

Appendix 4:

Golder Associates. 2001b. *Technical Impracticability of Achieving copper and cobalt Preliminary Remediation Goals in Blackbird and Bucktail Creeks.*
Appendix C to Golder (2001a)

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APPENDIX C

**TECHNICAL IMPRACTICABILITY OF ACHIEVING COPPER
AND COBALT PRGS IN BLACKBIRD AND BUCKTAIL CREEKS**

**BLACKBIRD MINE SITE
LEMHI COUNTY, IDAHO**

Prepared for:

Blackbird Mine Site Group

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C-1. INTRODUCTION

This section provides an analysis of the ability to achieve EPA's proposed PRGs in Blackbird Creek, Bucktail Creek, and South Fork Big Deer Creek, which are shown in Table C-1. This "technical impracticability" analysis is provided in support of an ARARs waiver for meeting the copper water quality standard in these creeks. EPA's proposed PRG for cobalt is not an ARAR.

C-2. CURRENT LOADINGS OF COBALT AND COPPER

Tables D-2a and D-2b show the loading of cobalt and copper in Blackbird Creek and Bucktail/Big Deer Creeks during the fall of 2000 and the spring of 2001. These loads are compared to the load at the mouth of Blackbird Creek (BBSW-01A) and in Big Deer Creek downstream of So. Fork Big Deer Creek (BDSW-03).

In Blackbird Creek, the loading of cobalt increases dramatically at stations downstream of BBSW-07. The majority of the load (82% in the fall) is noted at BBSW-02, which is the station just after the West Fork Tailings Impoundment. In general, copper concentrations decrease between BBSW-07 and BBSW-01A in the fall and increase between these stations in the spring. In the fall, copper loading decreases between BBSW-07 and BBSW-03A, increases between BBSW-03A and BBSW-02, and decreases dramatically between BBSW-02 and BBSW-01A. The copper loads at all stations upstream of BBSW-01A are greater than the load at the mouth. In the spring, there is a decrease between BBSW-07 and BBSW-03A and an increase between BBSW-03A and BBSW-01A. The increase between BBSW-03 and BBSW-01A cannot be attributed to a specific source since no sampling was done at BBSW-02 in spring 2001.

In Bucktail and South Fork Big Deer/Big Deer Creeks, the copper load increases in the fall from BBSW-01 proceeding downstream to BDSW-03. In the spring, a decrease is seen between BBSW-01 to SFSW-01 and an increase between SFSW-01 and BDSW-03. In the fall, the majority of the copper load is noted at SFSW-01. In the spring, the majority of the copper load is noted at BBSW-01. In both spring and fall, the cobalt loading decreases proceeding downstream to SFSW-01, but increases between SFSW-01 and BDSW-03.

C-3. SAMPLE CALCULATIONS

This section provides sample calculations of the analyses performed on Blackbird Creek.

C-3.1 Reduction in One Source

This first example is for reduction in one source only and refers to Table C-3 Concentrations in Blackbird Creek with Reductions at Upper Meadow Creek. The calculation is performed for cobalt at stations BBSW-07, BBSW-03A, and BBSW-02 in fall 2000.

The following abbreviations are used in the formulas:

C = concentration

L = load

Q = flow

1. BBSW-07: Find the new concentration at BBSW-07 by applying a reduction to the concentration at BBSW-07. We will use 50% for this calculation.

$$\begin{aligned} C_{BBSW-07, new} &= C_{BBSW-07, old} * (1 - \%reduction) \\ &= 0.193 * (1 - 0.5) \\ &= 0.0965 \text{ mg/L} \end{aligned}$$

2. BBSW-03A: Find the new load at BBSW-03A by adding the "load delta" between BBSW-07 and BBSW-03A to the calculated load at BBSW-07. Load deltas are defined as the difference in loading between one station and a station upstream and are calculated from the existing data for the two stations. Negative load deltas are treated as zero.

$$\begin{aligned} \text{"load delta" (BBSW-03A to BBSW-07)} &= L_{BBSW-03A} - L_{BBSW-07} \\ &= 0.664 - 0.246 \\ &= 0.418 \text{ kg/day} \end{aligned}$$

$$\begin{aligned} L_{BBSW-03A, new} &= C_{BBSW-07, new} * Q_{BBSW-07} * 2.447 + \text{"load delta" }_{03A \text{ to } 07} \\ &= 0.0965 * 0.52 * 2.447 + 0.418 \\ &= 0.541 \text{ kg/day} \end{aligned}$$

$$\begin{aligned} C_{BBSW-03A, new} &= L_{BBSW-03A, new} / (2.447 * Q_{BBSW-03A}) \\ &= 0.541 / (2.447 * 0.91) \\ &= 0.243 \text{ mg/L} \end{aligned}$$

3. BBSW-02: This is done as before; add the "load delta" between BBSW-03A and BBSW-02 to the calculated load at BBSW-03A.

$$\begin{aligned} \text{"load_delta"}(BBSW - 02 \text{ to } BBSW - 03A) &= L_{BBSW-02} - L_{BBSW-03A} \\ &= 3.824 - 0.664 \\ &= 3.16 \text{ kg/day} \end{aligned}$$

$$\begin{aligned} C_{BBSW - 02, \text{ new}} &= (L_{BBSW-03A, \text{ new}} + \text{"load delta"}_{02 \text{ to } 03A}) / (2.447 * Q_{BBSW-02}) \\ &= (0.541 + 3.16) / (2.447 * 1.78) \\ &= 0.850 \text{ mg/L} \end{aligned}$$

C-3.2 Reduction Multiple Sources

This example is for reduction in multiple sources and refers to Tables D-4b and D-4c Concentrations at BBSW-03A and BBSW-02 with Reductions at Upper Meadow Creek and/or Upper Blackbird Creek. Cobalt concentrations are calculated for stations BBSW-03A and BBSW-02 using Fall 2000 data.

The following abbreviations are used in the formulas:

C = concentration

L = load

Q = flow

1. BBSW-03A: Calculate the new concentration at BBSW-03A with a 50% reduction in Upper Meadow Creek sources and a 40% reduction in Upper blackbird Creek sources. Sum the load at BBSW-07, which is reduced by 50%, and the load delta between BBSW-03A and BBSW-07, which is reduced by 40%. This calculated load at BBSW-03A is then converted to a concentration.

$$\begin{aligned} L_{BBSW-03A, \text{ new}} &= C_{BBSW-07, \text{ old}} * Q_{BBSW-07} * 2.447 * (1 - \% \text{reduction}) + \text{"load delta"}_{03A \text{ to } 07} * (1 - \% \text{reduction}) \\ &= 0.193 * 0.520 * 2.447 * (1 - .5) + 0.418 * (1 - 0.4) \\ &= 0.373 \text{ kg/day} \end{aligned}$$

$$\begin{aligned} C_{BBSW-03A, \text{ new}} &= L_{BBSW-03A, \text{ new}} / (Q_{BBSW-03A} * 2.447) \\ &= 0.334 / (0.91 * 2.447) \\ &= 0.168 \text{ mg/L} \end{aligned}$$

2. BBSW-02: Add the load delta between BBSW-02 and BBSW-03A to the new load at BBSW-03A and convert to a concentration.

$$L_{BBSW-02, \text{ new}} = L_{BBSW-03A, \text{ new}} + \text{"load delta"}_{02 \text{ to } 03A}$$

$$= 0.373 + 3.16$$

$$= 3.53 \text{ kg/day}$$

$$C_{BBSW-02, new} = L_{BBSW-02, new} / (Q_{BBSW-02} * 2.447)$$

$$= 3.53 / (1.78 * 2.447)$$

$$= 0.811 \text{ mg/L}$$

C-4. BLACKBIRD CREEK

C-4.1 Summary of Early Actions

A significant reduction in metals concentrations has already been achieved in Blackbird Creek as a result of the Early Actions that have been implemented.

Under similar flow conditions during the rising limb of the snowmelt hydrograph in 1995 and 2000, dissolved copper concentrations at BBSW-07 have been reduced from a peak of 13.2 mg/L on May 10, 1995 to 0.26 mg/L on April 26, 2000, representing a reduction of 98%. Dissolved copper loading has been reduced from a peak load of 175 kg/day on May 18, 1995 to 2.4 kg/day in the spring of 2000, a 98.6% reduction. Dissolved cobalt concentrations were reduced from 5.4 mg/L on May 10, 1995 to 0.782 mg/L on April 26, 2000, a reduction of 85%. Peak cobalt loading decreased from 235 kg/day on June 2, 1995 to 7.3 kg/day in the spring of 2000, representing a reduction of 97%.

During low flow conditions in the fall, concentrations prior to Early Actions and the amount of reductions following Early Actions were virtually the same at BBSW-07 for both dissolved copper and cobalt. Both dissolved copper and cobalt concentrations were reduced from about 1 mg/L in 1995 and a load of about 2 kg/day to < 0.2 mg/L and a load of about 0.25 kg/day in 2000, representing reductions in concentration of 82% and loading of 88%.

During the spring of 2000, the dissolved copper concentration and loading at BBSW-01A were 0.044 mg/L and 1.43 kg/day, as compared to 1995 concentrations of 0.820 mg/L and loading of 18.8 kg/day. Even with the lower 1995 flows, this represents a reduction in concentration of about 95% and reduction in loading of about 92%. The dissolved cobalt concentration was 0.387 mg/L and loading was 12.56 kg/day during 2000, compared to the 1995 concentration of 1.27 mg/L with loading of 29.2 kg/day. This represents a reduction in dissolved cobalt concentrations of 70% and loading of 57%. The spring 2001 results at this station were 0.049 mg/L dissolved copper with loading of 3.7 kg/day, and 0.150 mg/L dissolved cobalt with loading of 11.38 kg/day.

