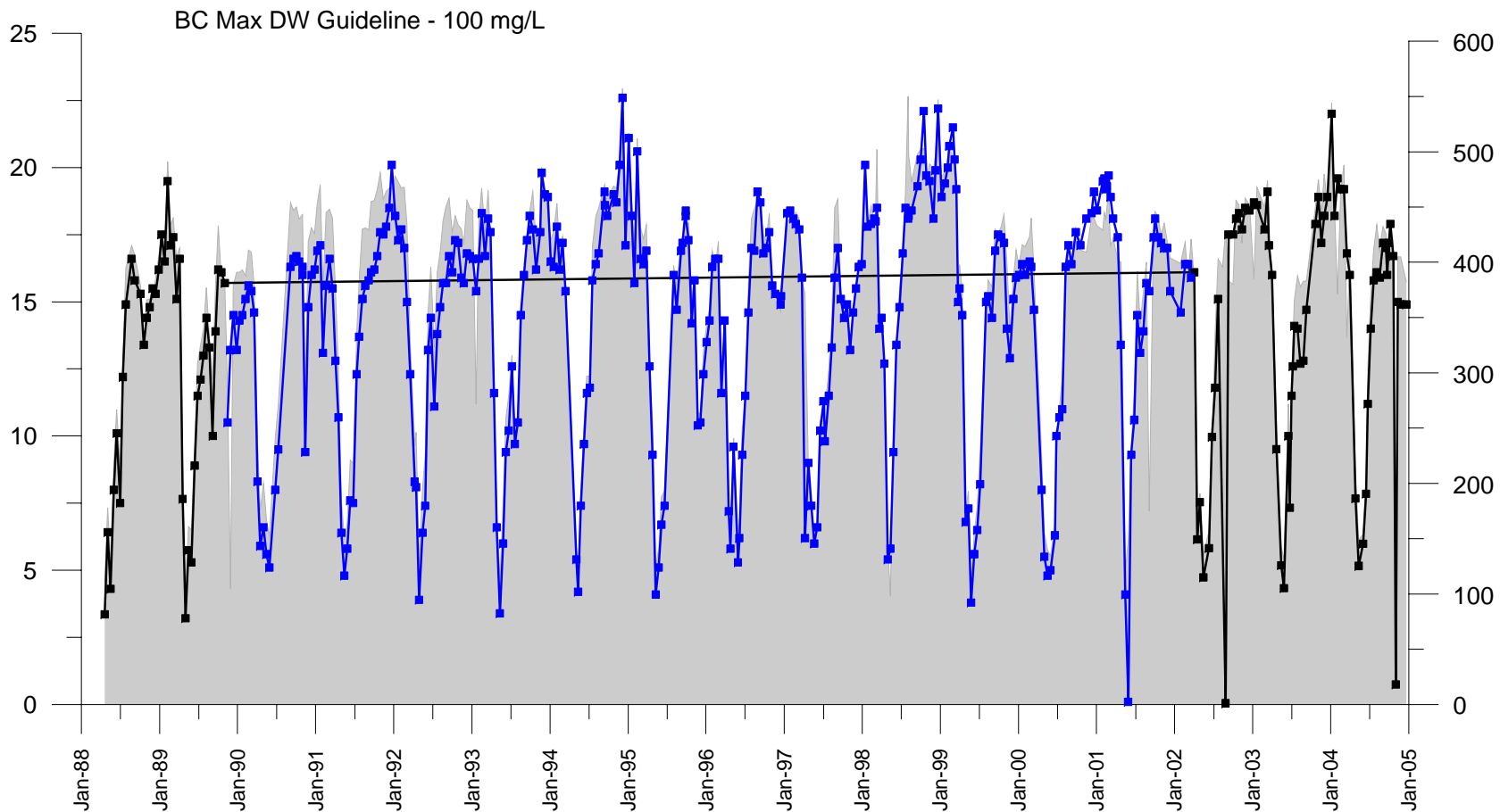
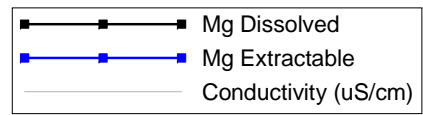
Outlier Removed at: 03/10/1990 9:00 - 2.04 ug/L



Salmon River at Hwy 1 Bridge

Magnesium Dissolved and Extractable (mg/L)

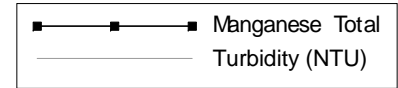
Figure 39



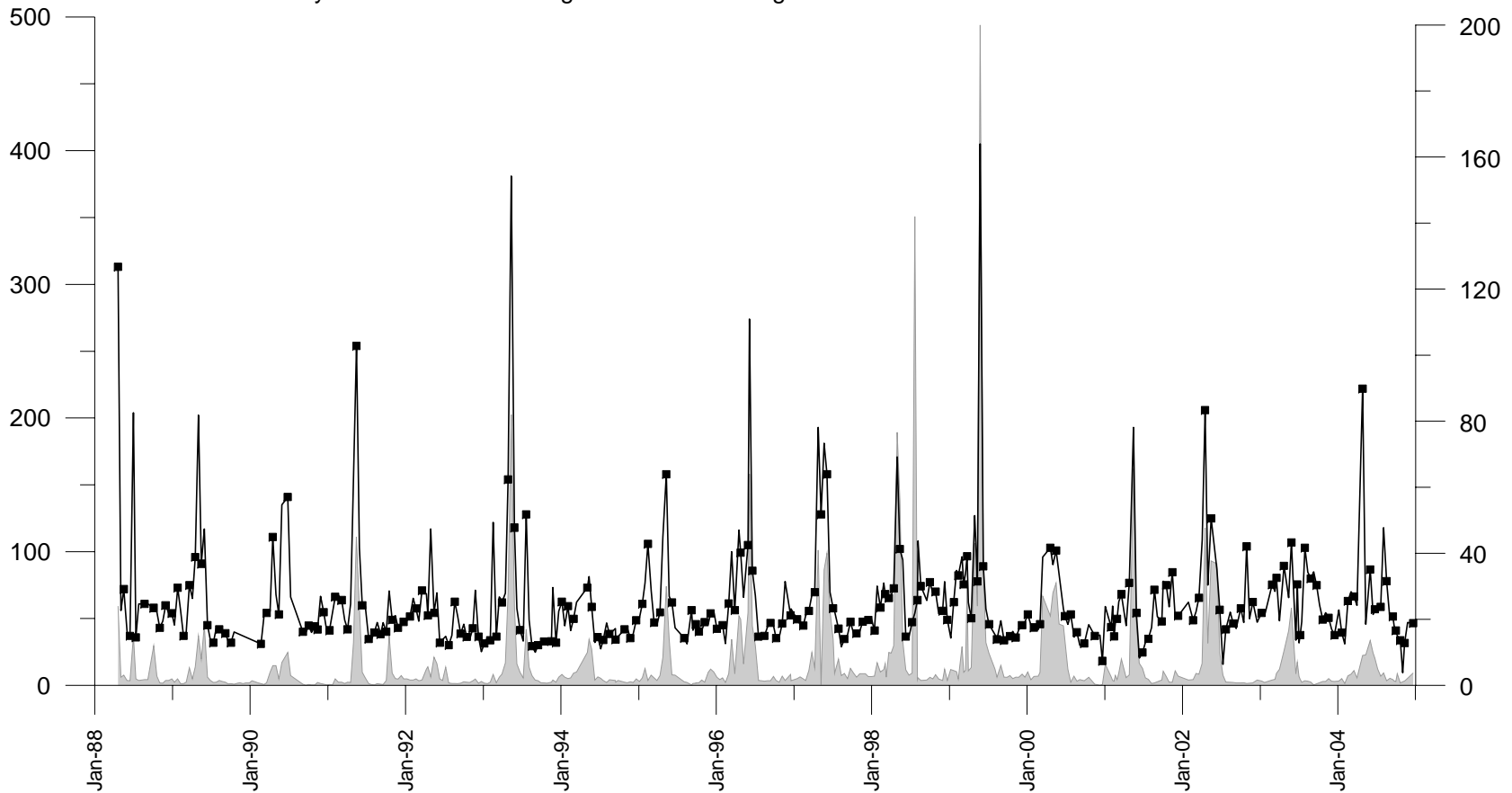
Salmon River at Hwy 1 Bridge

Manganese Total (ug/L)

Figure 40



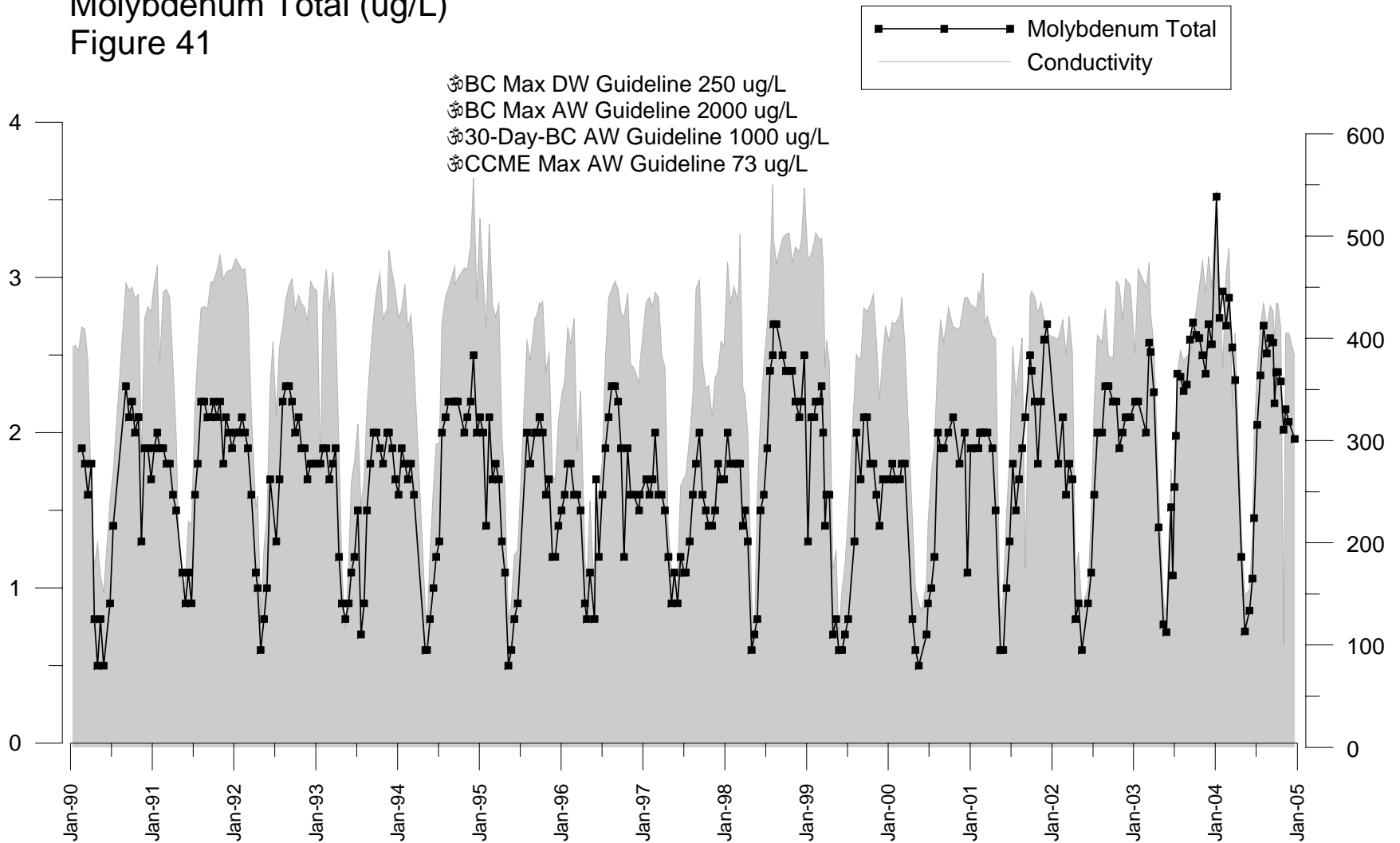
☞ BC Max AW Mn Guideline range 1043.39-3537.44 ug/L
☞ BC 30 Day Aw Mn Guideline range 805.99-1801.8 ug/L



Salmon River at Hwy 1 Bridge

Molybdenum Total (ug/L)

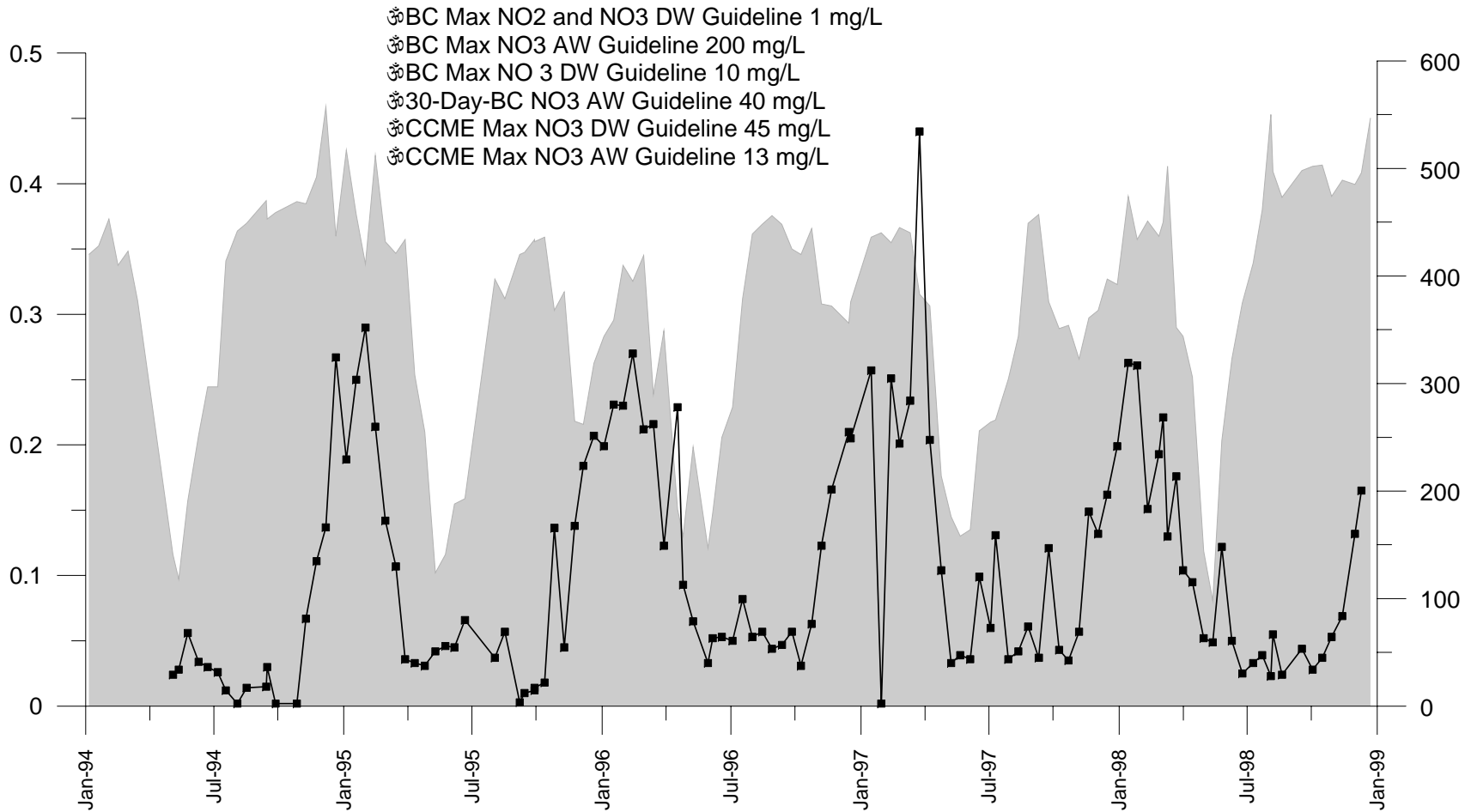
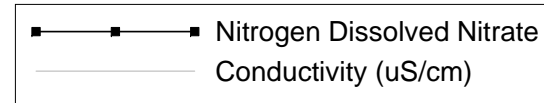
Figure 41



Salmon River at Hwy 1 Bridge

Nitrogen Dissolved Nitrate (mg/L)