During the fall of 2000, at BBSW-01A, the dissolved copper concentration and loading were 0.010 mg/L and 0.058 kg/day, as compared to 1995 concentrations of 1.17 mg/L and loading of 7.3 kg/day. This represents a reduction in concentration and loading of 99%. The dissolved cobalt concentration was 0.800 mg/L and loading was 4.68 kg/day during 2000, compared to the 1995 concentration of 1.85 mg/L with loading of 11.55 kg/day. This represents a reduction in dissolved cobalt concentrations of 57% and loading of 59%.

Early Actions have been implemented to remove the majority of the metals loading, and additional reductions will be more difficult to achieve. Additional reductions in metals loading are possible. However, because remaining sources are more diffuse than sources controlled by the Early Actions, it is unlikely that additional reductions greater than 90% could be achieved. Reductions less than 90% are likely. Therefore, in the following analysis estimated reductions in metals loadings have been capped at 90% for the various areas evaluated.

C-4.2 Potential Load Reductions in Upper Meadow Creek

Additional actions in upper Meadow Creek will be evaluated that would further reduce metals loading in Blackbird Creek. These actions include controls of seepage entering Meadow Creek below the 7800 waste rock dump, and maintenance of the Meadow Creek cap underdrain system above the water treatment plant to ensure contaminated water is not discharged to Blackbird Creek.

Based on the 2000 and 2001 data, between about 89% (in the spring) and 75% (in the fall) of the loading of copper and cobalt observed at BBSW-07 is due to sources in upper Meadow Creek. Any removal above 75% during the fall low flow and 89% in the spring cannot be attributed to the seepage, but to diffuse sources; thus these are the maximum loadings from Upper Meadow Creek that could be addressed through additional actions. However, as discussed in Section 1.3.1, it is unlikely that this loading can be reduced any further than an additional 90%.

Table C-3 shows the concentrations at the selected Blackbird Creek stations that would result from reductions in cobalt and copper loading in Upper Meadow Creek as measured at BBSW-07. It should be noted that negative loads of copper, due to precipitation and adsorption of copper, are often observed in the lower parts of Blackbird Creek. These negative loads were treated as zero in this calculation.

Even at the maximum of 69% improvement in cobalt concentrations at BBSW-07 (90% of the load attributable to the seeps in Upper Meadow Creek), no station on Blackbird Creek meets the proposed PRG of 0.038 mg/L during the low flow condition. During the spring a 69% reduction is enough for BBSW-07 to meet EPA's proposed PRG for cobalt, but because there are other sources of cobalt between BBSW-07 and the mouth of Blackbird Creek, no other station meets EPA's proposed PRG. The maximum assumed reductions possible, 69% reduction in copper loading in the fall or 80% reduction in the spring at BBSW-07, are not enough to meet EPA's proposed PRG at that station or any station downstream.

The reductions in Upper Meadow Creek sources effect the concentrations of cobalt and copper in Panther Creek. At PASW-09 the cobalt PRG cannot be met, even with maximum reductions, during fall low-flow conditions. In the spring, only a 50% reduction in Upper Meadow Creek sources would be required to meet the cobalt PRG. To meet the copper PRG in the fall, only a 25% reduction in the sources is required, but no amount of reduction is enough to meet the copper PRG in the spring. PASW-05 either already meets the cobalt PRG (Spring 2001) or cannot meet PRG even with the maximum reduction in sources (Fall 2000). For copper, no reduction is required in the fall, and a 50% reduction would meet the copper PRG in the spring. The only time that PASW-04 does not meet a PRG is for copper in the spring, and a small reduction (25%) in Upper Meadow Creek sources would decrease the concentration to below the PRG.

C-4.3 Potential Load Reductions in Upper Blackbird Creek

Downstream of BBSW-07 some of the sources of metals loading to Upper Blackbird Creek include overbank materials and seeps between stations BBSW-07 and BBSW-03A. Table C-4a shows the concentrations that would be expected in Blackbird and Panther Creeks if the sources of metal loading were reduced in Upper Blackbird Creek only. This single action, even with 90% removal of all sources, is not enough to meet EPA's proposed PRG for either cobalt or copper at any Blackbird Creek station downstream. The concentrations of both copper and cobalt in Blackbird Creek are still several times higher than EPA's proposed PRGs. The water quality in Panther Creek is not dramatically affected by changes in Upper Blackbird Creek. In the fall, PASW-04 and PASW-05 do not meet the cobalt PRG and at the maximum reduction does not bring the concentrations below the PRG. PASW-09 does not meet the cobalt PRG in spring, but a 40% reduction results in concentrations below the PRG. All Panther Creek stations meet the copper PRG in the fall, but no station, even with maximum reductions, meets the copper PRG in the spring.

Because removing the sources in Upper Blackbird Creek does not improve water quality enough to meet EPA's proposed PRGs, a combination of removals from Upper Meadow Creek and Upper Blackbird Creek were evaluated. Table C-4b shows the concentrations at BBSW-03A as a result of combinations of removals from Upper Meadow Creek and Upper Blackbird Creek. BBSW-03A does manage to meet EPA's cobalt PRG in the spring, but there must be at least a 76% reduction from Upper Meadow and 90% removal in Upper Blackbird Creek.

Table C-4c shows the estimated concentrations of cobalt and copper at BBSW-02 resulting from combinations of removals in Upper Meadow Creek and Upper Blackbird Creek. Table C-4d is the same, except that the concentrations are for BBSW-01A. Neither of these stations meets any of EPA's PRGs for any combination of removal, even 90% of each. This is to be expected because there is large loading of cobalt and increased copper loading from the West Fork Impoundment.

Tables D-4e through D-4g show the effects of the combined removals on the concentrations in Panther Creek. No combination of removals can reduce cobalt concentrations at PASW-09 below the PRG in the fall. Either a 40% reduction in Upper Blackbird Sources or 20% in Upper Blackbird and 25% in Upper Meadow Creek would meet the PRG for cobalt at PASW-09 in the spring. For copper, the PRG is met with no reduction in the fall, and no combination of reductions will meet the PRG for copper in the spring. For PASW-05, no combination of reductions will decrease the cobalt concentration to below the PRG, but at least a 60% reduction in both sources will bring the concentrations close to the PRG. The cobalt PRG at PASW-05 is already met in the spring. A 50% reduction in Upper Meadow Creek with no decrease in Upper Blackbird Creek sources will allow PASW-05 to meet the copper PRG in the spring, and the copper PRG is already met in the fall.

C-4.4 Potential Load Reductions at the West Fork Tailings Impoundment

The West Fork Impoundment is the largest source of cobalt loading downstream of BBSW-03A. Because cobalt loading from the West Fork Impoundment is high, a calculation was performed to evaluate metals reductions from the Tailings Impoundment only. The summary of this calculation is provided in Table C-5a. It should be noted that the region between BBSW-02 and BBSW-01A has historically lost cobalt load in the spring and copper year round; as in the previous calculations, these losses were not included.

Even with 90% reduction in metals loading from the West Fork Impoundment, the concentrations downstream in Blackbird Creek would not meet EPA's PRGs for cobalt or copper year round. Blackbird Creek downstream concentrations of cobalt are more than four times higher than EPA's proposed PRG in the fall and 1.5 times higher in the spring. Copper concentrations downstream are two or three times higher than EPA's proposed PRG.

An 80% reduction of the sources from the West Fork Impoundment would ensure that the cobalt PRG would be met in Panther Creek year round. Specifically, at PASW-09 an 80% reduction meets cobalt PRGs in the fall and a 20% reduction is required in the spring. The copper PRG is met at PASW-09 with no reduction in the fall, and cannot be met in the spring. Only a 20% reduction is required to meet the cobalt PRG at PASW-05 in the fall and none is required in the spring. PASW-05 copper concentrations meet the PRG in the fall and only a 40% reduction is required in spring. PASW-04 meets both PRGs year round with out reductions from either source.

Estimates of concentrations at BBSW-02 resulting from combinations of removals of loads from the West Fork Impoundment and areas above the West Fork Impoundment (i.e. Upper Meadow and Upper Blackbird) are shown in Table C-5b. No combination of reductions would achieve EPA's cobalt PRG during low flow conditions in the fall. A 60% reduction of all sources above West Fork Impoundment and a 90% reduction of the West Fork Impoundment would be required to meet EPA's cobalt PRG in the spring, or at least 80% removal both at the West Fork Impoundment and upstream of the impoundment. To meet copper in the spring with 80% removal of the sources above the West Fork Impoundment 90% removal at the West Fork Impoundment would be needed. In the fall 90% upstream of the impoundment would be required along with at least 80% reduction from the West Fork Impoundment.

Table C-5c shows the estimated concentrations that would result at BBSW-01A with combinations of removals of West Fork Impoundment and all sources above West Fork Impoundment. Cobalt cannot be met during low flow conditions in the fall with any combination of reductions. In the spring either a 60% removal above West Fork Impoundment and 90% removal at West Fork Impoundment, or at least 80% removal at both would have to be achieved. To meet the copper concentrations in the spring it would be necessary to reduce the sources above West Fork impoundment by 90% plus 90% reduction at the West Fork Impoundment. To meet copper in the fall various

combinations with at least 80% reduction from sources upstream of the Impoundment with 20% to 60% removal at the West Fork Impoundment would be needed.