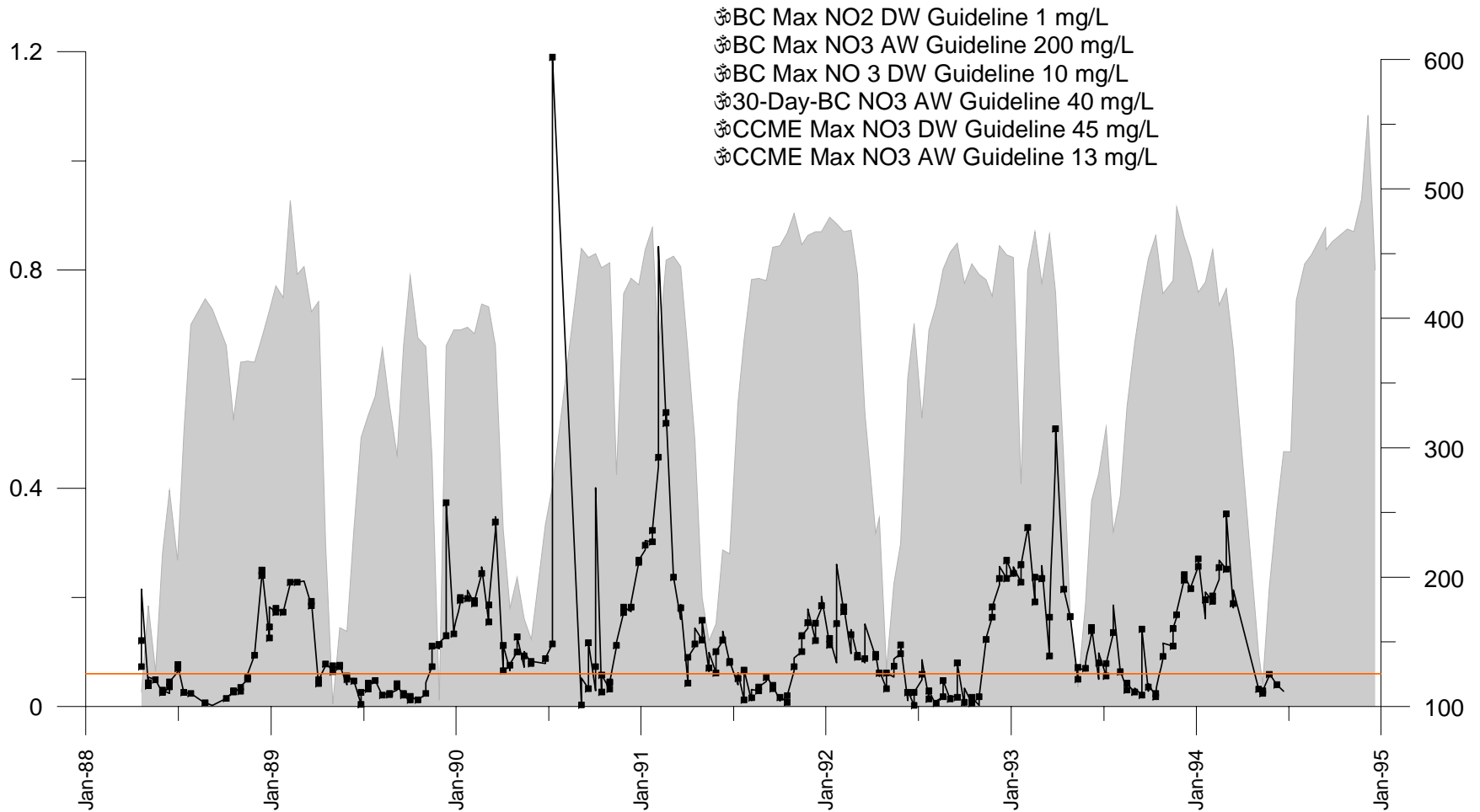
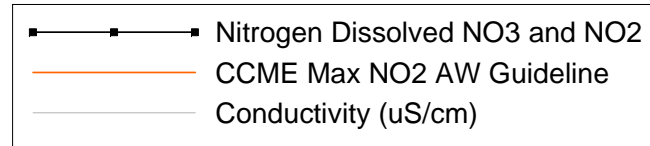
Figure 42



Salmon River at Hwy 1 Bridge

Nitrogen Dissolved NO3 and NO2 (mg/L)

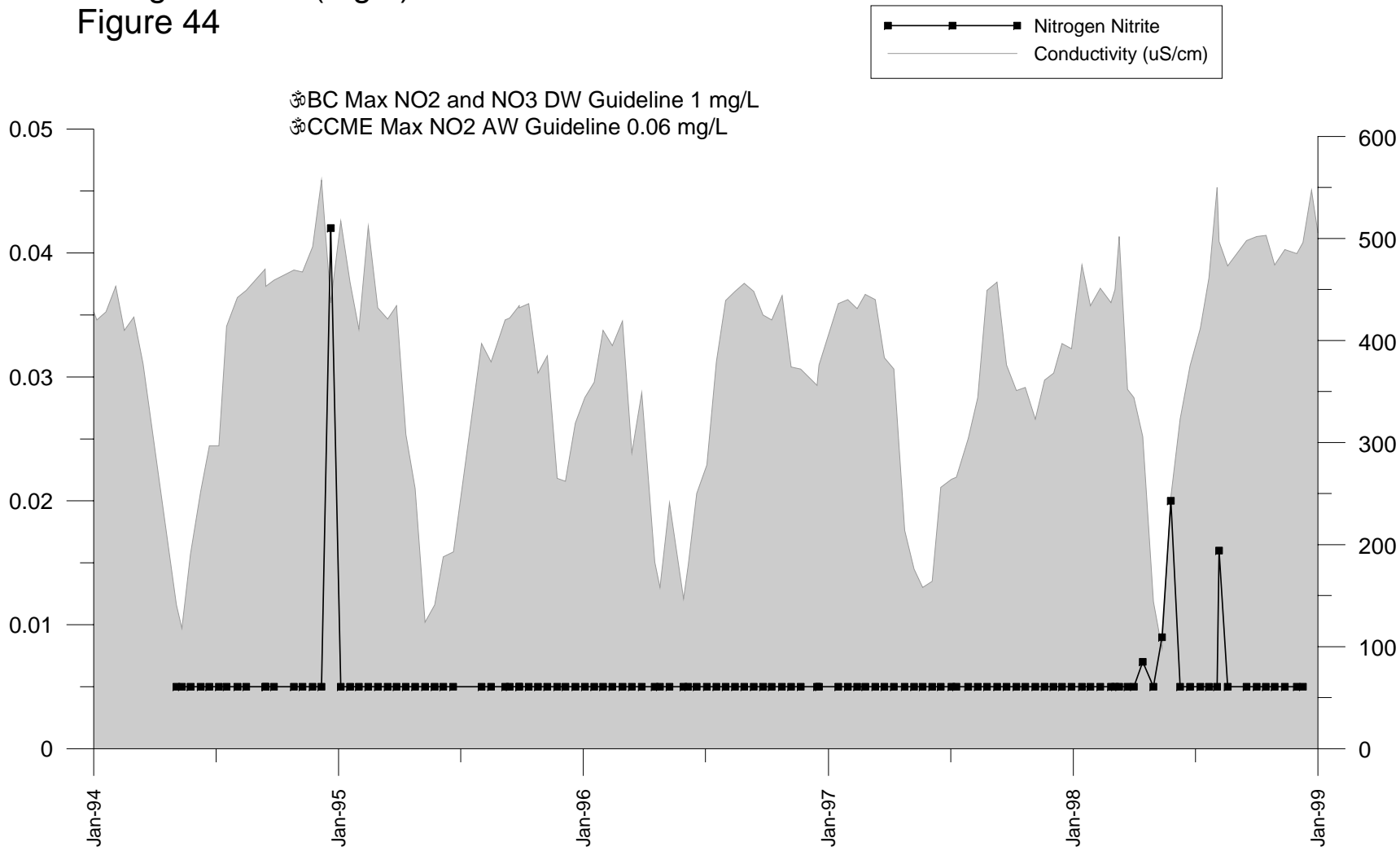
Figure 43



Salmon River at Hwy 1 Bridge

Nitrogen Nitrite (mg/L)

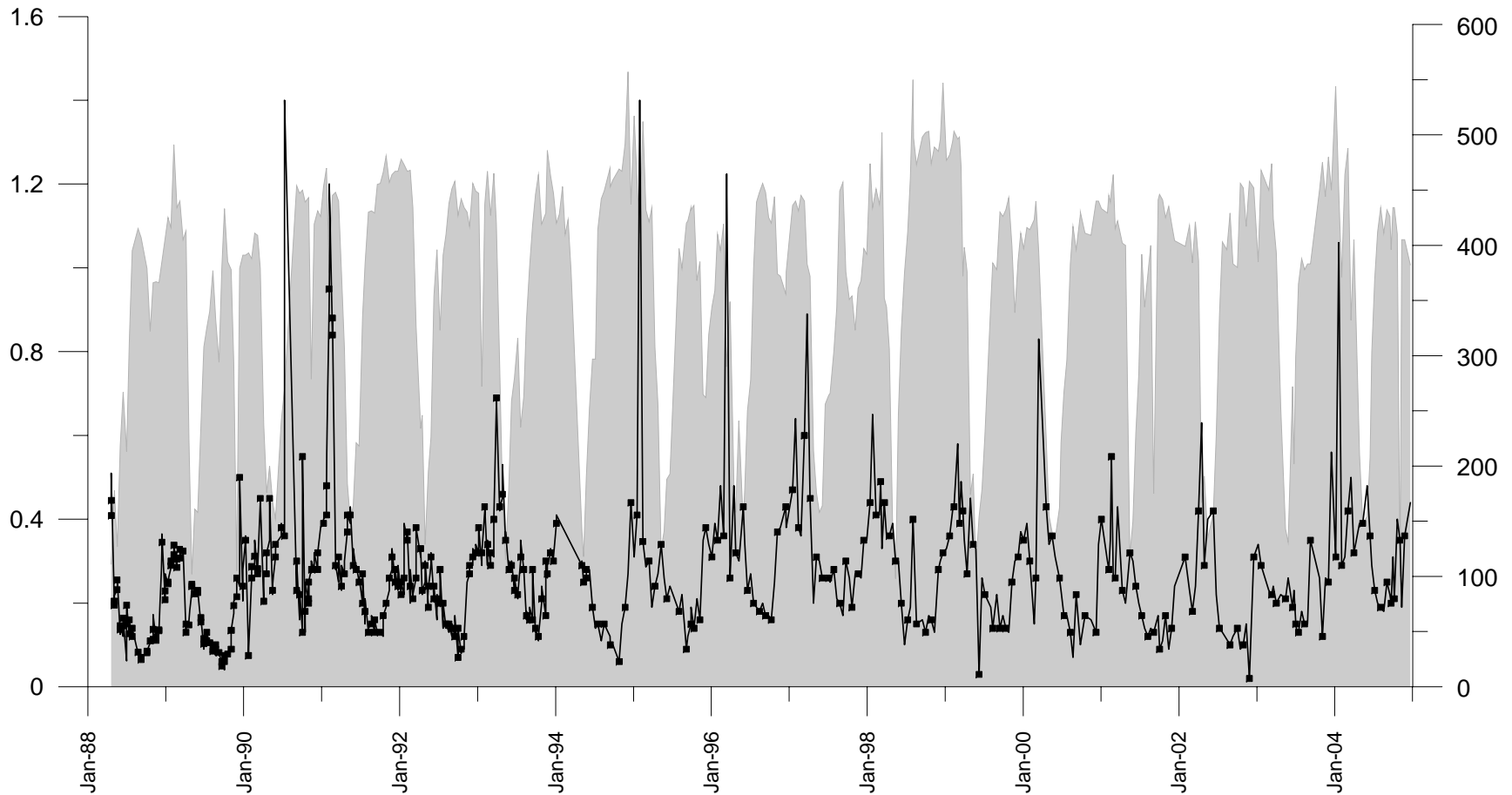
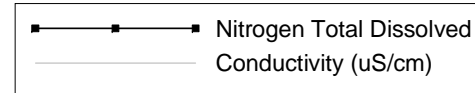
Figure 44



Salmon River at Hwy 1 Bridge

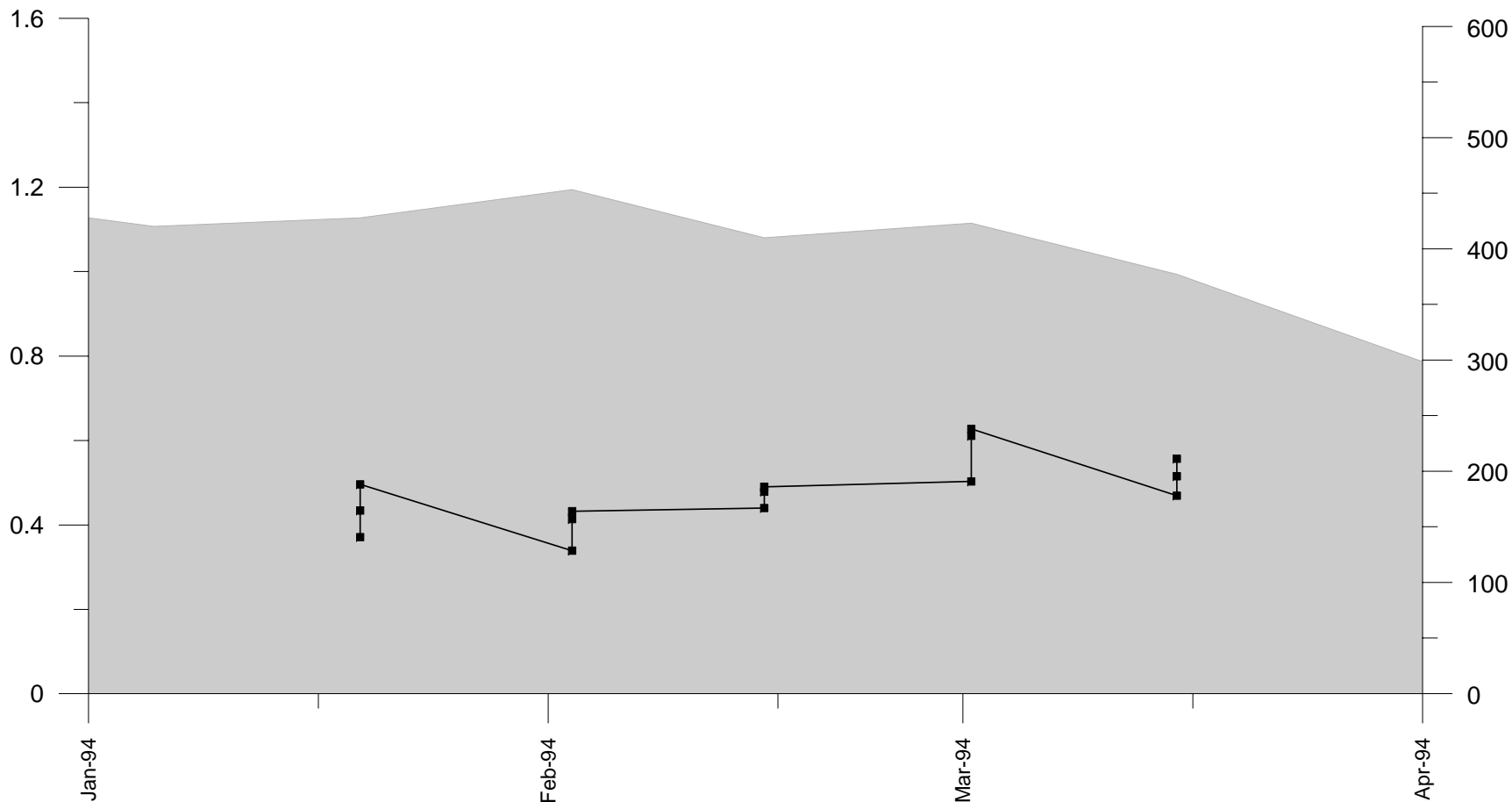
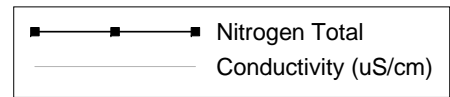
Nitrogen Total Dissolved (mg/L)