The effects of the combinations of removals on Panther Creek are seen in Tables D-5d through D-5f. Both PRGs can be met year round at PASW-09 with some combination of removals. An 80% reduction in the West Fork Impoundment sources and 60% reduction of other upstream sources would be required to meet both PRGs year round. To just meet cobalt PRGs, an 80% reduction in West Fork sources or a 60% reduction in West Fork sources and 20% reduction in sources above the West Fork are necessary to meet the PRGs in the fall. The copper PRG is met in the fall and, large reductions in both sources would be required to meet the PRGs in the spring.

For PASW-05 much smaller reductions would be required. A 20% reduction in sources above the West Fork and at the West Fork would meet cobalt and copper PRGs year round. Cobalt PRGs can easily be met in the fall at PASW-05 with only a 20% reduction in West Fork sources; in the spring, the PRG is already met. For copper, either a 60% reduction of West Fork sources or a 20% reduction in sources above West Fork would be needed to meet the PRG in the spring; the PRG is already met in the fall.

The only time that a PRG is not met at PASW-04 is copper in the spring. A simple 20% reduction in either sources at the West Fork or above the West Fork will meet the PRG for copper.

C-4.5 Potential Load Reductions in Lower Blackbird Creek

Virtually all of the metals loading in Blackbird Creek occur from the West Fork Impoundment upstream to the area below the 7800 waste rock dump in Meadow Creek. Therefore, removing only the sources of cobalt and copper loading in Lower Blackbird Creek would be ineffective at reducing concentrations in Blackbird and Panther Creeks to levels below EPA's proposed PRGs. Table C-6a shows the results of this calculation.

Table C-6b shows what the concentrations at BBSW-01A would be by removing various amounts of the sources above Lower Black Bird Creek and/or removing sources in Lower Blackbird Creek. However, as illustrated on the table the effectiveness at meeting the PRGs is not sensitive to removal percentages in lower Blackbird Creek, again supporting the observation that all the significant loading occurs from sources in upper Blackbird Creek (area between BBSW-07 and BBSW-02) and Meadow Creek. As indicated in the table, the EPA cobalt PRG cannot be met during low flow in the fall even with 90% removal from both upper and lower Blackbird Creek. In the spring at least 80% removal of all sources above Lower Blackbird Creek would be required to meet the PRG. For copper, 90% removal of the up stream sources would be required to meet the PRG at BBSW-01A in the spring, with at least 80% required in the fall.

Tables D-6c through D-6e show the combinations of removals from Lower Blackbird Creek and other sources upstream to meet the PRGs in Panther Creek. An 80% reduction in sources upstream of Lower Blackbird Creek would allow both the cobalt and copper PRGs to be met year round at PASW-09. No reduction in Lower Blackbird

Creek would be needed. There are other combinations that would meet the PRGs, but these vary by season and constituent. In the fall at least a 60% reduction in Lower Blackbird Creek and at least 40% reduction in upstream sources would be required to meet the PRG for cobalt at PASW-09, while in the spring, only a 20% reduction of all sources upstream is required. At PASW-05 and PASW-04, the only way to meet the PRGs year round is to remove 20% of the upstream sources. No reduction in Lower Blackbird Creek is necessary.

C-4.6 Maximum Combined Load Reductions for Blackbird Creek

The EPA cobalt PRG can be met at BBSW-07 in the spring if there is 69% (90% of the load from the 7800 waste rock dump area) reduction of sources in Upper Meadow Creek. Even with that reduction, water quality at BBSW-07 would not meet the cobalt PRG in the fall, nor would it meet the copper PRG in spring or fall. The 69% reduction is not sufficient to meet EPA's proposed PRGs for copper or cobalt at the rest of the stations downstream on Blackbird Creek.

The EPA cobalt PRG at BBSW-03A cannot be met year round, even with 80% reduction in the sources in Upper Meadow Creek and 90% reduction of the sources in Upper Blackbird Creek. The EPA copper PRG cannot be met at BBSW-03A. These removals are not enough to meet the concentrations at other stations downstream on Blackbird Creek.

The EPA cobalt PRG cannot be met during low flow conditions at BBSW-02. To meet the EPA cobalt PRG in the spring at BBSW-02, 60% of the sources above the West Fork Impoundment plus 90% removal of West Fork Impoundment would be required. For copper 90% of the sources above the West Fork Impoundment plus 80% of the West Fork Impoundment would have to be removed to meet EPA's proposed PRG at BBSW-02 year round.

The cobalt PRG cannot be met year round at BBSW-01A. At BBSW-01A, the only way to meet the cobalt PRG in the spring is to remove 80% of the sources of cobalt loading above Lower Blackbird. To meet the copper PRG year round, 90% of the sources above Lower Blackbird would have to be removed.

C-4.7 Summary

Early Actions have already removed the majority of the copper and cobalt loading to Blackbird Creek. Reductions of an additional 90% (or more) are not technically practicable. Even at 90% reduction, EPA's proposed copper PRG cannot be met during early spring.

Even at 90% reduction, EPA's cobalt PRG cannot be met in Blackbird Creek during low-flow conditions. In addition, this analysis used 2001 spring synoptic sampling data, which is not worst-case conditions. Cobalt concentrations in prior years during the early spring prior to significant run off have been about six times the concentrations used in this analysis.

C-5. BUCKTAIL AND SOUTH FORK BIG DEER CREEKS

C-5.1 Calculation of Expected Downstream Concentrations

Sampling data from South Fork of Big Deer Creek between SFSW-02 and SFSW-01 has shown this reach to be a gaining reach for metals load at times and a losing reach during other sampling events. Table C-7 shows the difference in cobalt and copper loads for selected stations in the region.

The potential sources of loading in South Fork Big Deer Creek observed during fall 2000 (and some of the prior sampling) were discussed in the RI, with dissolution and/or desorption from sediments proposed as the likely source. Some have hypothesized that groundwater discharges from debris deposits in lower Bucktail Creek and along South Fork Big Deer Creek may be a source of loading. Sampling during spring 2001 did not detect this loading. Geochemical modeling presented in the RI indicated that dissolution and/or desorption from sediments would occur relatively rapidly, once the sources of metals from Bucktail Creek are reduced. Both positive loads as well as the negative loads have been assumed to be zero in this evaluation.

In this evaluation a reduction in metals loading from Bucktail Creek, as measured at BTSW-01, was the only area of source reduction considered. The expected concentration at BTSW-01 was calculated by reducing the concentration at BTSW-01 up to 90%. To calculate the concentration at downstream stations, it is assumed that a reduction at BTSW-01 would result in the same reduction downstream. So the concentration at any downstream station would be the measured concentration times one minus the fractional reduction at BTSW-01. The results of this calculation are provided in Table C-8.

At SFSW-02 EPA's proposed PRG for copper cannot be met in the spring and a 90% reduction of loading from Bucktail Creek would be required in the fall. For SFSW-01, the copper PRG cannot be met in either the spring or the fall, but at 90% reduction, the concentration is very close to the PRG. For cobalt, at least an 80% reduction would be needed to meet EPA's PRG at SFSW-01 in both spring and fall. Cobalt is not as significant a load in Bucktail Creek as in Blackbird Creek. However, 80% load reduction for cobalt and 90% for copper may not be practical.

BDSW-03 and PASW-04 do not have as high concentrations of cobalt and copper as Bucktail or So, Fork Big Deer Creek, but there are exceedances of one PRG at these stations. BDSW-03 meets the cobalt PRG year round, but doesn't meet the copper PRG at any time. In both the spring and fall, an 80% reduction would result in copper concentrations below the PRG. PASW-04 meets both PRGs year round, and large reductions drop both cobalt and copper concentrations close to zero.

C-5.2 Summary

Even at 90% reduction, the copper PRG cannot be met in Bucktail or South Fork Big Deer Creeks in early spring. It may be possible to meet the copper PRG during low-flow conditions (e.g., the fall) below SFSW-02, but not upstream. South Fork Big Deer Creek can meet EPA's proposed cobalt PRG year-round.