Figure 45



Salmon River at Hwy 1 Bridge

Nitrogen Total (mg/L)
Figure 46

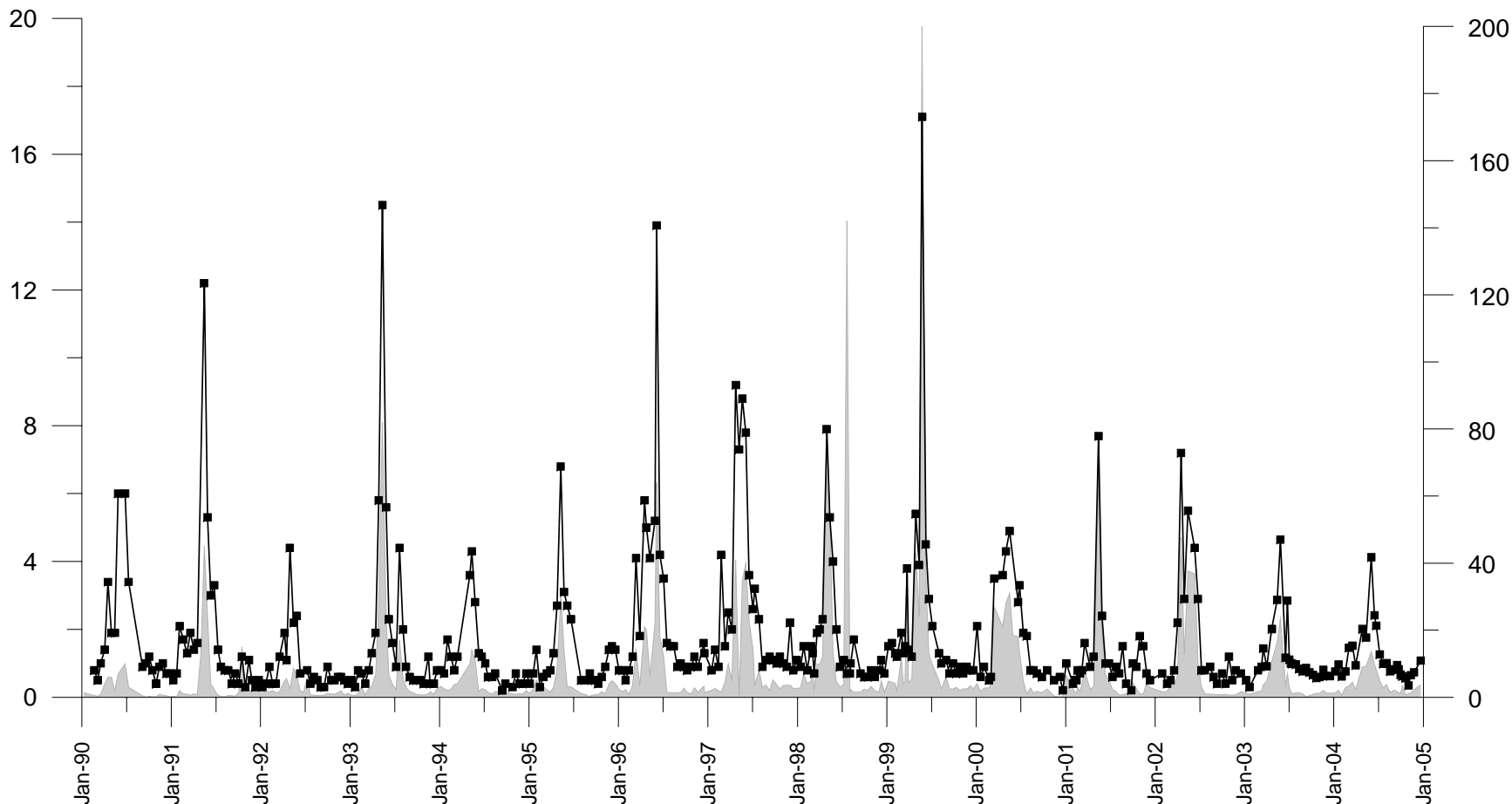
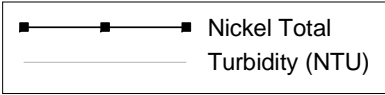


Salmon River at Hwy 1 Bridge

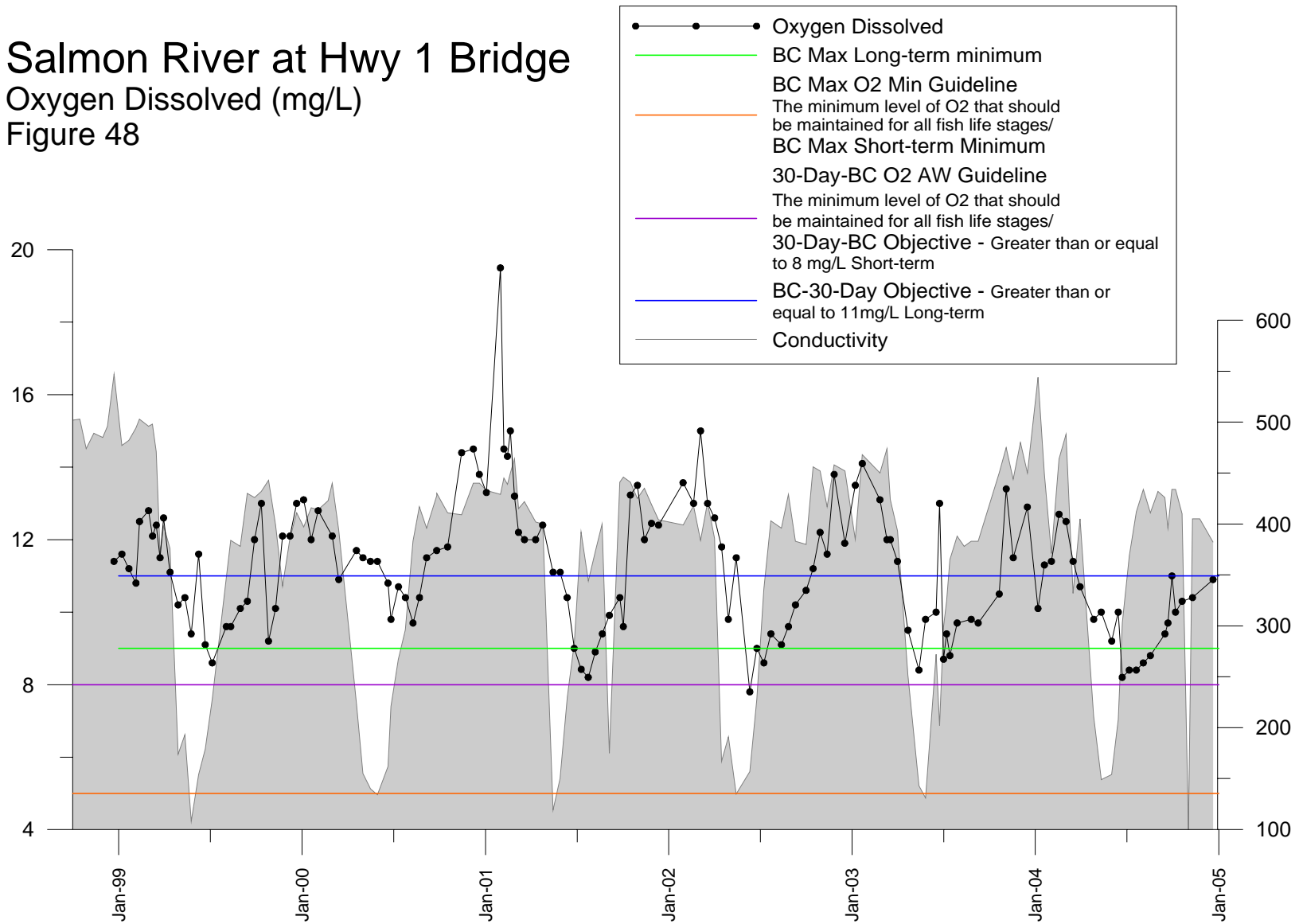
Nickel Total (ug/L)

Figure 47

BC/CCME AW Ni Guideline Range 52.69-204.47 ug/L



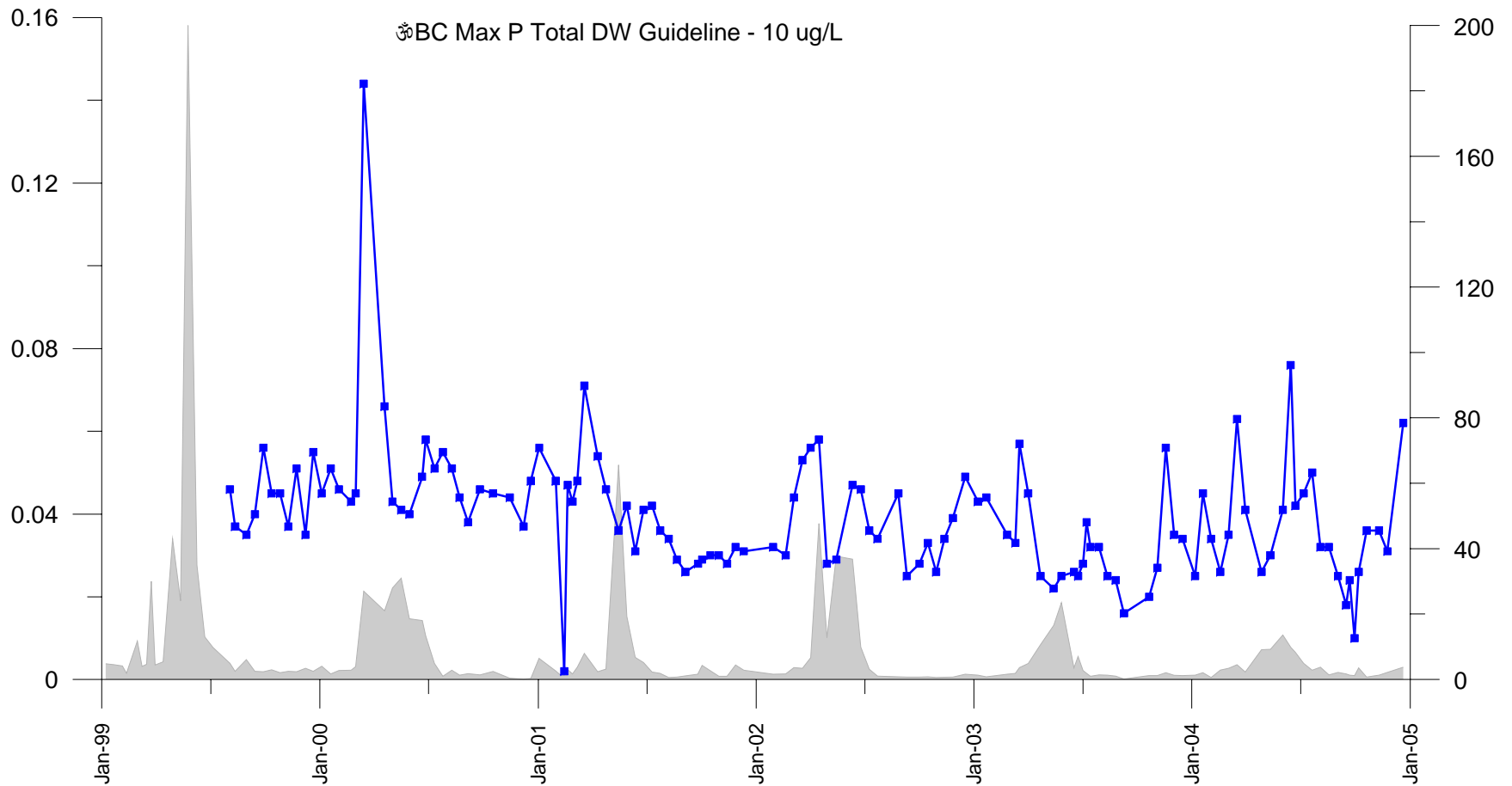
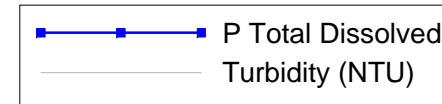
Salmon River at Hwy 1 Bridge
Oxygen Dissolved (mg/L)
Figure 48



Salmon River at Hwy 1 Bridge

Phosphorus Total Dissolved (mg/L)

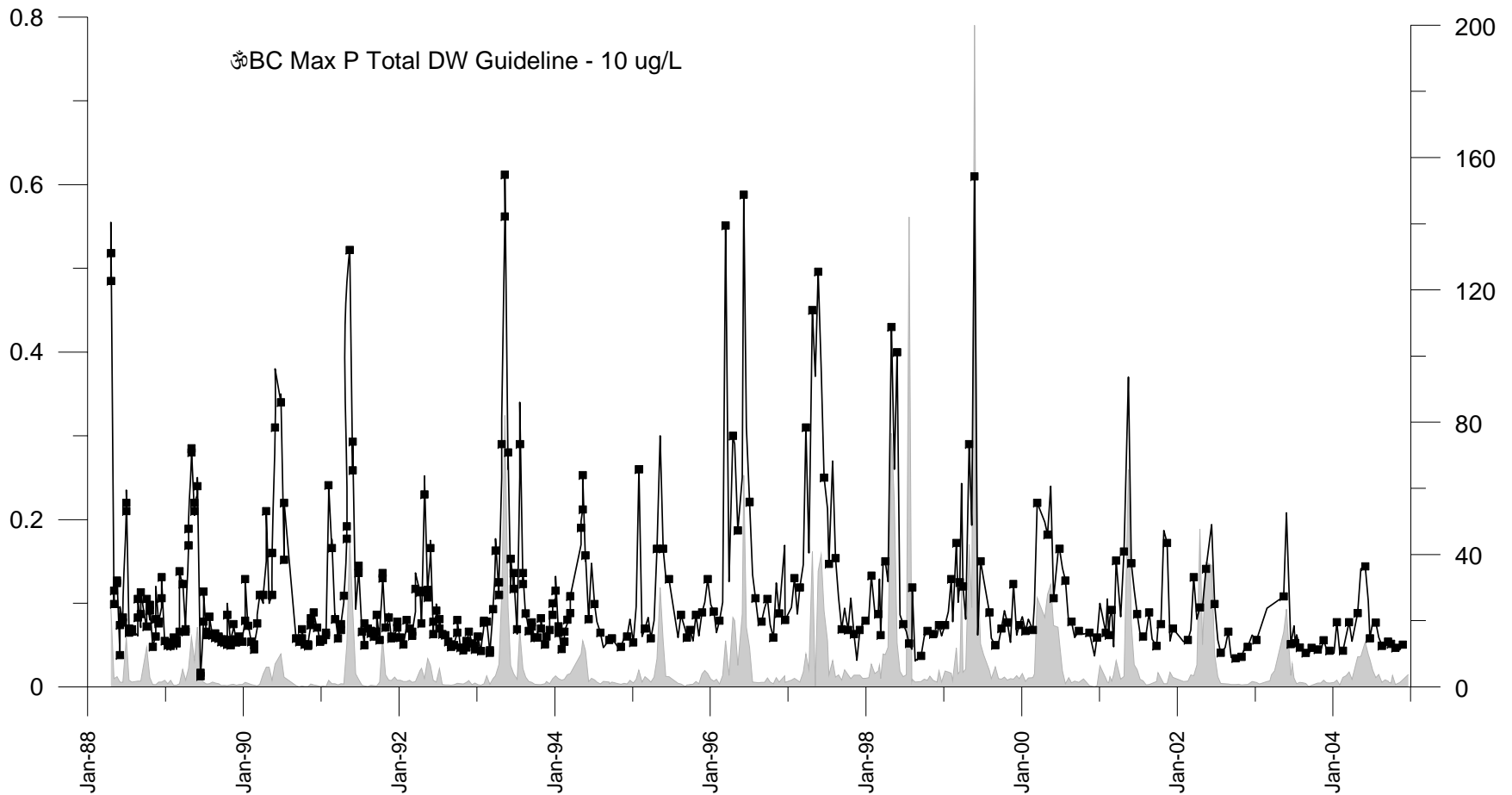
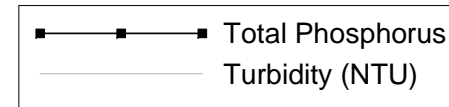
Figure 49



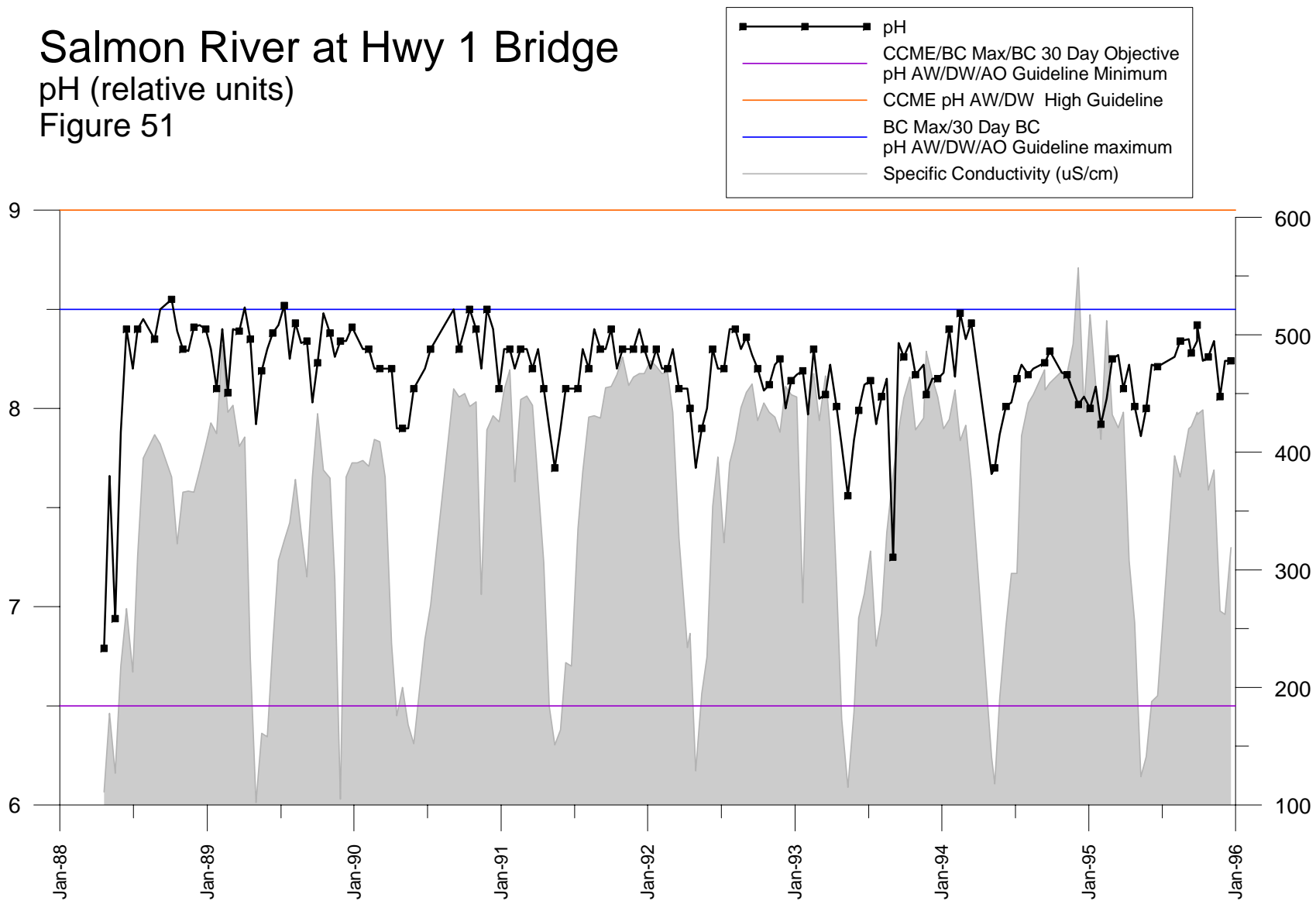
Salmon River at Hwy 1 Bridge

Total Phosphorus (mg/L)

Figure 50

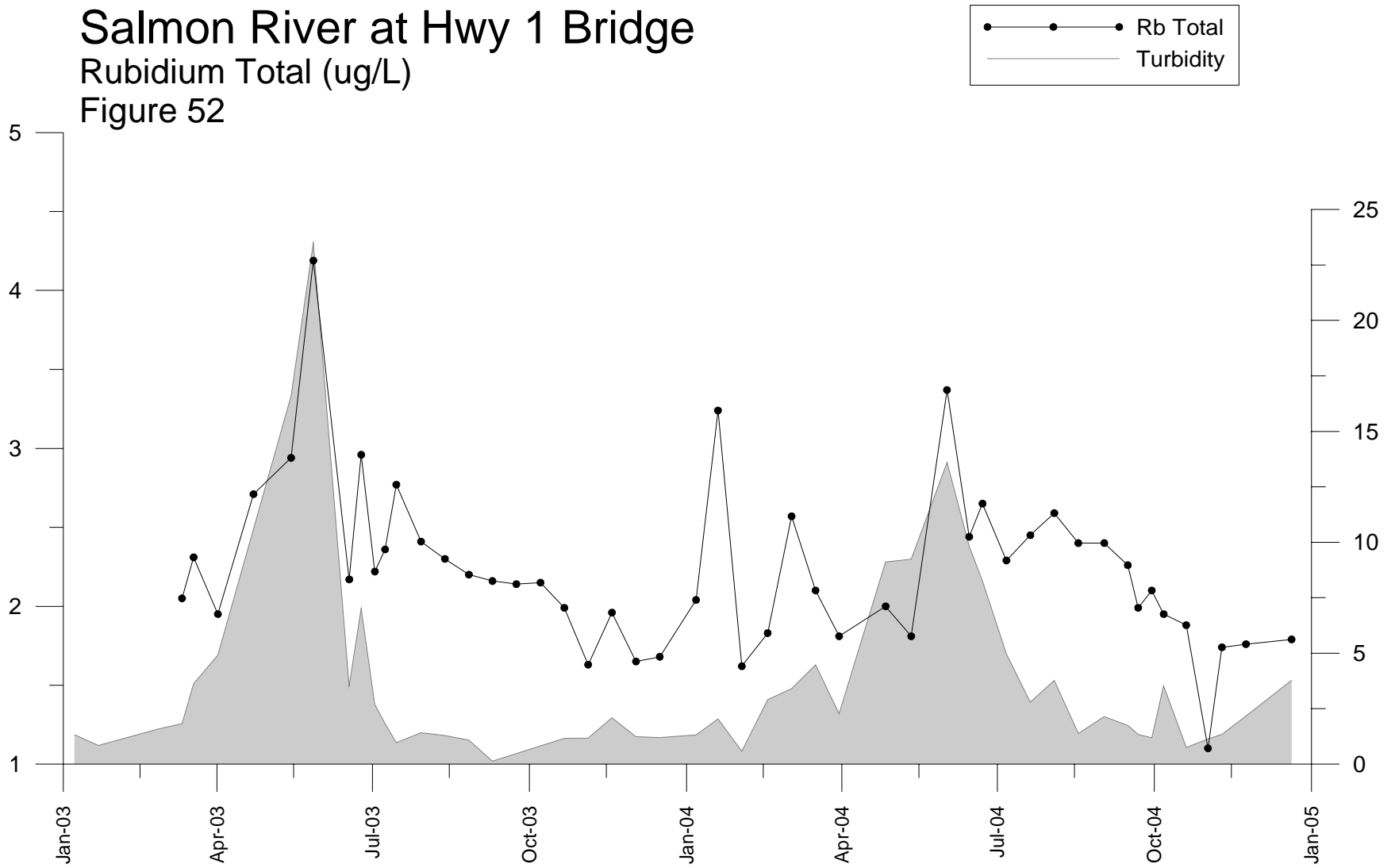


Salmon River at Hwy 1 Bridge
 pH (relative units)
 Figure 51



Salmon River at Hwy 1 Bridge

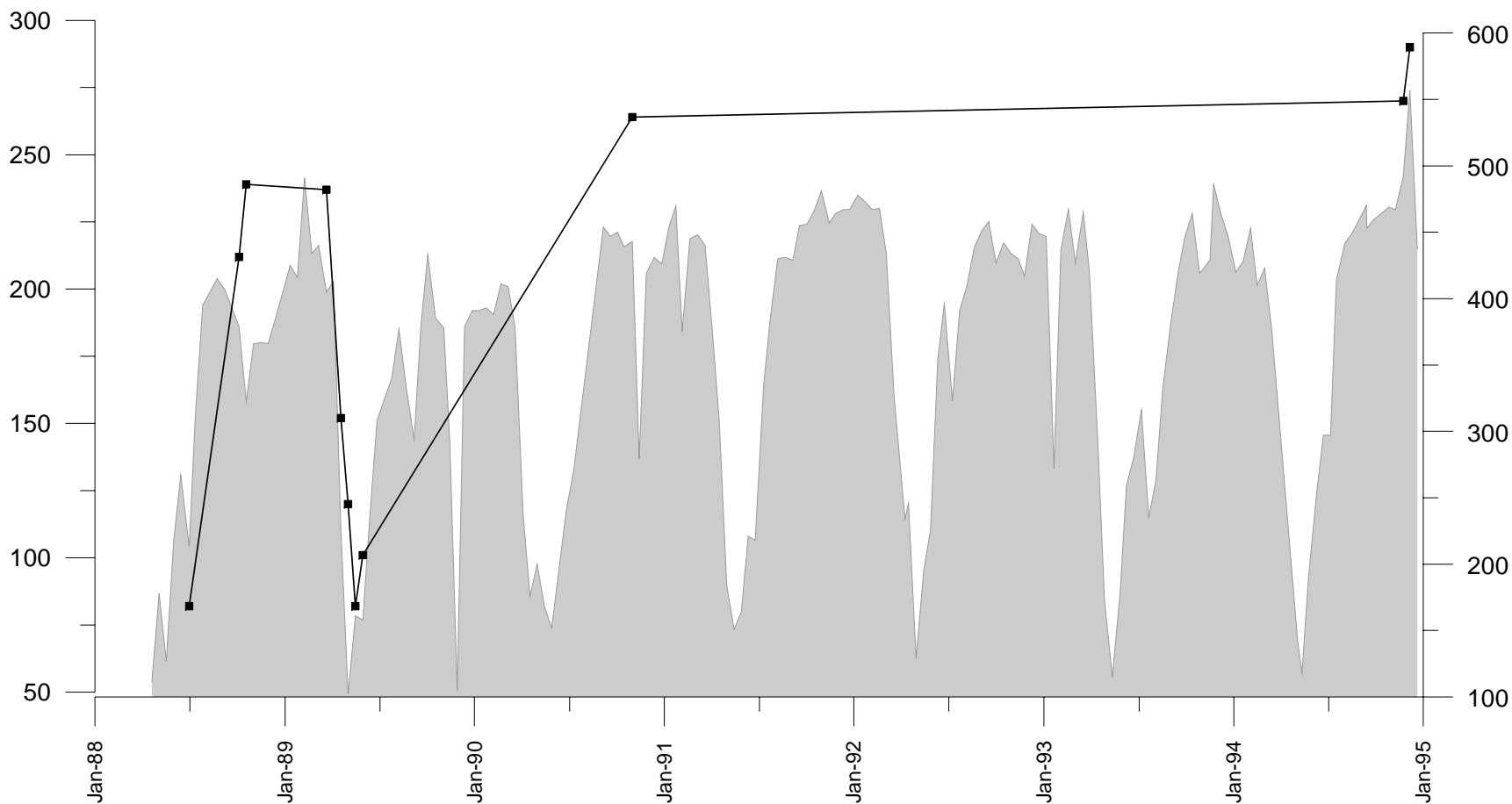
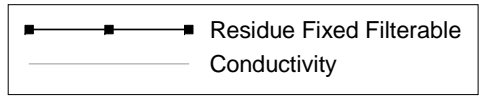
Rubidium Total (ug/L)
Figure 52



Salmon River at Hwy 1 Bridge

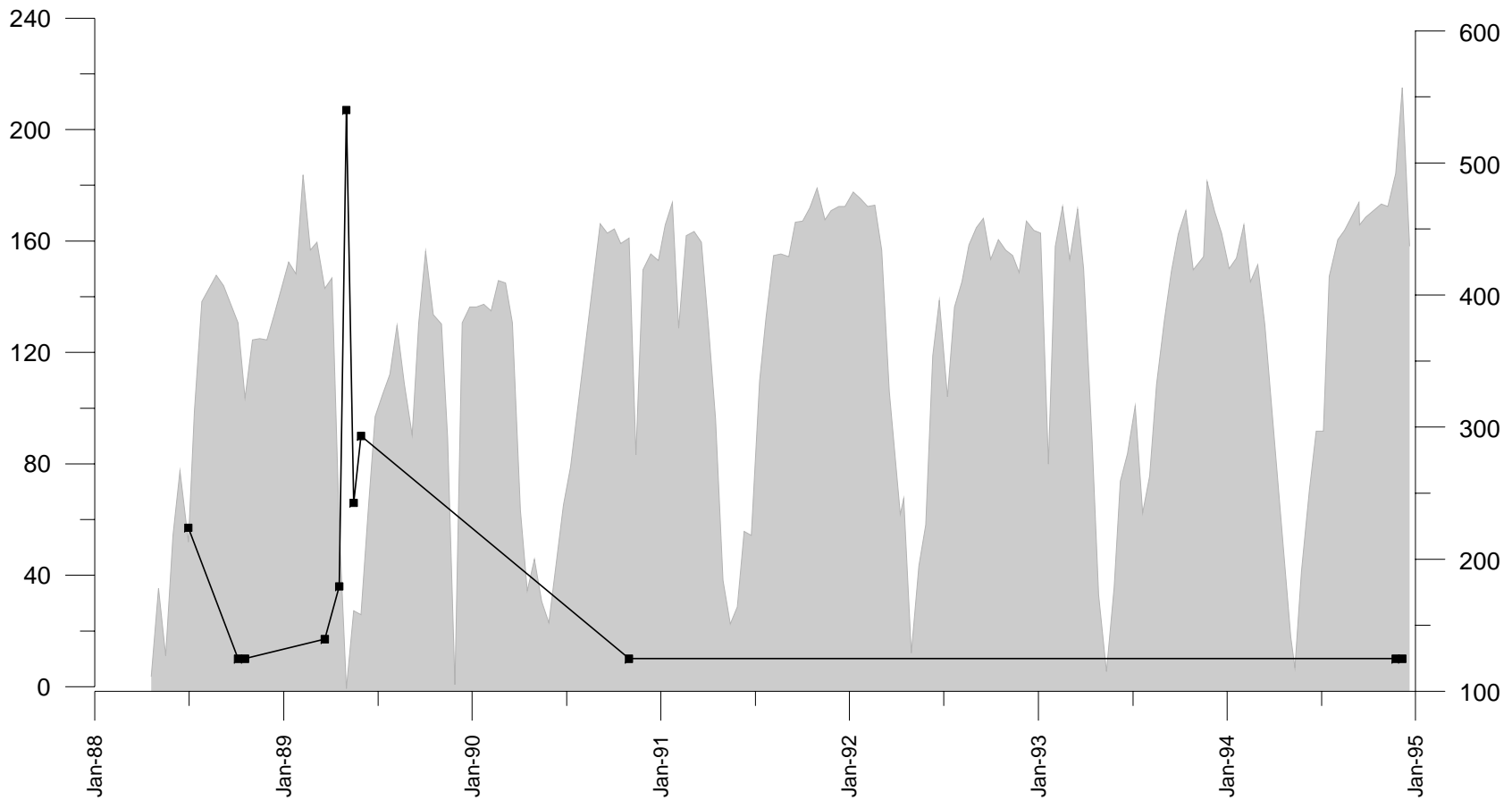
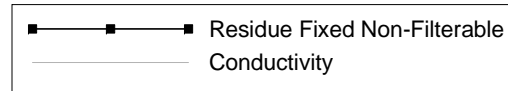
Residue Fixed Filterable (mg/L)