TABLES

TABLE C-1
PRGs for Blackbird, South Fork Big Deer Creek, Big Deer Creek and Panther Creek

| | Date and Time | Cobalt (mg/L) | Copper (mg/L) |
|---|-----------------|---------------|---------------|
| Fall 2000 | | | |
| Blackbird Creek | | | |
| BBSW-07 | 9/20/00 2:05 PM | 0.038 | 0.0053 |
| BBSW-03A | 9/20/00 3:10 PM | 0.038 | 0.0097 |
| BBSW-02 | 9/20/00 5:05 PM | 0.038 | 0.0098 |
| BBSW-01A | 9/20/00 5:20 PM | 0.038 | 0.0116 |
| Bucktail, SF Big Deer, Big Deer Creeks | | | |
| BTSW-01 | 9/19/00 3:15 PM | NA | NA |
| SFSW-02 | 9/19/00 5:00 PM | 0.038 | 0.0095 |
| SFSW-01 | 9/19/00 5:20 PM | 0.038 | 0.0101 |
| BDSW-03 | 9/19/00 7:15 PM | 0.038 | 0.0051 |
| Panther Creek | | | |
| PASW-09 | 9/20/01 7:20 PM | 0.038 | 0.0062 |
| PASW-05 | 9/20/01 7:20 AM | 0.038 | 0.0055 |
| PASW-04 | 9/20/00 8:00 AM | 0.038 | 0.0055 |
| Spring 2001 | | | |
| Blackbird Creek | | | |
| BBSW-07 | 5/2/01 1:50 PM | 0.038 | 0.0111 |
| BBSW-03A | 5/2/01 2:45 PM | 0.038 | 0.0088 |
| BBSW-02 | not sampled | 0.038 | 0.0114* |
| BBSW-01A | 5/2/01 5:45 PM | 0.038 | 0.0064 |
| Bucktail, SF Big Deer, Big Deer Creeks | | | |
| BTSW-01 | 5/17/01 1:25 PM | NA | NA |
| SFSW-02 | 5/17/01 2:40 PM | 0.038 | 0.0073 |
| SFSW-01 | 5/17/01 3:20 PM | 0.038 | 0.0072 |
| BDSW-03 | 5/17/01 5:30 PM | 0.038 | 0.0035 |
| Panther Creek | | | |
| PASW-09 | 5/2/01 6:30 PM | 0.038 | 0.0055 |
| PASW-05 | 5/17/01 8:20 PM | 0.038 | 0.0035 |
| PASW-04 | 5/17/01 9:30 PM | 0.038 | 0.0035 |

*Based on an estimated hardness of 100 mg/L

TABLE C-2a
Current Cobalt and Copper Loading in Blackbird Creek

| Station | Date and Time | Cobalt Load | % of Load at BBSW-01A | Copper Load | % of Load at BBSW-01A |
|----------------------|-----------------|-------------|-----------------------|-------------|-----------------------|
| Fall 2000 | | | | | |
| BBSW-07 | 9/20/00 2:05 PM | 0.246 | 5.3 | 0.233 | 401.7 |
| BBSW-03A | 9/20/00 3:10 PM | 0.664 | 14.2 | 0.140 | 241.4 |
| BBSW-02 | 9/20/00 5:05 PM | 3.82 | 81.7 | 0.192 | 331.0 |
| BBSW-01A | 9/20/00 5:20 PM | 4.68 | | 0.058 | |
| Spring 2001 | | | | | |
| BBSW-07 | 5/2/01 1:50 PM | 1.89 | 16.6 | 2.42 | 65.0 |
| BBSW-03A | 5/2/01 2:45 PM | 4.31 | 37.9 | 2.33 | 62.8 |
| BBSW-02 ^a | not sampled | 10.8 | 95.2 | 3.96 | 106.6 |
| BBSW-01A | 5/2/01 5:45 PM | 11.4 | | 3.72 | |

^a BBSW-02 values were approximated from previous years.

TABLE C-2b
Current Cobalt and Copper Loading in Bucktail/Big Deer Creeks

| Station | Date and Time | Cobalt Load | % of Load at BDSW-03 | Copper Load | % of Load at BDSW-03 |
|--------------------|-----------------|-------------|-------------------------|----------------|-------------------------|
| Fall 2000 | | | | | |
| BTSW-01 | 9/19/00 3:15 PM | 0.429 | 228.2 | 0.176 | 49.0 |
| SFSW-02 | 9/19/00 5:00 PM | 0.164 | 87.2 | 0.173 | 48.2 |
| SFSW-01 | 9/19/00 5:20 PM | 0.153 | 81.4 | 0.285 | 79.4 |
| BDSW-03 | 9/19/00 7:15 PM | 0.188 | | 0.359 | |
| Spring 2001 | | | | | |
| BTSW-01 | 9/19/00 3:15 PM | 2.61 | 119.7 | 2.45 | 102.1 |
| SFSW-02 | 9/19/00 5:00 PM | 2.08 | 95.4 | 1.70 | 70.8 |
| SFSW-01 | 9/19/00 5:20 PM | 1.88 | 86.2 | 1.53 | 63.8 |
| BDSW-03 | 9/19/00 7:15 PM | 2.18 | | 2.40 | |

TABLE C-3
Concentrations in Blackbird Creek with Reductions at BBSW-07 (due to Meadow Creek)

| | Date and Time | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | | |
| BBSW-07 | 9/20/00 2:05 PM | 0.193 | 0.183 | 0.145 | 0.137 | 0.097 | 0.092 | 0.059 | 0.056 | * | * | * | * |
| BBSW-03A | 9/20/00 3:10 PM | 0.298 | 0.105 | 0.270 | 0.078 | 0.243 | 0.052 | 0.222 | 0.032 | * | * | * | * |
| BBSW-02 | 9/20/00 5:05 PM | 0.878 | 0.065 | 0.864 | 0.052 | 0.850 | 0.039 | 0.839 | 0.028 | * | * | * | * |
| BBSW-01A | 9/20/00 5:20 PM | 0.800 | 0.049 | 0.789 | 0.039 | 0.779 | 0.029 | 0.771 | 0.021 | * | * | * | * |
| PASW-09 | 9/20/01 7:20 PM | 0.065 | 0.006 | 0.064 | 0.005 | 0.063 | 0.005 | 0.063 | 0.004 | * | * | * | * |
| PASW-05 | 9/20/01 7:20 AM | 0.045 | 0.005 | 0.044 | 0.005 | 0.043 | 0.004 | 0.043 | 0.004 | * | * | * | * |
| PASW-04 | 9/20/00 8:00 AM | 0.037 | 0.003 | 0.037 | 0.003 | 0.036 | 0.003 | 0.036 | 0.003 | * | * | * | * |
| Spring 2001 | | | | | | | | | | | | | |
| BBSW-07 | 5/2/01 1:50 PM | 0.107 | 0.137 | 0.080 | 0.103 | 0.054 | 0.069 | 0.033 | 0.042 | 0.026 | 0.033 | 0.021 | 0.027 |
| BBSW-03A | 5/2/01 2:45 PM | 0.205 | 0.115 | 0.182 | 0.086 | 0.160 | 0.057 | 0.143 | 0.035 | 0.137 | 0.027 | 0.133 | 0.023 |
| BBSW-02 | not sampled | 0.164 | 0.061 | 0.157 | 0.052 | 0.150 | 0.043 | 0.144 | 0.036 | 0.142 | 0.033 | 0.141 | 0.032 |
| BBSW-01A | 5/2/01 5:45 PM | 0.150 | 0.053 | 0.144 | 0.045 | 0.138 | 0.037 | 0.133 | 0.031 | 0.131 | 0.029 | 0.130 | 0.028 |
| PASW-09 | 5/2/01 6:30 PM | 0.040 | 0.014 | 0.039 | 0.012 | 0.037 | 0.010 | 0.036 | 0.008 | 0.035 | 0.008 | 0.035 | 0.007 |
| PASW-05 | 5/17/01 8:20 PM | 0.012 | 0.004 | 0.012 | 0.004 | 0.011 | 0.003 | 0.011 | 0.003 | 0.011 | 0.002 | 0.010 | 0.002 |
| PASW-04 | 5/17/01 9:30 PM | 0.012 | 0.004 | 0.012 | 0.003 | 0.011 | 0.003 | 0.011 | 0.002 | 0.011 | 0.002 | 0.011 | 0.002 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

* 90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4a
Concentrations in Blackbird Creek with Reductions at Upper Blackbird Creek Only