Figure 53



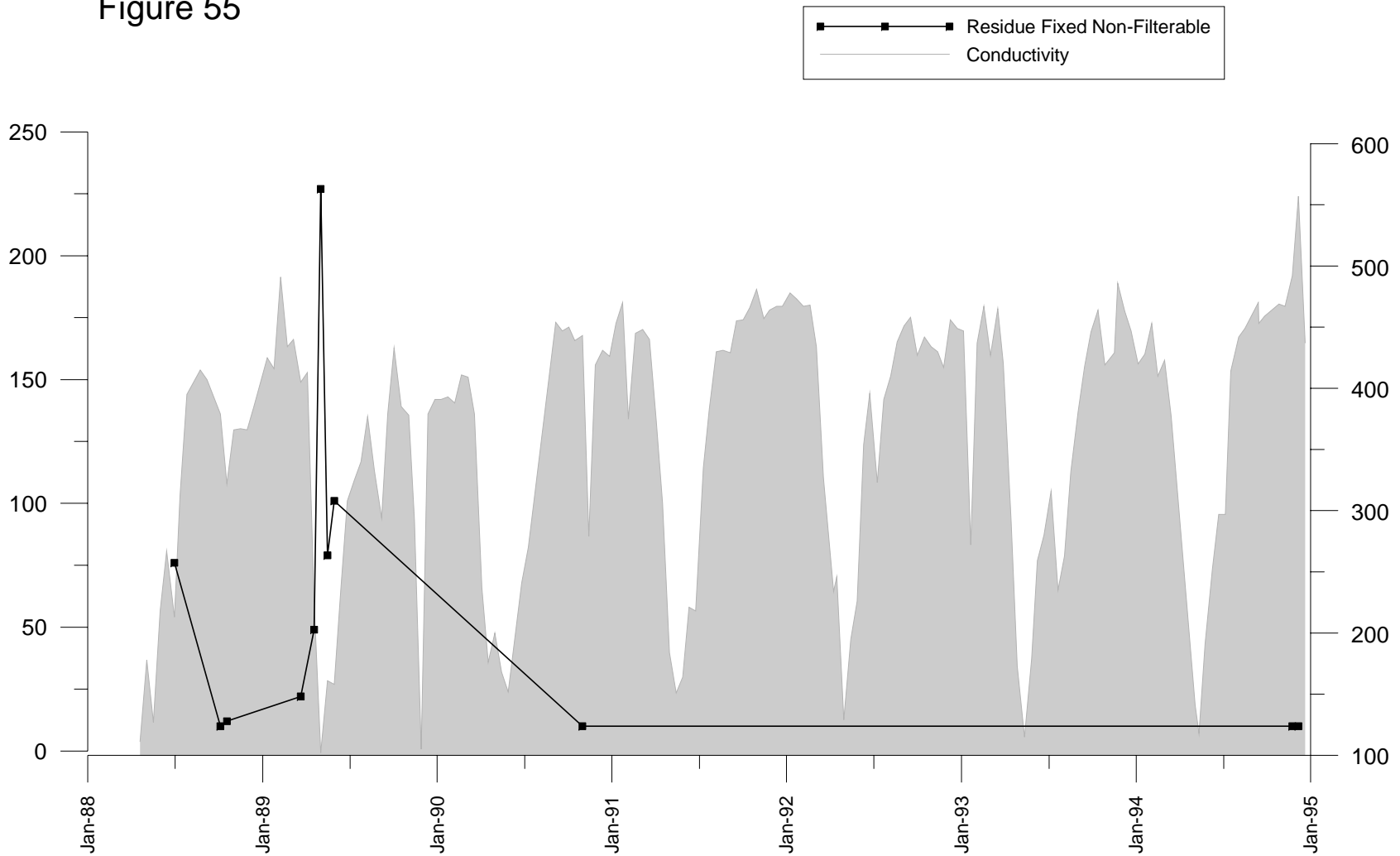
Salmon River at Hwy 1 Bridge

Residue Fixed Non-Filterable (mg/L)
Figure 54



Salmon River at Hwy 1 Bridge

Residue Non-Filterable (mg/L)
Figure 55

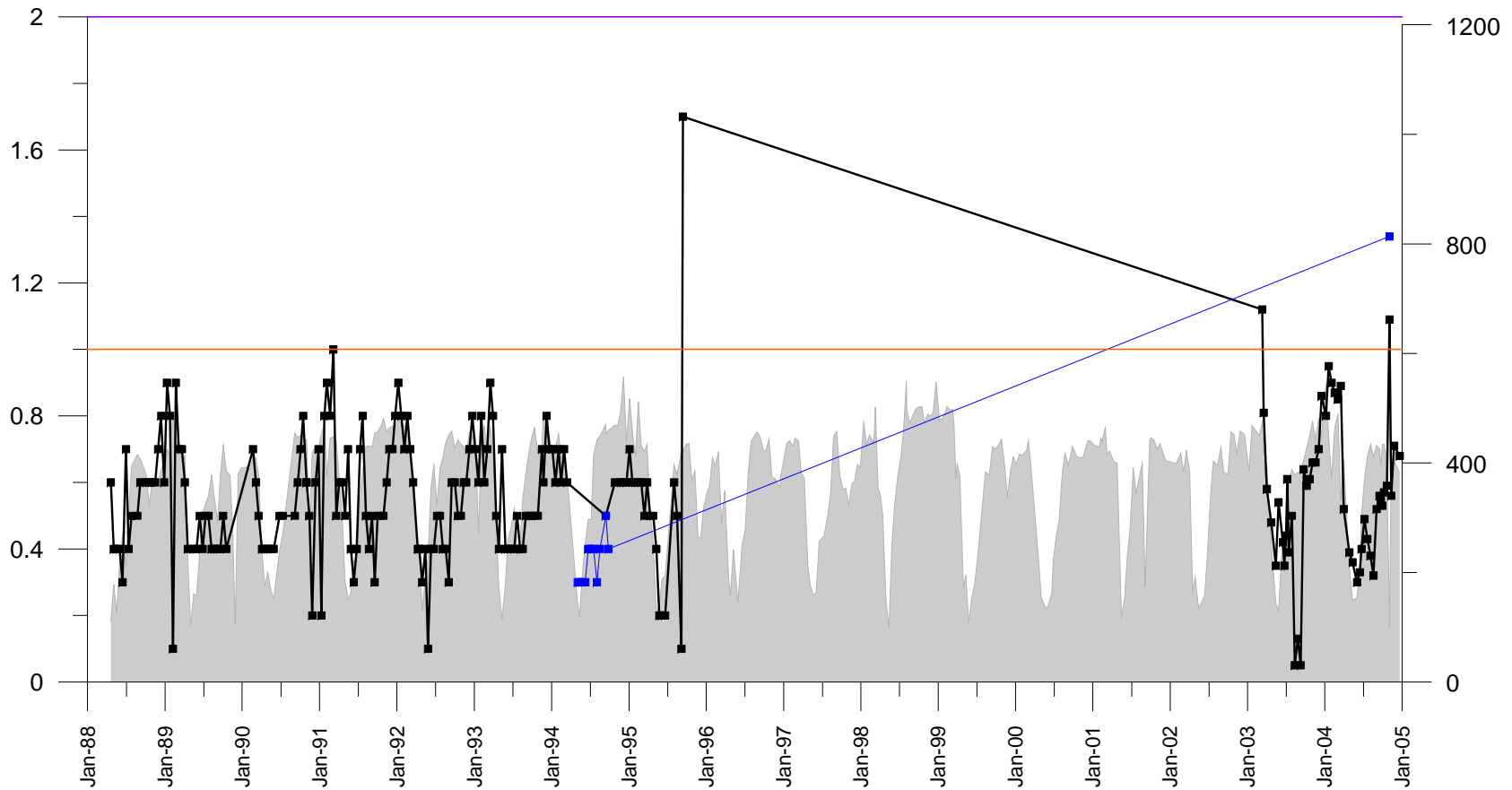
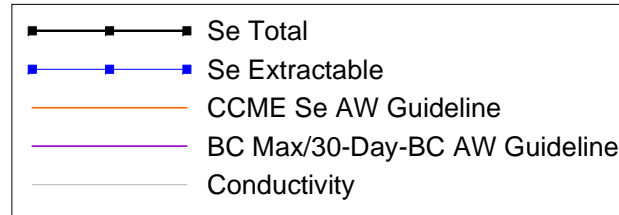


Salmon River at Hwy 1 Bridge

Selenium Total (ug/L)

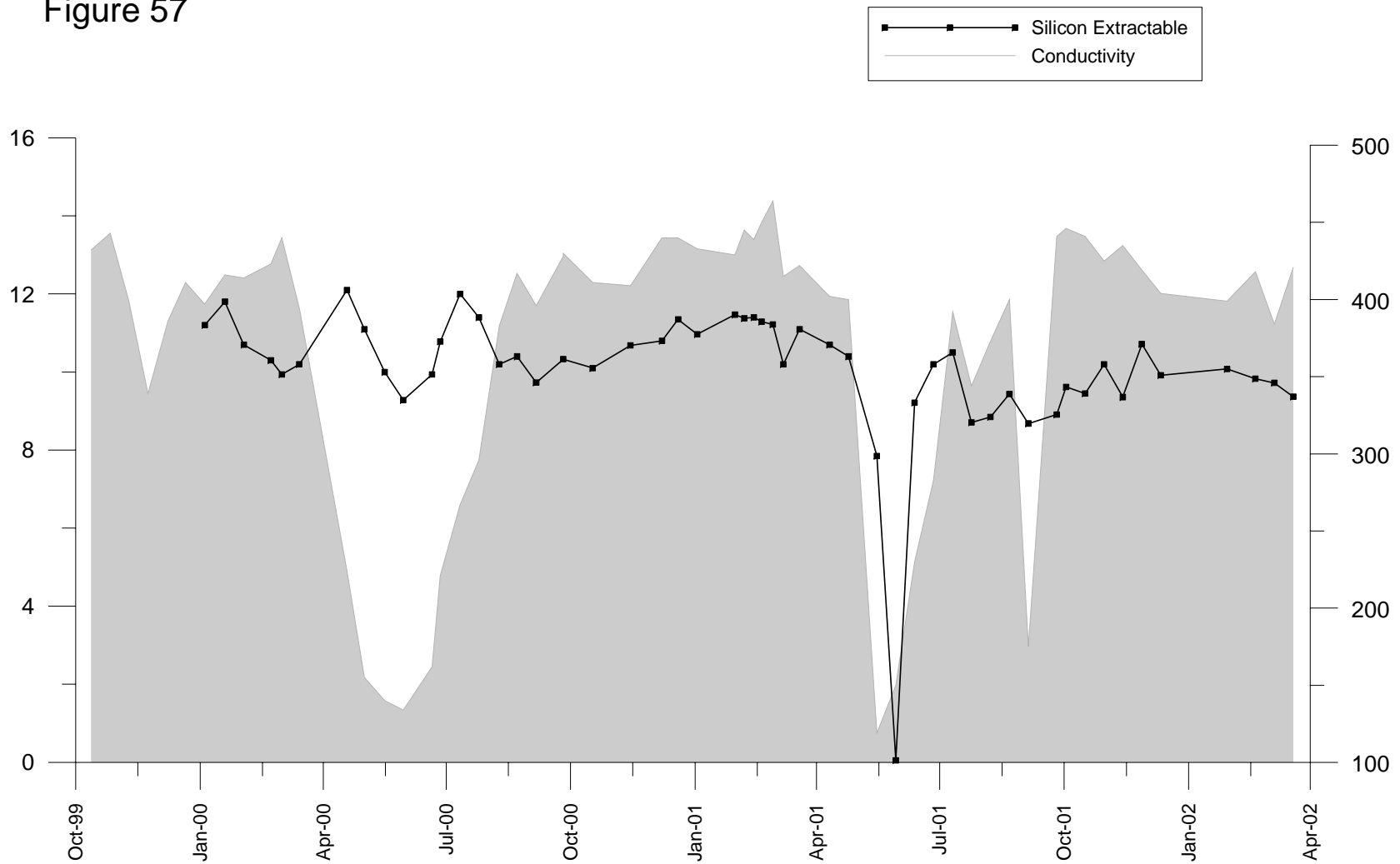
Figure 56

♻️ BC/CCME Max Se DW Guideline - 10ug/L



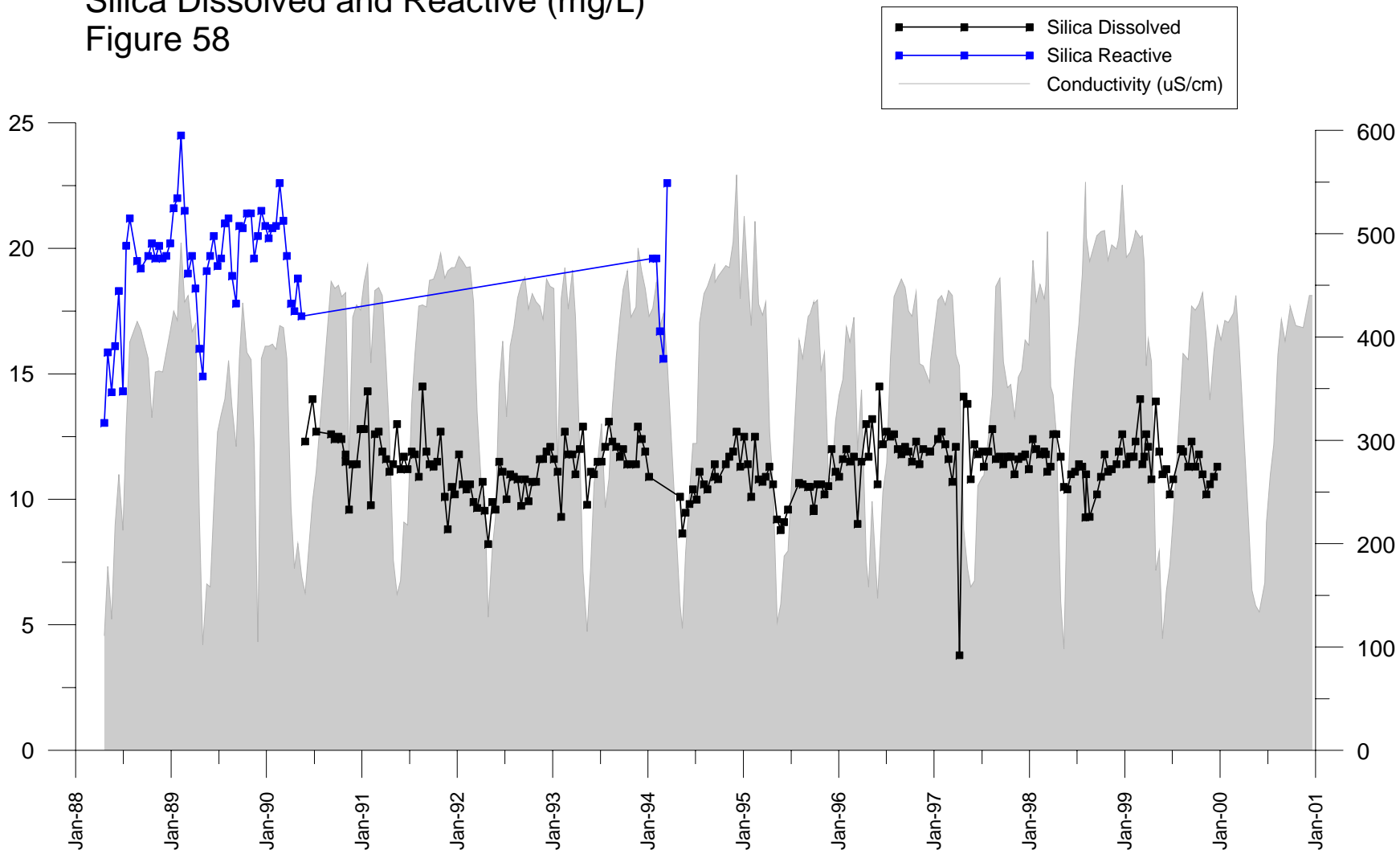
Salmon River at Hwy 1 Bridge

Silicon Extractable (mg/L)
Figure 57



Salmon River at Hwy 1 Bridge

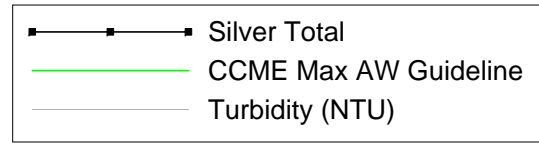
Silica Dissolved and Reactive (mg/L)
Figure 58



Salmon River at Hwy 1 Bridge

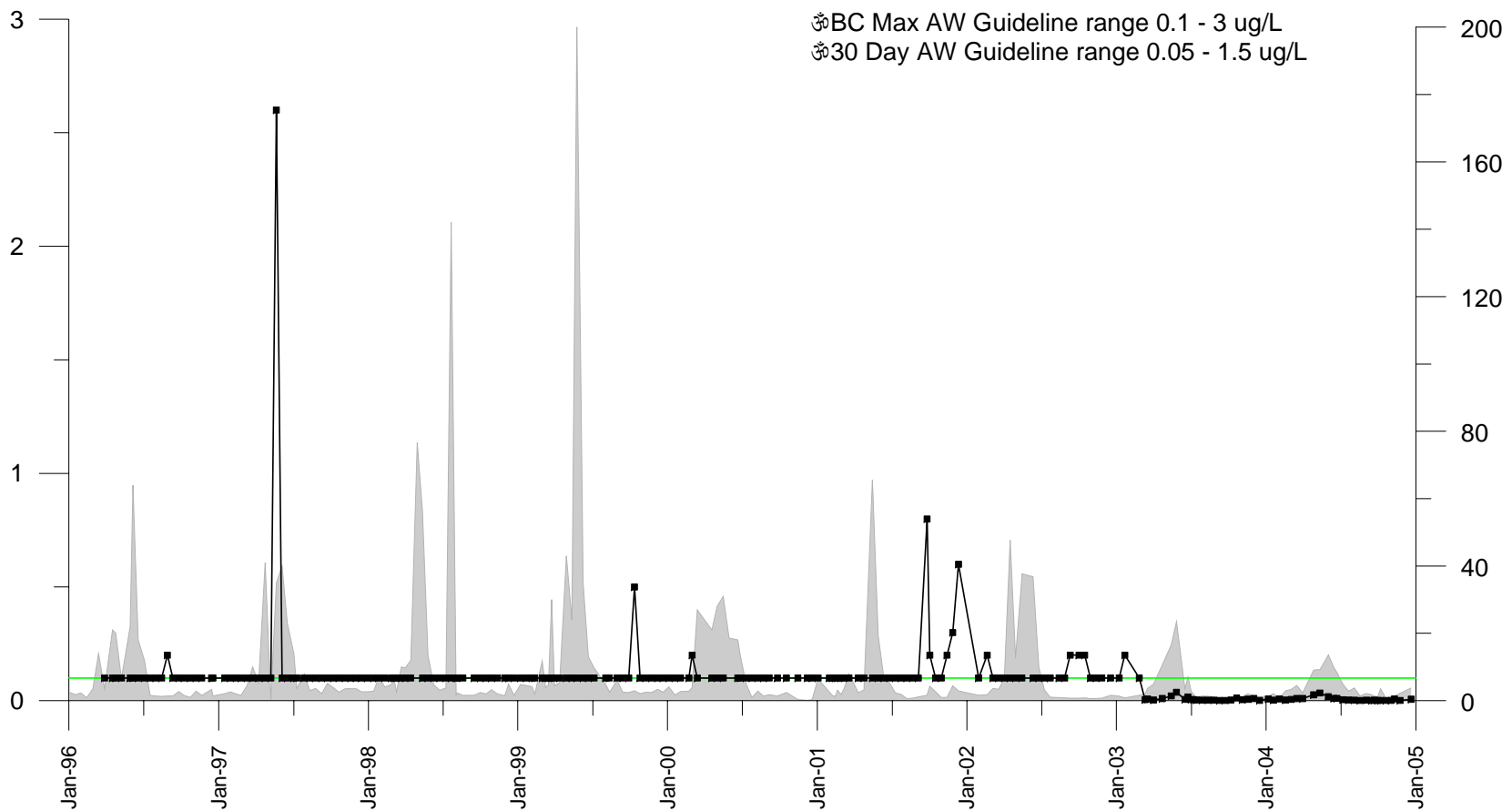
Silver Total (ug/L)