| | Date and Time | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | | |
| BBSW-03A | 9/20/00 3:10 PM | 0.298 | 0.105 | 0.260 | 0.105 | 0.223 | 0.105 | 0.185 | 0.105 | 0.148 | 0.105 | 0.129 | 0.105 |
| BBSW-02 | 9/20/00 5:05 PM | 0.878 | 0.065 | 0.859 | 0.065 | 0.840 | 0.065 | 0.820 | 0.065 | 0.801 | 0.065 | 0.792 | 0.065 |
| BBSW-01A | 9/20/00 5:20 PM | 0.800 | 0.049 | 0.786 | 0.049 | 0.771 | 0.049 | 0.757 | 0.049 | 0.743 | 0.049 | 0.736 | 0.049 |
| PASW-09 | 9/20/01 7:20 PM | 0.065 | 0.006 | 0.064 | 0.006 | 0.063 | 0.006 | 0.062 | 0.006 | 0.061 | 0.006 | 0.060 | 0.006 |
| PASW-05 | 9/20/01 7:20 AM | 0.045 | 0.005 | 0.044 | 0.005 | 0.043 | 0.005 | 0.042 | 0.005 | 0.041 | 0.005 | 0.041 | 0.005 |
| PASW-04 | 9/20/00 8:00 AM | 0.037 | 0.003 | 0.037 | 0.003 | 0.036 | 0.003 | 0.035 | 0.003 | 0.035 | 0.003 | 0.034 | 0.003 |
| Spring 2001 | | | | | | | | | | | | | |
| BBSW-03A | 5/2/01 2:45 PM | 0.205 | 0.115 | 0.182 | 0.115 | 0.159 | 0.115 | 0.136 | 0.115 | 0.113 | 0.115 | 0.101 | 0.115 |
| BBSW-02 | not sampled | 0.164 | 0.061 | 0.157 | 0.061 | 0.149 | 0.061 | 0.142 | 0.061 | 0.135 | 0.061 | 0.131 | 0.061 |
| BBSW-01A | 5/2/01 5:45 PM | 0.150 | 0.053 | 0.144 | 0.053 | 0.137 | 0.053 | 0.131 | 0.053 | 0.124 | 0.053 | 0.121 | 0.053 |
| PASW-09 | 5/2/01 6:30 PM | 0.040 | 0.014 | 0.039 | 0.014 | 0.037 | 0.014 | 0.035 | 0.014 | 0.033 | 0.014 | 0.033 | 0.014 |
| PASW-05 | 5/17/01 8:20 PM | 0.012 | 0.004 | 0.012 | 0.004 | 0.011 | 0.004 | 0.011 | 0.004 | 0.010 | 0.004 | 0.010 | 0.004 |
| PASW-04 | 5/17/01 9:30 PM | 0.012 | 0.004 | 0.012 | 0.004 | 0.011 | 0.004 | 0.011 | 0.004 | 0.010 | 0.004 | 0.010 | 0.004 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4b
Concentrations at BBSW-03A with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird \ BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.298 | 0.105 | 0.270 | 0.078 | 0.243 | 0.052 | 0.222 | 0.032 | 0.214 | 0.025 | 0.209 | 0.020 |
| 20% | 0.260 | 0.105 | 0.233 | 0.078 | 0.205 | 0.052 | 0.184 | 0.032 | 0.177 | 0.025 | 0.172 | 0.020 |
| 40% | 0.223 | 0.105 | 0.195 | 0.078 | 0.168 | 0.052 | 0.147 | 0.032 | 0.139 | 0.025 | 0.134 | 0.020 |
| 60% | 0.185 | 0.105 | 0.158 | 0.078 | 0.130 | 0.052 | 0.109 | 0.032 | 0.101 | 0.025 | 0.097 | 0.020 |
| 80% | 0.148 | 0.105 | 0.120 | 0.078 | 0.093 | 0.052 | 0.072 | 0.032 | 0.064 | 0.025 | 0.059 | 0.020 |
| 90% | 0.129 | 0.105 | 0.101 | 0.078 | 0.074 | 0.052 | 0.053 | 0.032 | 0.045 | 0.025 | 0.040 | 0.020 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.205 | 0.115 | 0.182 | 0.086 | 0.160 | 0.057 | 0.143 | 0.035 | 0.137 | 0.027 | 0.133 | 0.023 |
| 20% | 0.182 | 0.115 | 0.159 | 0.086 | 0.137 | 0.057 | 0.120 | 0.035 | 0.114 | 0.027 | 0.110 | 0.023 |
| 40% | 0.159 | 0.115 | 0.136 | 0.086 | 0.114 | 0.057 | 0.097 | 0.035 | 0.091 | 0.027 | 0.087 | 0.023 |
| 60% | 0.136 | 0.115 | 0.113 | 0.086 | 0.091 | 0.057 | 0.074 | 0.035 | 0.068 | 0.027 | 0.064 | 0.023 |
| 80% | 0.113 | 0.115 | 0.090 | 0.086 | 0.068 | 0.057 | 0.051 | 0.035 | 0.044 | 0.027 | 0.041 | 0.023 |
| 90% | 0.101 | 0.115 | 0.079 | 0.086 | 0.056 | 0.057 | 0.039 | 0.035 | 0.033 | 0.027 | 0.029 | 0.023 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4c
Concentrations at BBSW-02 with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.878 | 0.065 | 0.864 | 0.052 | 0.850 | 0.039 | 0.839 | 0.028 | 0.835 | 0.025 | 0.833 | 0.022 |
| 20% | 0.859 | 0.065 | 0.845 | 0.052 | 0.831 | 0.039 | 0.820 | 0.028 | 0.816 | 0.025 | 0.814 | 0.022 |
| 40% | 0.840 | 0.065 | 0.826 | 0.052 | 0.811 | 0.039 | 0.801 | 0.028 | 0.797 | 0.025 | 0.794 | 0.022 |
| 60% | 0.820 | 0.065 | 0.806 | 0.052 | 0.792 | 0.039 | 0.781 | 0.028 | 0.778 | 0.025 | 0.775 | 0.022 |
| 80% | 0.801 | 0.065 | 0.787 | 0.052 | 0.773 | 0.039 | 0.762 | 0.028 | 0.758 | 0.025 | 0.756 | 0.022 |
| 90% | 0.792 | 0.065 | 0.778 | 0.052 | 0.764 | 0.039 | 0.753 | 0.028 | 0.749 | 0.025 | 0.746 | 0.022 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.164 | 0.061 | 0.157 | 0.052 | 0.150 | 0.043 | 0.144 | 0.036 | 0.142 | 0.033 | 0.141 | 0.032 |
| 20% | 0.157 | 0.061 | 0.150 | 0.052 | 0.142 | 0.043 | 0.137 | 0.036 | 0.135 | 0.033 | 0.134 | 0.032 |
| 40% | 0.149 | 0.061 | 0.142 | 0.052 | 0.135 | 0.043 | 0.130 | 0.036 | 0.128 | 0.033 | 0.126 | 0.032 |
| 60% | 0.142 | 0.061 | 0.135 | 0.052 | 0.128 | 0.043 | 0.122 | 0.036 | 0.120 | 0.033 | 0.119 | 0.032 |
| 80% | 0.135 | 0.061 | 0.128 | 0.052 | 0.120 | 0.043 | 0.115 | 0.036 | 0.113 | 0.033 | 0.112 | 0.032 |
| 90% | 0.131 | 0.061 | 0.124 | 0.052 | 0.117 | 0.043 | 0.111 | 0.036 | 0.109 | 0.033 | 0.108 | 0.032 |

Gray boxes indicate exceedance of PRG
 90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

TABLE C-4d
Concentrations at BBSW-01A with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.800 | 0.049 | 0.789 | 0.039 | 0.779 | 0.029 | 0.771 | 0.021 | 0.768 | 0.018 | 0.766 | 0.017 |
| 20% | 0.786 | 0.049 | 0.775 | 0.039 | 0.765 | 0.029 | 0.757 | 0.021 | 0.754 | 0.018 | 0.752 | 0.017 |
| 40% | 0.771 | 0.049 | 0.761 | 0.039 | 0.750 | 0.029 | 0.742 | 0.021 | 0.739 | 0.018 | 0.738 | 0.017 |
| 60% | 0.757 | 0.049 | 0.747 | 0.039 | 0.736 | 0.029 | 0.728 | 0.021 | 0.725 | 0.018 | 0.723 | 0.017 |
| 80% | 0.743 | 0.049 | 0.732 | 0.039 | 0.722 | 0.029 | 0.714 | 0.021 | 0.711 | 0.018 | 0.709 | 0.017 |
| 90% | 0.736 | 0.049 | 0.725 | 0.039 | 0.715 | 0.029 | 0.707 | 0.021 | 0.704 | 0.018 | 0.702 | 0.017 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.150 | 0.053 | 0.144 | 0.045 | 0.138 | 0.037 | 0.133 | 0.031 | 0.131 | 0.029 | 0.130 | 0.028 |
| 20% | 0.144 | 0.053 | 0.137 | 0.045 | 0.131 | 0.037 | 0.126 | 0.031 | 0.125 | 0.029 | 0.124 | 0.028 |
| 40% | 0.137 | 0.053 | 0.131 | 0.045 | 0.125 | 0.037 | 0.120 | 0.031 | 0.118 | 0.029 | 0.117 | 0.028 |
| 60% | 0.131 | 0.053 | 0.125 | 0.045 | 0.118 | 0.037 | 0.114 | 0.031 | 0.112 | 0.029 | 0.111 | 0.028 |
| 80% | 0.124 | 0.053 | 0.118 | 0.045 | 0.112 | 0.037 | 0.107 | 0.031 | 0.106 | 0.029 | 0.104 | 0.028 |
| 90% | 0.121 | 0.053 | 0.115 | 0.045 | 0.109 | 0.037 | 0.104 | 0.031 | 0.102 | 0.029 | 0.101 | 0.028 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4e
Concentrations at PASW-09 with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.065 | 0.006 | 0.064 | 0.005 | 0.063 | 0.005 | 0.063 | 0.004 | 0.063 | 0.004 | 0.062 | 0.004 |
| 20% | 0.064 | 0.006 | 0.063 | 0.005 | 0.062 | 0.005 | 0.062 | 0.004 | 0.061 | 0.004 | 0.061 | 0.004 |
| 40% | 0.063 | 0.006 | 0.062 | 0.005 | 0.061 | 0.005 | 0.060 | 0.004 | 0.060 | 0.004 | 0.060 | 0.004 |
| 60% | 0.062 | 0.006 | 0.061 | 0.005 | 0.060 | 0.005 | 0.059 | 0.004 | 0.059 | 0.004 | 0.059 | 0.004 |
| 80% | 0.061 | 0.006 | 0.060 | 0.005 | 0.059 | 0.005 | 0.058 | 0.004 | 0.058 | 0.004 | 0.058 | 0.004 |
| 90% | 0.060 | 0.006 | 0.059 | 0.005 | 0.058 | 0.005 | 0.058 | 0.004 | 0.057 | 0.004 | 0.057 | 0.004 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.040 | 0.014 | 0.039 | 0.012 | 0.037 | 0.010 | 0.036 | 0.008 | 0.035 | 0.008 | 0.035 | 0.007 |
| 20% | 0.039 | 0.014 | 0.037 | 0.012 | 0.035 | 0.010 | 0.034 | 0.008 | 0.034 | 0.008 | 0.033 | 0.007 |
| 40% | 0.037 | 0.014 | 0.035 | 0.012 | 0.034 | 0.010 | 0.032 | 0.008 | 0.032 | 0.008 | 0.032 | 0.007 |
| 60% | 0.035 | 0.014 | 0.033 | 0.012 | 0.032 | 0.010 | 0.031 | 0.008 | 0.030 | 0.008 | 0.030 | 0.007 |
| 80% | 0.033 | 0.014 | 0.032 | 0.012 | 0.030 | 0.010 | 0.029 | 0.008 | 0.028 | 0.008 | 0.028 | 0.007 |
| 90% | 0.033 | 0.014 | 0.031 | 0.012 | 0.029 | 0.010 | 0.028 | 0.008 | 0.028 | 0.008 | 0.027 | 0.007 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4f

Concentrations at PASW-05 with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird \ BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.045 | 0.005 | 0.044 | 0.005 | 0.043 | 0.004 | 0.043 | 0.004 | 0.043 | 0.003 | 0.043 | 0.003 |
| 20% | 0.044 | 0.005 | 0.043 | 0.005 | 0.043 | 0.004 | 0.042 | 0.004 | 0.042 | 0.003 | 0.042 | 0.003 |
| 40% | 0.043 | 0.005 | 0.042 | 0.005 | 0.042 | 0.004 | 0.041 | 0.004 | 0.041 | 0.003 | 0.041 | 0.003 |
| 60% | 0.042 | 0.005 | 0.042 | 0.005 | 0.041 | 0.004 | 0.041 | 0.004 | 0.040 | 0.003 | 0.040 | 0.003 |
| 80% | 0.041 | 0.005 | 0.041 | 0.005 | 0.040 | 0.004 | 0.040 | 0.004 | 0.040 | 0.003 | 0.039 | 0.003 |
| 90% | 0.041 | 0.005 | 0.040 | 0.005 | 0.040 | 0.004 | 0.039 | 0.004 | 0.039 | 0.003 | 0.039 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.012 | 0.004 | 0.011 | 0.003 | 0.011 | 0.003 | 0.011 | 0.002 | 0.010 | 0.002 |
| 20% | 0.012 | 0.004 | 0.011 | 0.004 | 0.011 | 0.003 | 0.010 | 0.003 | 0.010 | 0.002 | 0.010 | 0.002 |
| 40% | 0.011 | 0.004 | 0.011 | 0.004 | 0.010 | 0.003 | 0.010 | 0.003 | 0.010 | 0.002 | 0.009 | 0.002 |
| 60% | 0.011 | 0.004 | 0.010 | 0.004 | 0.010 | 0.003 | 0.009 | 0.003 | 0.009 | 0.002 | 0.009 | 0.002 |
| 80% | 0.010 | 0.004 | 0.010 | 0.004 | 0.009 | 0.003 | 0.009 | 0.003 | 0.009 | 0.002 | 0.008 | 0.002 |
| 90% | 0.010 | 0.004 | 0.009 | 0.004 | 0.009 | 0.003 | 0.008 | 0.003 | 0.008 | 0.002 | 0.008 | 0.002 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-4g
Concentrations at PASW-04 with Reductions at BBSW-07 (Meadow Creek) and/or Upper Blackbird Creek

| Upper Blackbird \ BBSW-07 (Meadow Creek) | 0% | | 25% | | 50% | | 69% | | 76% | | 80% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.037 | 0.005 | 0.037 | 0.004 | 0.036 | 0.004 | 0.036 | 0.003 | 0.036 | 0.003 | 0.036 | 0.003 |
| 20% | 0.037 | 0.005 | 0.036 | 0.004 | 0.036 | 0.004 | 0.035 | 0.003 | 0.035 | 0.003 | 0.035 | 0.003 |
| 40% | 0.036 | 0.005 | 0.036 | 0.004 | 0.035 | 0.004 | 0.035 | 0.003 | 0.035 | 0.003 | 0.035 | 0.003 |
| 60% | 0.036 | 0.005 | 0.036 | 0.004 | 0.035 | 0.004 | 0.035 | 0.003 | 0.035 | 0.003 | 0.035 | 0.003 |
| 80% | 0.035 | 0.005 | 0.035 | 0.004 | 0.034 | 0.004 | 0.034 | 0.003 | 0.034 | 0.003 | 0.034 | 0.003 |
| 90% | 0.035 | 0.005 | 0.034 | 0.004 | 0.034 | 0.004 | 0.034 | 0.003 | 0.033 | 0.003 | 0.033 | 0.003 |
| 90% | 0.034 | 0.005 | 0.034 | 0.004 | 0.034 | 0.004 | 0.033 | 0.003 | 0.033 | 0.003 | 0.033 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.012 | 0.003 | 0.011 | 0.003 | 0.011 | 0.002 | 0.011 | 0.002 | 0.011 | 0.002 |
| 20% | 0.012 | 0.004 | 0.011 | 0.003 | 0.011 | 0.003 | 0.011 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 |
| 40% | 0.011 | 0.004 | 0.011 | 0.003 | 0.010 | 0.003 | 0.010 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 |
| 60% | 0.011 | 0.004 | 0.010 | 0.003 | 0.010 | 0.003 | 0.010 | 0.002 | 0.010 | 0.002 | 0.010 | 0.002 |
| 80% | 0.010 | 0.004 | 0.010 | 0.003 | 0.010 | 0.003 | 0.009 | 0.002 | 0.009 | 0.002 | 0.009 | 0.002 |
| 90% | 0.010 | 0.004 | 0.010 | 0.003 | 0.009 | 0.003 | 0.009 | 0.002 | 0.009 | 0.002 | 0.009 | 0.002 |

Gray boxes indicate exceedance of PRG
 90% reduction of Meadow Creek Load = 69% reduction at BBSW-07

TABLE C-5a
Concentrations in Blackbird Creek with Reductions from West Fork Tailings Impoundment Only

| | Date and Time | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | | |
| BBSW-02 | 9/20/00 5:05 PM | 0.878 | 0.044 | 0.733 | 0.042 | 0.588 | 0.039 | 0.443 | 0.037 | 0.297 | 0.035 | 0.225 | 0.033 |
| BBSW-01A | 9/20/00 5:20 PM | 0.800 | 0.033 | 0.692 | 0.031 | 0.584 | 0.029 | 0.476 | 0.028 | 0.368 | 0.026 | 0.313 | 0.025 |
| PASW-09 | 9/20/01 7:20 PM | 0.065 | 0.005 | 0.056 | 0.005 | 0.048 | 0.005 | 0.039 | 0.004 | 0.030 | 0.004 | 0.026 | 0.004 |
| PASW-05 | 9/20/01 7:20 AM | 0.045 | 0.004 | 0.038 | 0.004 | 0.032 | 0.004 | 0.026 | 0.004 | 0.020 | 0.004 | 0.017 | 0.004 |
| PASW-04 | 9/20/00 8:00 AM | 0.037 | 0.004 | 0.033 | 0.004 | 0.028 | 0.004 | 0.023 | 0.004 | 0.019 | 0.004 | 0.016 | 0.004 |
| Spring 2001 | | | | | | | | | | | | | |
| BBSW-02 | not sampled | 0.164 | 0.060 | 0.144 | 0.055 | 0.124 | 0.050 | 0.105 | 0.045 | 0.085 | 0.040 | 0.075 | 0.038 |
| BBSW-01A | 5/2/01 5:45 PM | 0.150 | 0.052 | 0.133 | 0.048 | 0.116 | 0.044 | 0.098 | 0.039 | 0.081 | 0.035 | 0.073 | 0.033 |
| PASW-09 | 5/2/01 6:30 PM | 0.040 | 0.014 | 0.036 | 0.013 | 0.031 | 0.012 | 0.026 | 0.011 | 0.022 | 0.009 | 0.020 | 0.009 |
| PASW-05 | 5/17/01 8:20 PM | 0.012 | 0.004 | 0.011 | 0.004 | 0.009 | 0.004 | 0.008 | 0.003 | 0.007 | 0.003 | 0.006 | 0.003 |
| PASW-04 | 5/17/01 9:30 PM | 0.012 | 0.004 | 0.011 | 0.003 | 0.010 | 0.003 | 0.009 | 0.003 | 0.008 | 0.002 | 0.007 | 0.002 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-5b
Concentrations at BBSW-02 with Reductions Above West Fork and/or West Fork Tailings Impoundment

| Above West Fork Tailings Impoundment | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.878 | 0.065 | 0.848 | 0.055 | 0.817 | 0.044 | 0.787 | 0.033 | 0.756 | 0.022 | 0.741 | 0.017 |
| 20% | 0.733 | 0.063 | 0.702 | 0.052 | 0.672 | 0.042 | 0.642 | 0.031 | 0.611 | 0.020 | 0.596 | 0.015 |
| 40% | 0.588 | 0.061 | 0.557 | 0.050 | 0.527 | 0.039 | 0.496 | 0.028 | 0.466 | 0.018 | 0.451 | 0.012 |
| 60% | 0.443 | 0.058 | 0.412 | 0.047 | 0.382 | 0.037 | 0.351 | 0.026 | 0.321 | 0.015 | 0.306 | 0.010 |
| 80% | 0.297 | 0.056 | 0.267 | 0.045 | 0.237 | 0.034 | 0.206 | 0.024 | 0.176 | 0.013 | 0.160 | 0.008 |
| 90% | 0.225 | 0.055 | 0.194 | 0.044 | 0.164 | 0.033 | 0.134 | 0.023 | 0.103 | 0.012 | 0.088 | 0.007 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.164 | 0.061 | 0.151 | 0.054 | 0.138 | 0.047 | 0.125 | 0.039 | 0.112 | 0.032 | 0.105 | 0.028 |
| 20% | 0.144 | 0.056 | 0.131 | 0.049 | 0.118 | 0.042 | 0.105 | 0.034 | 0.092 | 0.027 | 0.086 | 0.023 |
| 40% | 0.124 | 0.051 | 0.111 | 0.044 | 0.098 | 0.037 | 0.085 | 0.029 | 0.072 | 0.022 | 0.066 | 0.018 |
| 60% | 0.105 | 0.046 | 0.092 | 0.039 | 0.079 | 0.032 | 0.066 | 0.025 | 0.053 | 0.017 | 0.046 | 0.014 |
| 80% | 0.085 | 0.042 | 0.072 | 0.034 | 0.059 | 0.027 | 0.046 | 0.020 | 0.033 | 0.012 | 0.026 | 0.009 |
| 90% | 0.075 | 0.039 | 0.062 | 0.032 | 0.049 | 0.024 | 0.036 | 0.017 | 0.023 | 0.010 | 0.016 | 0.006 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-5c
Concentrations at BBSW-01A with Reductions Above West Fork and/or West Fork Tailings Impoundment