Figure 59

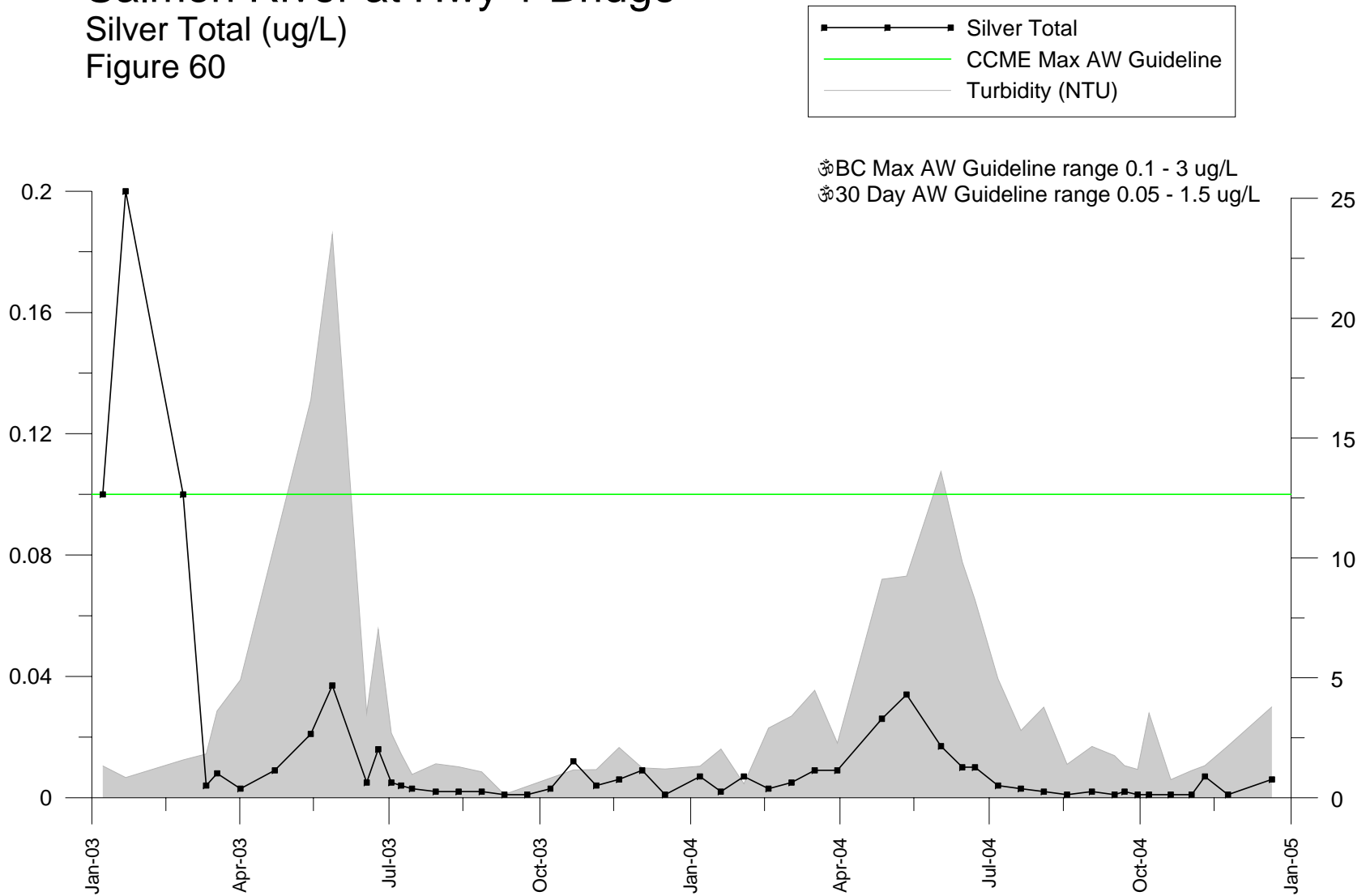


Data point not shown on 7/10/90 -10ug/L

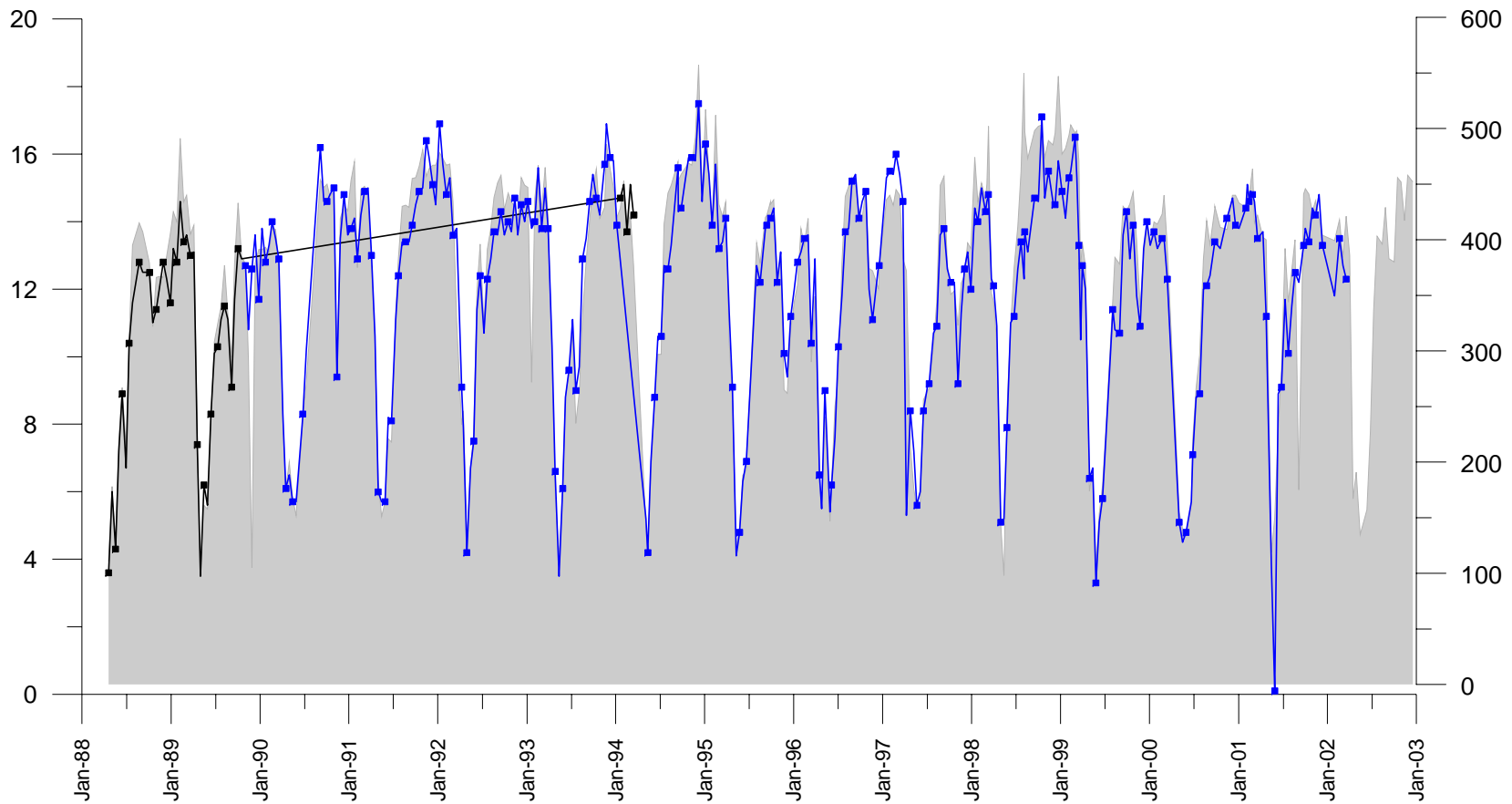
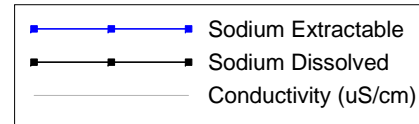
Outlier Removed at: 30/04/1998 12:01 - 75.7 ug/L



Salmon River at Hwy 1 Bridge
 Silver Total (ug/L)
 Figure 60

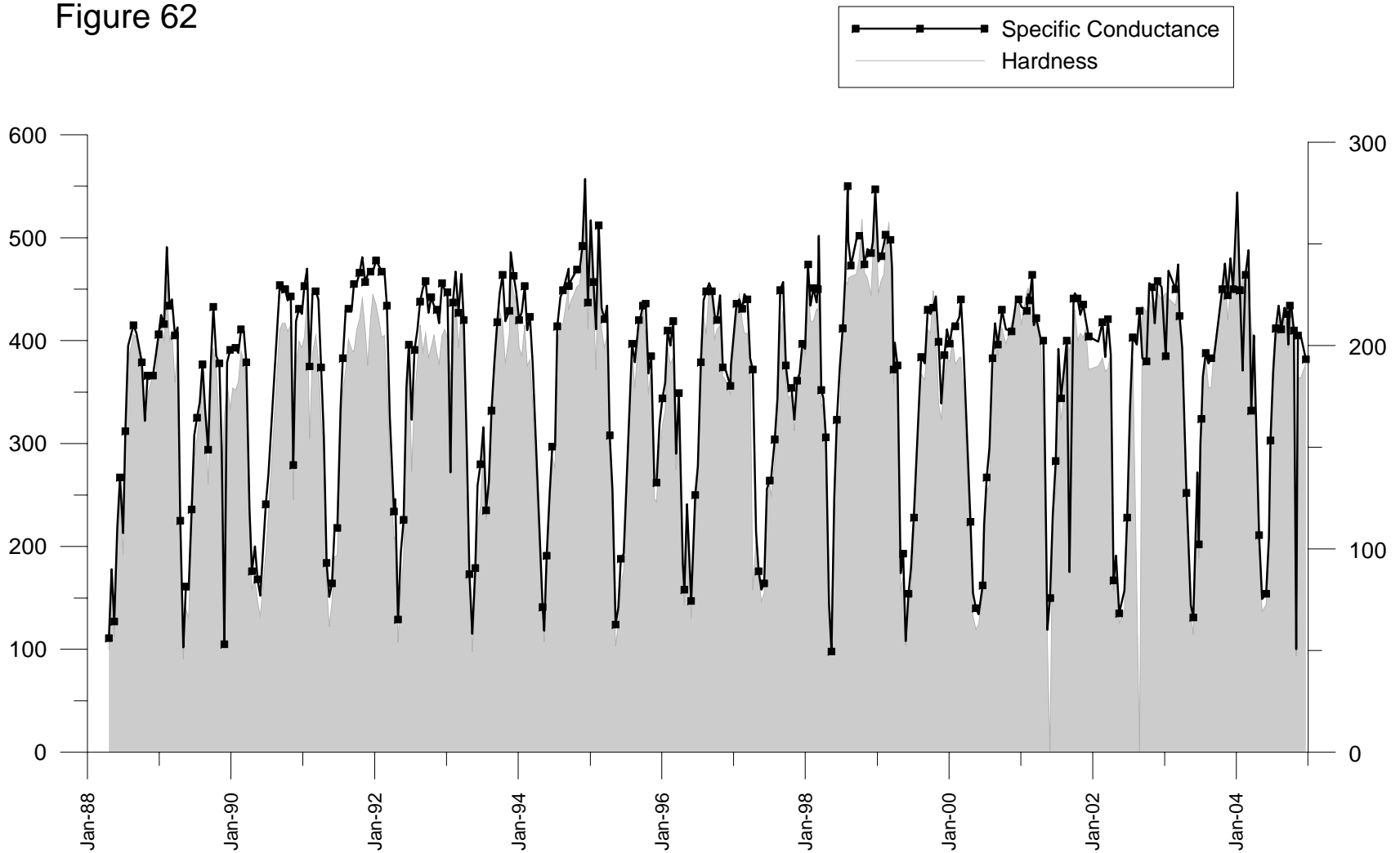


Salmon River at Hwy 1 Bridge Sodium Dissolved and Extractable (mg/L) Figure 61



Salmon River at Hwy 1 Bridge

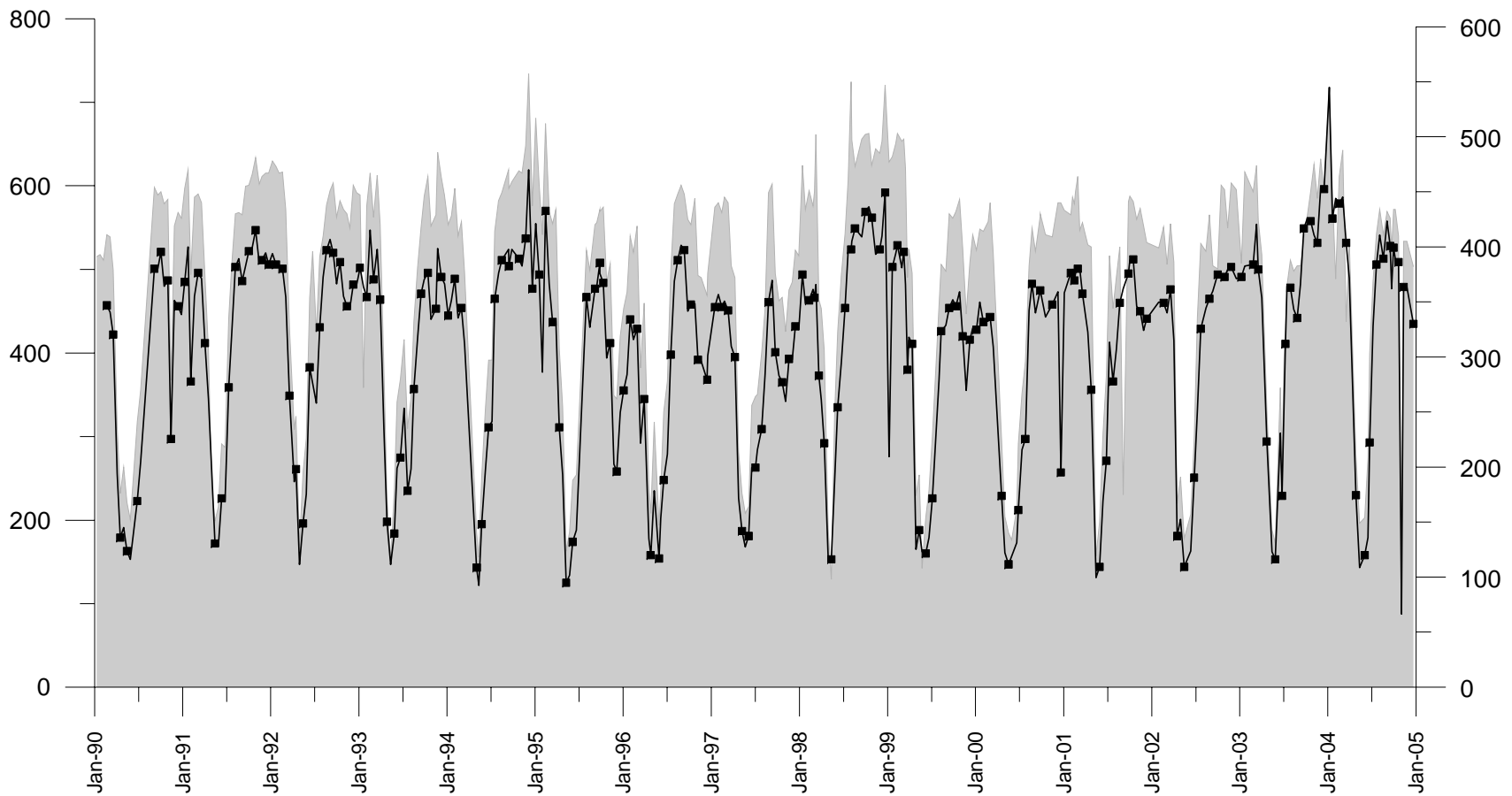
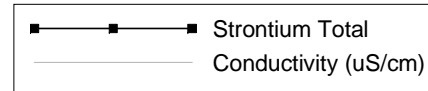
Specific Conductance (uS/cm)
Figure 62