| Above West Fork Tailings Impoundment | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.800 | 0.049 | 0.777 | 0.041 | 0.755 | 0.033 | 0.732 | 0.025 | 0.709 | 0.017 | 0.698 | 0.013 |
| 20% | 0.692 | 0.047 | 0.669 | 0.039 | 0.646 | 0.031 | 0.624 | 0.023 | 0.601 | 0.015 | 0.590 | 0.011 |
| 40% | 0.584 | 0.045 | 0.561 | 0.037 | 0.538 | 0.029 | 0.516 | 0.021 | 0.493 | 0.013 | 0.482 | 0.009 |
| 60% | 0.476 | 0.043 | 0.453 | 0.035 | 0.430 | 0.027 | 0.408 | 0.019 | 0.385 | 0.011 | 0.374 | 0.007 |
| 80% | 0.368 | 0.042 | 0.345 | 0.034 | 0.322 | 0.026 | 0.299 | 0.018 | 0.277 | 0.010 | 0.265 | 0.006 |
| 90% | 0.313 | 0.041 | 0.291 | 0.033 | 0.268 | 0.025 | 0.245 | 0.017 | 0.223 | 0.009 | 0.211 | 0.005 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.150 | 0.053 | 0.139 | 0.047 | 0.127 | 0.041 | 0.116 | 0.034 | 0.105 | 0.028 | 0.099 | 0.025 |
| 20% | 0.133 | 0.049 | 0.121 | 0.043 | 0.110 | 0.036 | 0.099 | 0.030 | 0.087 | 0.024 | 0.082 | 0.020 |
| 40% | 0.116 | 0.045 | 0.104 | 0.038 | 0.093 | 0.032 | 0.081 | 0.026 | 0.070 | 0.019 | 0.064 | 0.016 |
| 60% | 0.098 | 0.040 | 0.087 | 0.034 | 0.076 | 0.028 | 0.064 | 0.021 | 0.053 | 0.015 | 0.047 | 0.012 |
| 80% | 0.081 | 0.036 | 0.070 | 0.030 | 0.058 | 0.023 | 0.047 | 0.017 | 0.036 | 0.011 | 0.030 | 0.007 |
| 90% | 0.073 | 0.034 | 0.061 | 0.028 | 0.050 | 0.021 | 0.038 | 0.015 | 0.027 | 0.009 | 0.021 | 0.005 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-5d
Concentrations at PASW-09 with Reductions Above West Fork and/or West Fork Tailings Impoundment

| Above West Fork Tailings Impoundment | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.065 | 0.006 | 0.063 | 0.005 | 0.061 | 0.005 | 0.060 | 0.004 | 0.058 | 0.004 | 0.057 | 0.003 |
| 20% | 0.056 | 0.006 | 0.055 | 0.005 | 0.053 | 0.005 | 0.051 | 0.004 | 0.049 | 0.003 | 0.048 | 0.003 |
| 40% | 0.048 | 0.006 | 0.046 | 0.005 | 0.044 | 0.005 | 0.042 | 0.004 | 0.040 | 0.003 | 0.039 | 0.003 |
| 60% | 0.039 | 0.006 | 0.037 | 0.005 | 0.035 | 0.004 | 0.033 | 0.004 | 0.031 | 0.003 | 0.030 | 0.003 |
| 80% | 0.030 | 0.006 | 0.028 | 0.005 | 0.026 | 0.004 | 0.024 | 0.004 | 0.023 | 0.003 | 0.022 | 0.003 |
| 90% | 0.026 | 0.006 | 0.024 | 0.005 | 0.022 | 0.004 | 0.020 | 0.004 | 0.018 | 0.003 | 0.017 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.040 | 0.014 | 0.037 | 0.013 | 0.034 | 0.011 | 0.031 | 0.009 | 0.028 | 0.007 | 0.027 | 0.007 |
| 20% | 0.036 | 0.013 | 0.033 | 0.011 | 0.030 | 0.010 | 0.027 | 0.008 | 0.023 | 0.006 | 0.022 | 0.005 |
| 40% | 0.031 | 0.012 | 0.028 | 0.010 | 0.025 | 0.009 | 0.022 | 0.007 | 0.019 | 0.005 | 0.017 | 0.004 |
| 60% | 0.026 | 0.011 | 0.023 | 0.009 | 0.020 | 0.007 | 0.017 | 0.006 | 0.014 | 0.004 | 0.013 | 0.003 |
| 80% | 0.022 | 0.010 | 0.019 | 0.008 | 0.016 | 0.006 | 0.013 | 0.005 | 0.010 | 0.003 | 0.008 | 0.002 |
| 90% | 0.019 | 0.009 | 0.016 | 0.007 | 0.013 | 0.006 | 0.010 | 0.004 | 0.007 | 0.002 | 0.006 | 0.001 |

Gray boxes are above the PRG

TABLE C-5e
Concentrations at PASW-05 with Reductions Above West Fork and/or West Fork Tailings Impoundment

| Above West Fork West Fork | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.045 | 0.005 | 0.043 | 0.005 | 0.042 | 0.004 | 0.041 | 0.004 | 0.039 | 0.003 | 0.039 | 0.003 |
| 20% | 0.038 | 0.005 | 0.037 | 0.005 | 0.036 | 0.004 | 0.035 | 0.004 | 0.033 | 0.003 | 0.033 | 0.003 |
| 40% | 0.032 | 0.005 | 0.031 | 0.005 | 0.030 | 0.004 | 0.029 | 0.004 | 0.027 | 0.003 | 0.027 | 0.003 |
| 60% | 0.026 | 0.005 | 0.025 | 0.004 | 0.024 | 0.004 | 0.023 | 0.004 | 0.021 | 0.003 | 0.021 | 0.003 |
| 80% | 0.020 | 0.005 | 0.019 | 0.004 | 0.018 | 0.004 | 0.017 | 0.003 | 0.015 | 0.003 | 0.015 | 0.003 |
| 90% | 0.017 | 0.005 | 0.016 | 0.004 | 0.015 | 0.004 | 0.014 | 0.003 | 0.012 | 0.003 | 0.012 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.011 | 0.004 | 0.010 | 0.003 | 0.009 | 0.003 | 0.008 | 0.002 | 0.008 | 0.002 |
| 20% | 0.011 | 0.004 | 0.010 | 0.004 | 0.009 | 0.003 | 0.008 | 0.003 | 0.007 | 0.002 | 0.007 | 0.002 |
| 40% | 0.009 | 0.004 | 0.008 | 0.003 | 0.007 | 0.003 | 0.007 | 0.002 | 0.006 | 0.002 | 0.005 | 0.001 |
| 60% | 0.008 | 0.003 | 0.007 | 0.003 | 0.006 | 0.002 | 0.005 | 0.002 | 0.004 | 0.001 | 0.004 | 0.001 |
| 80% | 0.007 | 0.003 | 0.006 | 0.003 | 0.005 | 0.002 | 0.004 | 0.001 | 0.003 | 0.001 | 0.002 | 0.001 |
| 90% | 0.006 | 0.003 | 0.005 | 0.002 | 0.004 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-5f
Concentrations at PASW-04 with Reductions Above West Fork and/or West Fork Tailings Impoundment

| Above West Fork Tailings Impoundment | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.037 | 0.005 | 0.036 | 0.004 | 0.035 | 0.004 | 0.034 | 0.004 | 0.033 | 0.003 | 0.033 | 0.003 |
| 20% | 0.033 | 0.005 | 0.032 | 0.004 | 0.031 | 0.004 | 0.030 | 0.004 | 0.029 | 0.003 | 0.028 | 0.003 |
| 40% | 0.028 | 0.004 | 0.027 | 0.004 | 0.026 | 0.004 | 0.025 | 0.003 | 0.024 | 0.003 | 0.024 | 0.003 |
| 60% | 0.023 | 0.004 | 0.022 | 0.004 | 0.021 | 0.004 | 0.020 | 0.003 | 0.019 | 0.003 | 0.019 | 0.003 |
| 80% | 0.019 | 0.004 | 0.018 | 0.004 | 0.017 | 0.004 | 0.016 | 0.003 | 0.015 | 0.003 | 0.014 | 0.003 |
| 90% | 0.016 | 0.004 | 0.015 | 0.004 | 0.014 | 0.004 | 0.014 | 0.003 | 0.013 | 0.003 | 0.012 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.011 | 0.003 | 0.011 | 0.003 | 0.010 | 0.002 | 0.009 | 0.002 | 0.009 | 0.002 |
| 20% | 0.011 | 0.003 | 0.010 | 0.003 | 0.010 | 0.002 | 0.009 | 0.002 | 0.008 | 0.002 | 0.008 | 0.001 |
| 40% | 0.010 | 0.003 | 0.009 | 0.003 | 0.008 | 0.002 | 0.008 | 0.002 | 0.007 | 0.001 | 0.007 | 0.001 |
| 60% | 0.009 | 0.003 | 0.008 | 0.002 | 0.007 | 0.002 | 0.007 | 0.001 | 0.006 | 0.001 | 0.005 | 0.001 |
| 80% | 0.008 | 0.002 | 0.007 | 0.002 | 0.006 | 0.002 | 0.005 | 0.001 | 0.005 | 0.001 | 0.004 | 0.001 |
| 90% | 0.007 | 0.002 | 0.006 | 0.002 | 0.006 | 0.001 | 0.005 | 0.001 | 0.004 | 0.001 | 0.004 | 0.000 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-6a
Concentrations in Blackbird Creek with Reductions in Lower Blackbird Creek Only