Salmon River at Hwy 1 Bridge

Strontium Total (ug/L)

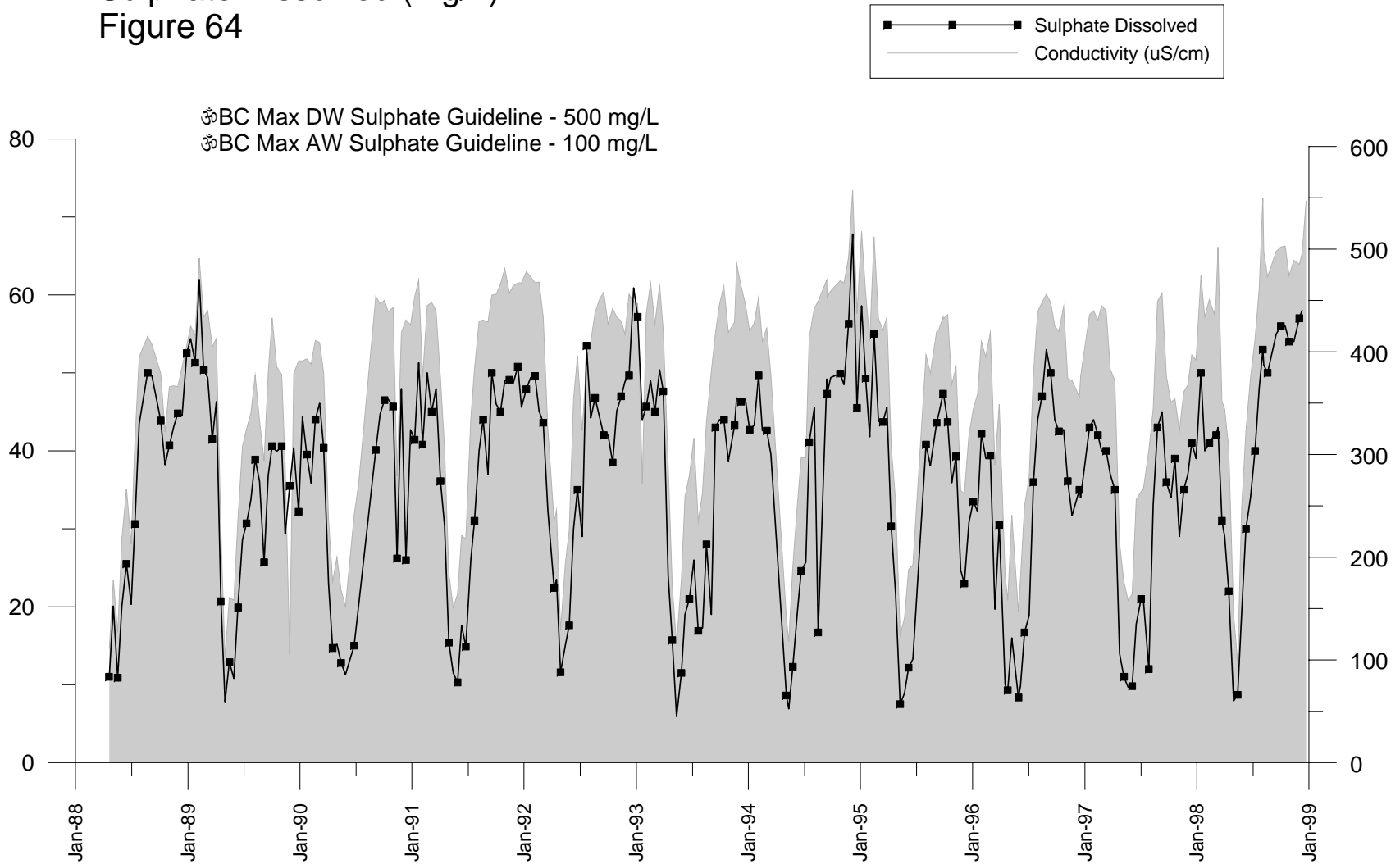
Figure 63



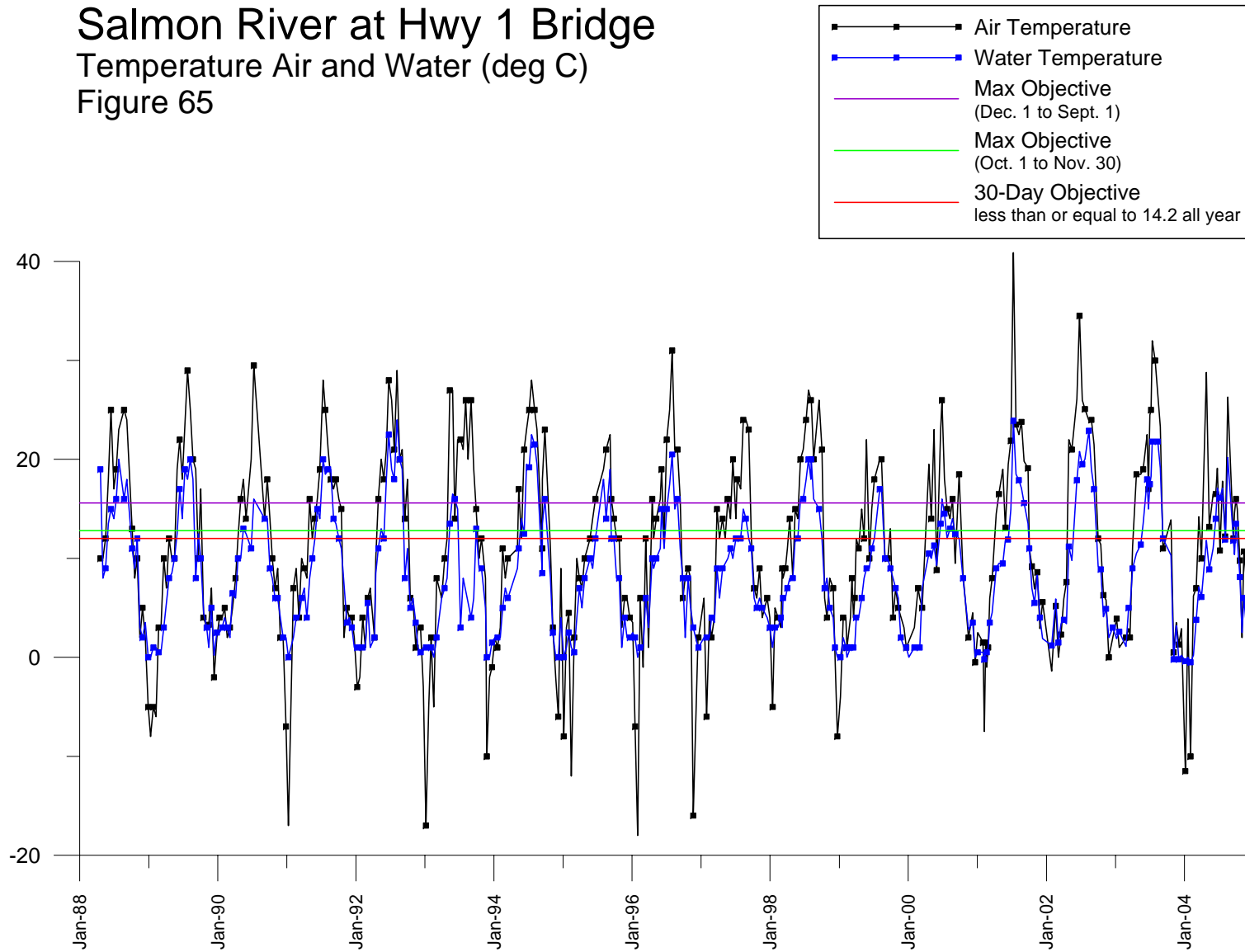
Salmon River at Hwy 1 Bridge

Sulphate Dissolved (mg/L)

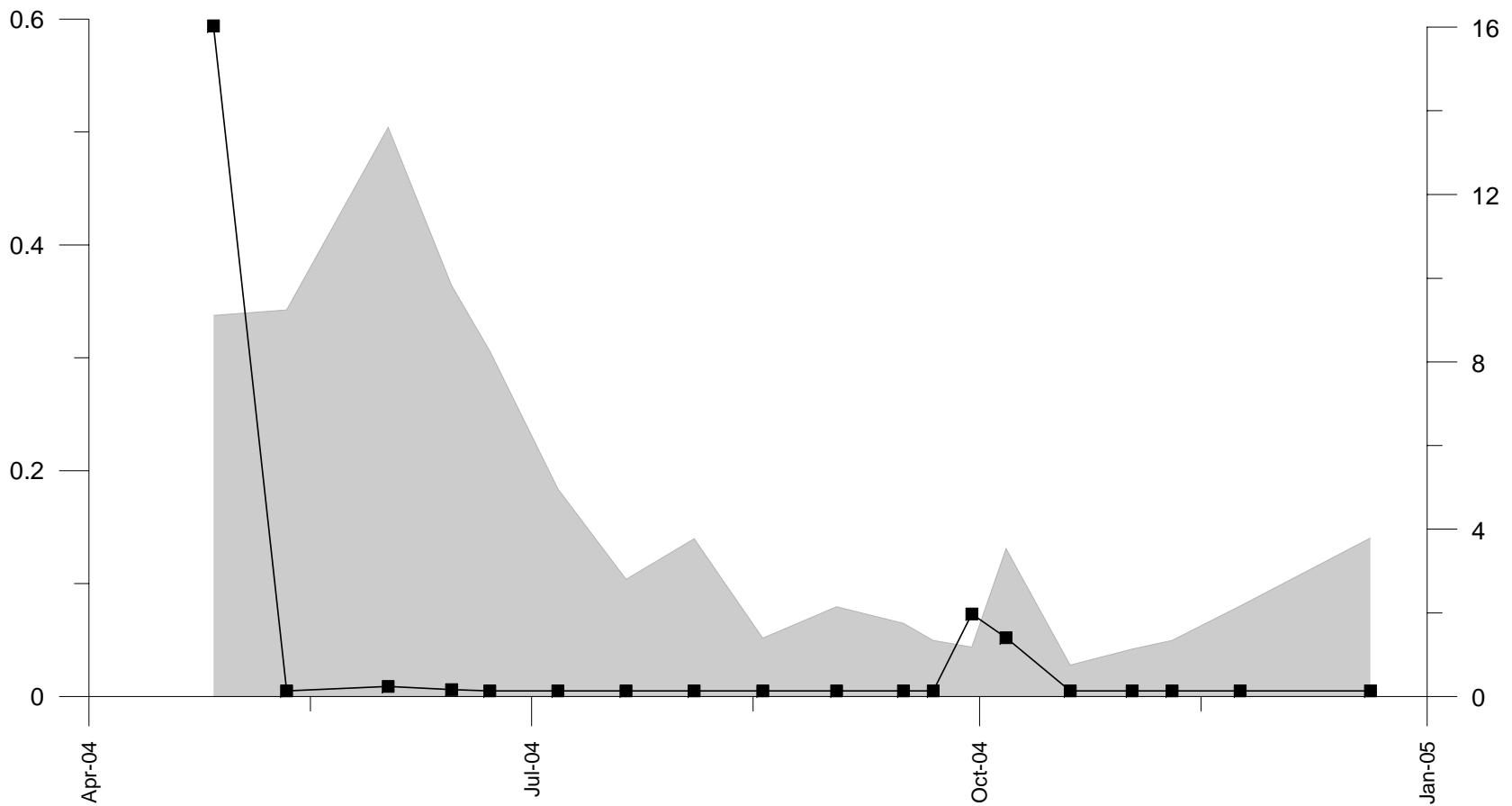
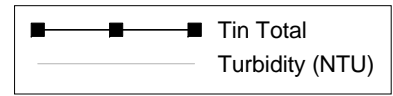
Figure 64



Salmon River at Hwy 1 Bridge
Temperature Air and Water (deg C)
Figure 65



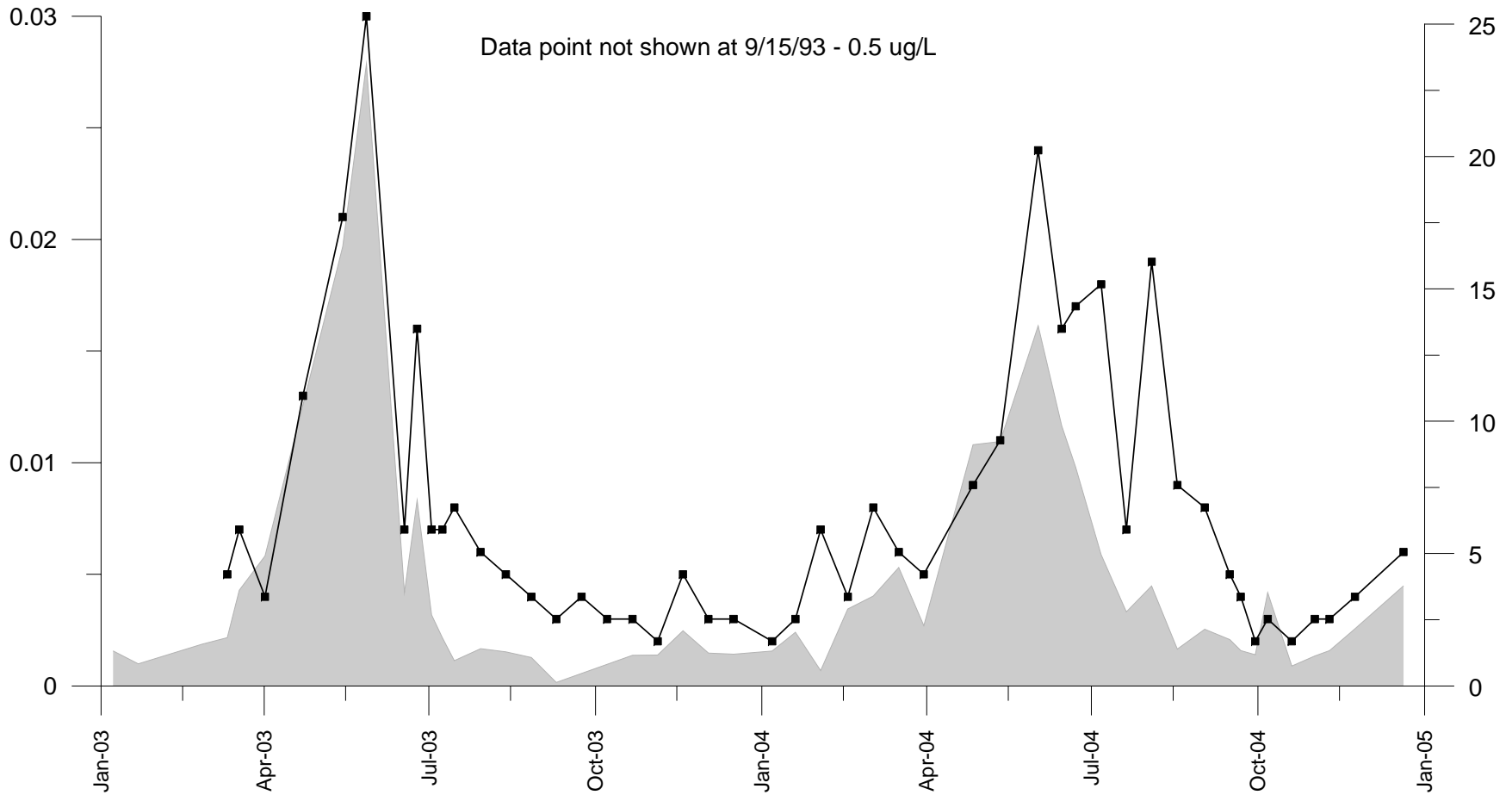
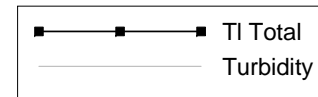
Salmon River at Hwy 1 Bridge
Tin Total (ug/L)
Figure 66



Salmon River at Hwy 1 Bridge

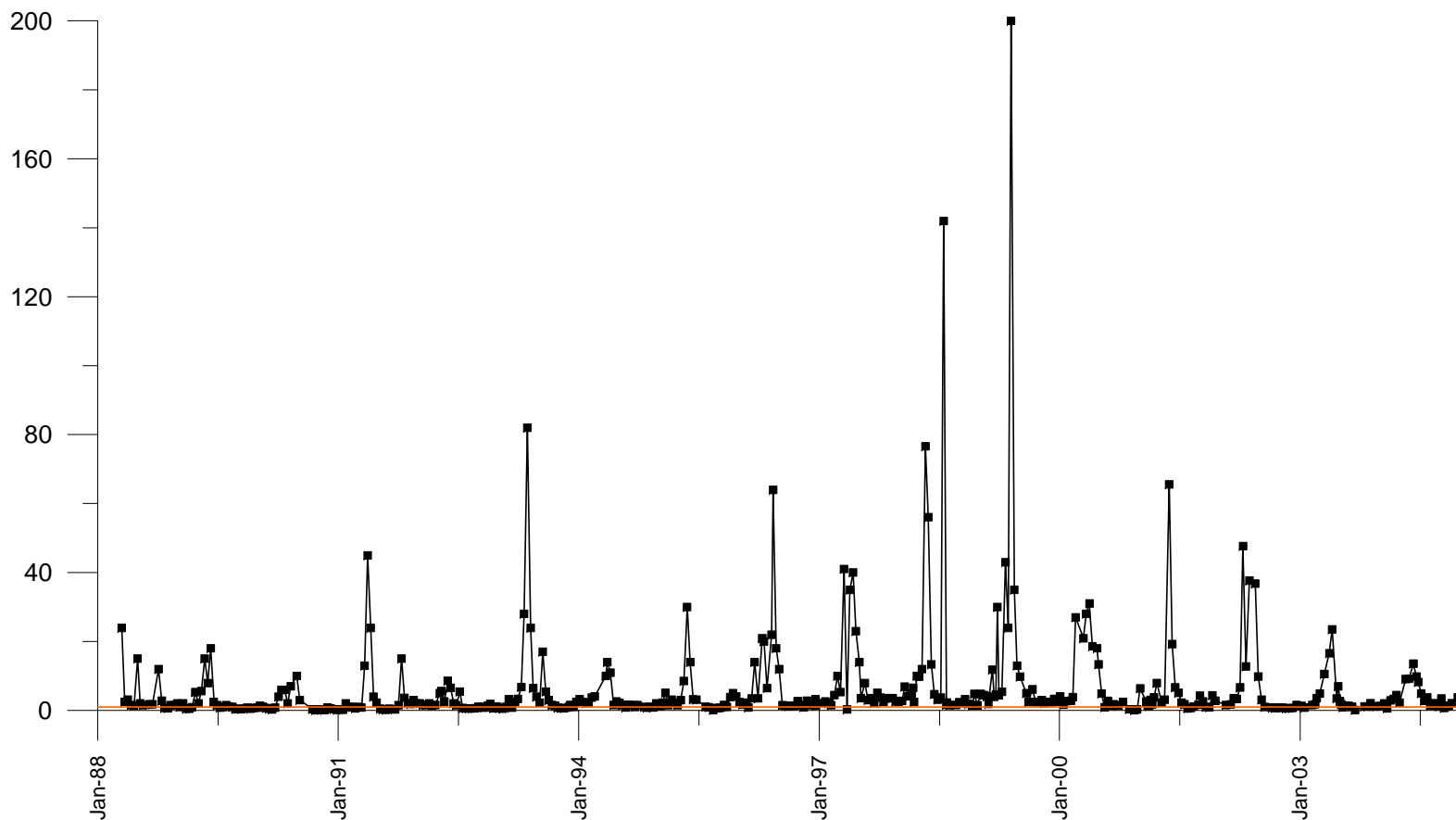
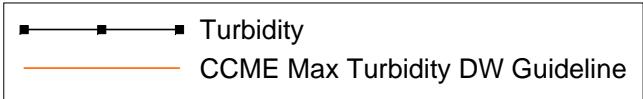
Thallium Total (ug/L)

Figure 67



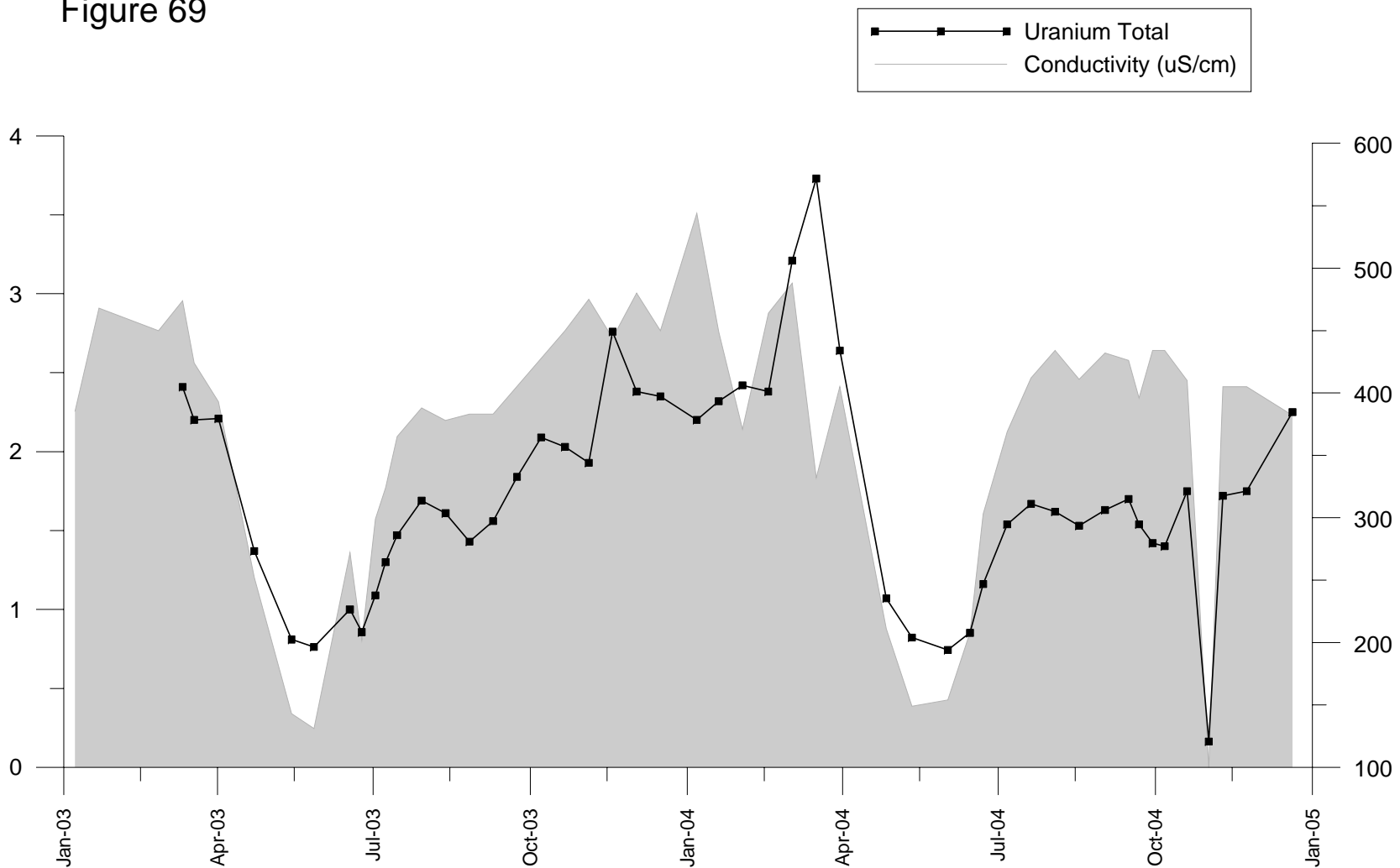
Salmon River at Hwy 1 Bridge

Turbidity (uS/cm)
Figure 68



Salmon River at Hwy 1 Bridge

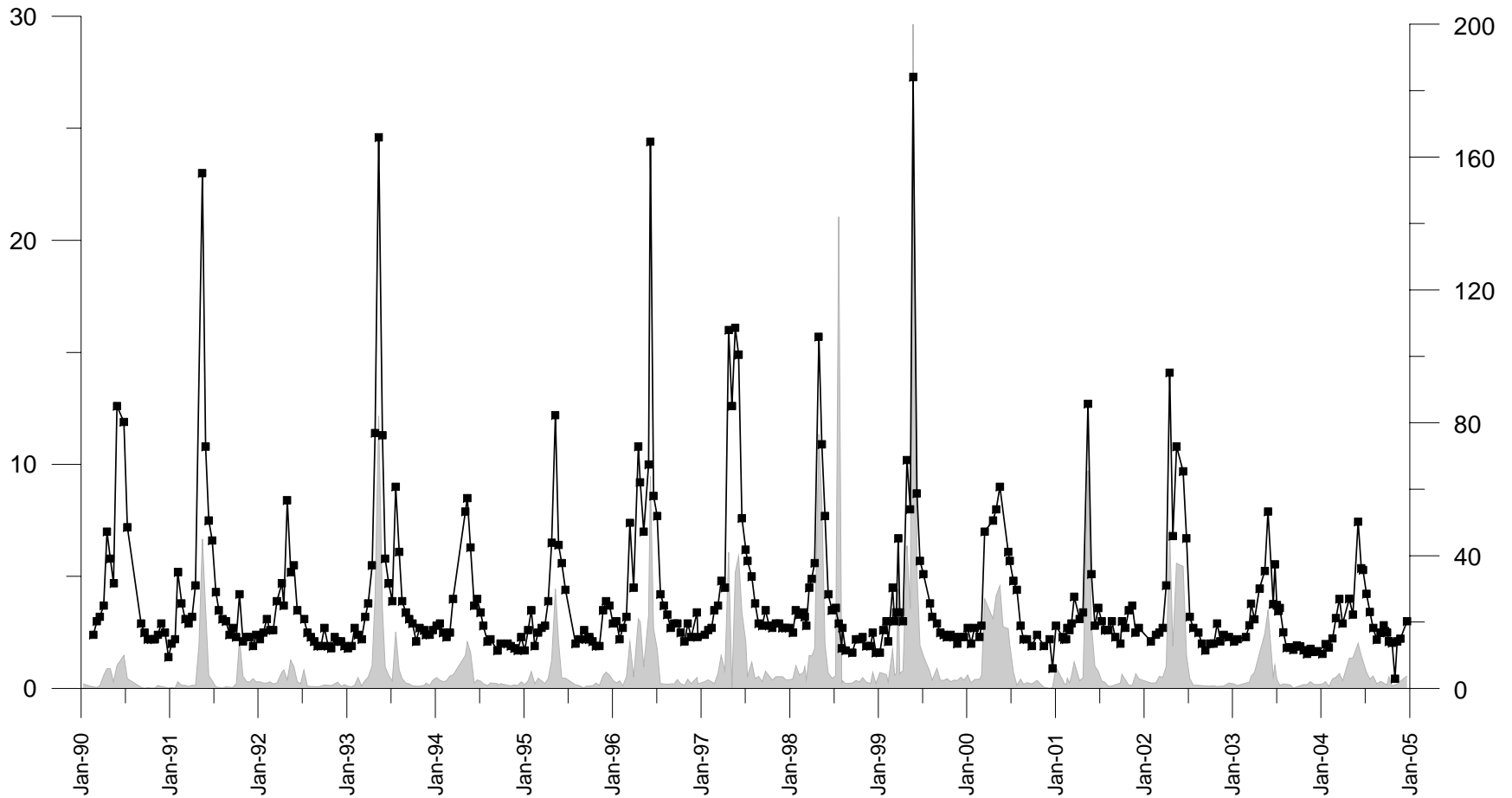
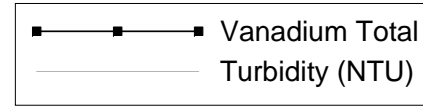
Uranium Total (ug/L)
Figure 69



Salmon River at Hwy 1 Bridge

Vanadium Total (ug/L)

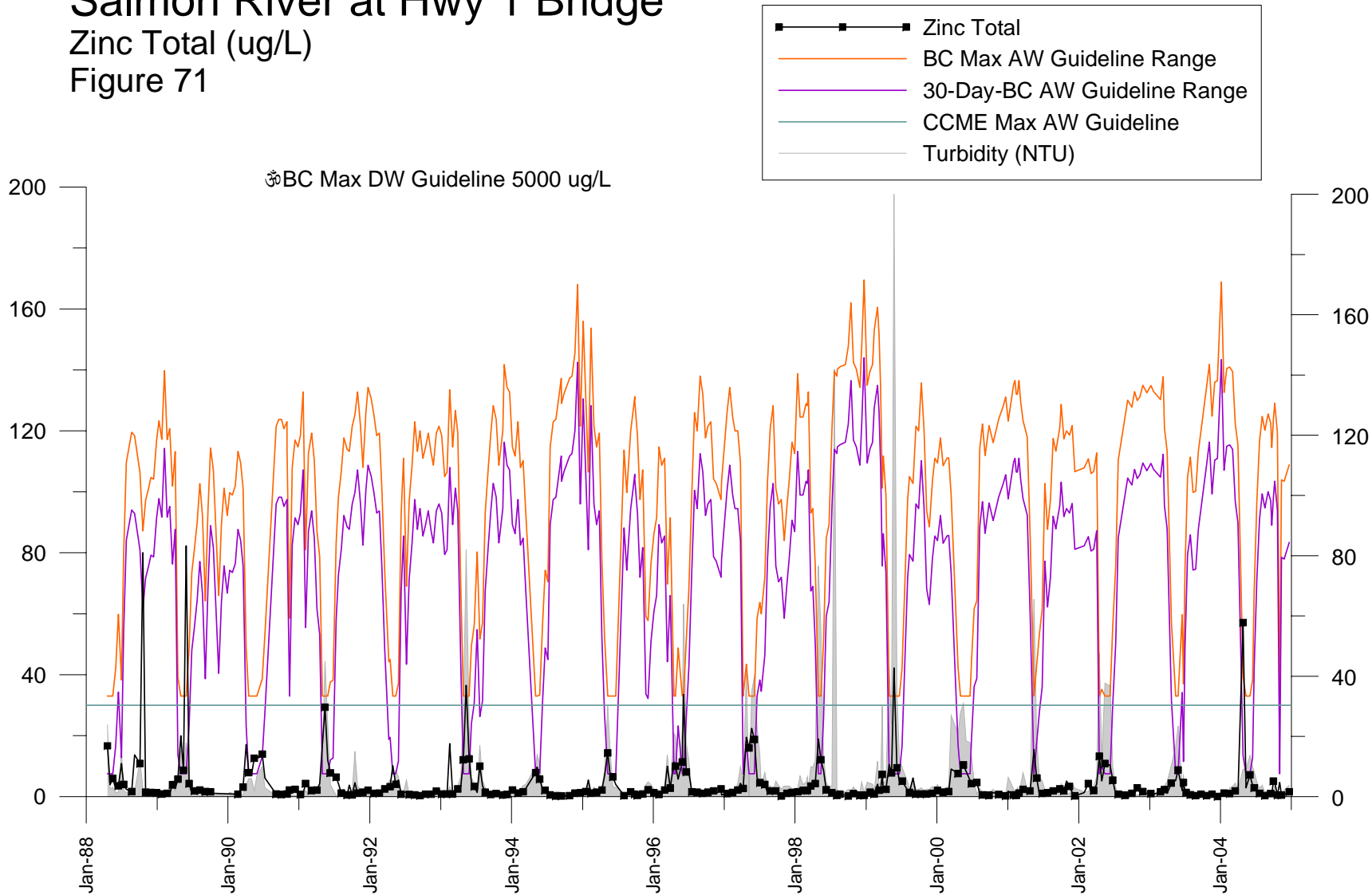
Figure 70



Salmon River at Hwy 1 Bridge

Zinc Total (ug/L)

Figure 71



Salmon River at Hwy 1 Bridge

Zinc Total (ug/L)

Figure 72