| | Date and Time | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | | |
| BBSW-01A | 9/20/00 5:20 PM | 0.800 | 0.033 | 0.771 | 0.033 | 0.741 | 0.033 | 0.712 | 0.033 | 0.683 | 0.033 | 0.669 | 0.033 |
| PASW-09 | 9/20/01 7:20 PM | 0.065 | 0.005 | 0.063 | 0.005 | 0.060 | 0.005 | 0.058 | 0.005 | 0.056 | 0.005 | 0.054 | 0.005 |
| PASW-05 | 9/20/01 7:20 AM | 0.045 | 0.004 | 0.043 | 0.004 | 0.041 | 0.004 | 0.040 | 0.004 | 0.038 | 0.004 | 0.037 | 0.004 |
| PASW-04 | 9/20/00 8:00 AM | 0.037 | 0.004 | 0.036 | 0.004 | 0.035 | 0.004 | 0.033 | 0.004 | 0.032 | 0.004 | 0.032 | 0.004 |
| Spring 2001 | | | | | | | | | | | | | |
| BBSW-01A | 5/2/01 5:45 PM | 0.150 | 0.052 | 0.149 | 0.052 | 0.147 | 0.052 | 0.146 | 0.052 | 0.144 | 0.052 | 0.144 | 0.052 |
| PASW-09 | 5/2/01 6:30 PM | 0.040 | 0.014 | 0.040 | 0.014 | 0.040 | 0.014 | 0.039 | 0.014 | 0.039 | 0.014 | 0.039 | 0.014 |
| PASW-05 | 5/17/01 8:20 PM | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 |
| PASW-04 | 5/17/01 9:30 PM | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 | 0.012 | 0.004 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-6b
Concentrations at BBSW-01A with Reductions Above Lower Blackbird Creek and/or Lower Blackbird Creek

| Above Lower BB Lower BB | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.800 | 0.049 | 0.669 | 0.039 | 0.538 | 0.029 | 0.408 | 0.019 | 0.277 | 0.010 | 0.211 | 0.005 |
| 20% | 0.771 | 0.049 | 0.640 | 0.039 | 0.509 | 0.029 | 0.378 | 0.019 | 0.248 | 0.010 | 0.182 | 0.005 |
| 40% | 0.742 | 0.049 | 0.611 | 0.039 | 0.480 | 0.029 | 0.349 | 0.019 | 0.218 | 0.010 | 0.153 | 0.005 |
| 60% | 0.712 | 0.049 | 0.582 | 0.039 | 0.451 | 0.029 | 0.320 | 0.019 | 0.189 | 0.010 | 0.124 | 0.005 |
| 80% | 0.683 | 0.049 | 0.552 | 0.039 | 0.422 | 0.029 | 0.291 | 0.019 | 0.160 | 0.010 | 0.095 | 0.005 |
| 90% | 0.669 | 0.049 | 0.538 | 0.039 | 0.407 | 0.029 | 0.276 | 0.019 | 0.145 | 0.010 | 0.080 | 0.005 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.150 | 0.053 | 0.121 | 0.043 | 0.093 | 0.032 | 0.064 | 0.021 | 0.036 | 0.011 | 0.021 | 0.005 |
| 20% | 0.149 | 0.053 | 0.120 | 0.043 | 0.091 | 0.032 | 0.063 | 0.021 | 0.034 | 0.011 | 0.020 | 0.005 |
| 40% | 0.147 | 0.053 | 0.119 | 0.043 | 0.090 | 0.032 | 0.061 | 0.021 | 0.033 | 0.011 | 0.019 | 0.005 |
| 60% | 0.146 | 0.053 | 0.117 | 0.043 | 0.089 | 0.032 | 0.060 | 0.021 | 0.031 | 0.011 | 0.017 | 0.005 |
| 80% | 0.144 | 0.053 | 0.116 | 0.043 | 0.087 | 0.032 | 0.059 | 0.021 | 0.030 | 0.011 | 0.016 | 0.005 |
| 90% | 0.144 | 0.053 | 0.115 | 0.043 | 0.086 | 0.032 | 0.058 | 0.021 | 0.029 | 0.011 | 0.015 | 0.005 |

Gray boxes are above the PRG

TABLE C-6c
Concentrations at PASW-09 with Reductions Above Lower Blackbird Creek and/or Lower Blackbird Creek

| Above Lower BB Lower BB | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.065 | 0.006 | 0.055 | 0.005 | 0.044 | 0.005 | 0.033 | 0.004 | 0.023 | 0.003 | 0.017 | 0.003 |
| 20% | 0.063 | 0.006 | 0.052 | 0.005 | 0.041 | 0.005 | 0.031 | 0.004 | 0.020 | 0.003 | 0.015 | 0.003 |
| 40% | 0.060 | 0.006 | 0.050 | 0.005 | 0.039 | 0.005 | 0.028 | 0.004 | 0.018 | 0.003 | 0.012 | 0.003 |
| 60% | 0.058 | 0.006 | 0.047 | 0.005 | 0.037 | 0.005 | 0.026 | 0.004 | 0.015 | 0.003 | 0.010 | 0.003 |
| 80% | 0.056 | 0.006 | 0.045 | 0.005 | 0.034 | 0.005 | 0.024 | 0.004 | 0.013 | 0.003 | 0.008 | 0.003 |
| 90% | 0.054 | 0.006 | 0.044 | 0.005 | 0.033 | 0.005 | 0.023 | 0.004 | 0.012 | 0.003 | 0.007 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.040 | 0.014 | 0.033 | 0.011 | 0.025 | 0.009 | 0.017 | 0.006 | 0.010 | 0.003 | 0.006 | 0.001 |
| 20% | 0.040 | 0.014 | 0.032 | 0.011 | 0.025 | 0.009 | 0.017 | 0.006 | 0.009 | 0.003 | 0.005 | 0.001 |
| 40% | 0.040 | 0.014 | 0.032 | 0.011 | 0.024 | 0.009 | 0.017 | 0.006 | 0.009 | 0.003 | 0.005 | 0.001 |
| 60% | 0.039 | 0.014 | 0.031 | 0.011 | 0.024 | 0.009 | 0.016 | 0.006 | 0.008 | 0.003 | 0.005 | 0.001 |
| 80% | 0.039 | 0.014 | 0.031 | 0.011 | 0.023 | 0.009 | 0.016 | 0.006 | 0.008 | 0.003 | 0.004 | 0.001 |
| 90% | 0.039 | 0.014 | 0.031 | 0.011 | 0.023 | 0.009 | 0.016 | 0.006 | 0.008 | 0.003 | 0.004 | 0.001 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-6d
Concentrations at PASW-05 with Reductions Above Lower Blackbird Creek and/or Lower Blackbird Creek

| Above Lower BB Lower BB | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.045 | 0.005 | 0.037 | 0.005 | 0.030 | 0.004 | 0.023 | 0.004 | 0.015 | 0.003 | 0.012 | 0.003 |
| 20% | 0.043 | 0.005 | 0.036 | 0.005 | 0.028 | 0.004 | 0.021 | 0.004 | 0.014 | 0.003 | 0.010 | 0.003 |
| 40% | 0.041 | 0.005 | 0.034 | 0.005 | 0.027 | 0.004 | 0.019 | 0.004 | 0.012 | 0.003 | 0.009 | 0.003 |
| 60% | 0.040 | 0.005 | 0.032 | 0.005 | 0.025 | 0.004 | 0.018 | 0.004 | 0.011 | 0.003 | 0.007 | 0.003 |
| 80% | 0.038 | 0.005 | 0.031 | 0.005 | 0.023 | 0.004 | 0.016 | 0.004 | 0.009 | 0.003 | 0.005 | 0.003 |
| 90% | 0.037 | 0.005 | 0.030 | 0.005 | 0.023 | 0.004 | 0.015 | 0.004 | 0.008 | 0.003 | 0.004 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.010 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 |
| 20% | 0.012 | 0.004 | 0.010 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 |
| 40% | 0.012 | 0.004 | 0.010 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 |
| 60% | 0.012 | 0.004 | 0.009 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 |
| 80% | 0.012 | 0.004 | 0.009 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |
| 90% | 0.012 | 0.004 | 0.009 | 0.004 | 0.007 | 0.003 | 0.005 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-6e
Concentrations at PASW-04 with Reductions Above Lower Blackbird Creek and/or Lower Blackbird Creek

| Above Lower BB Lower BB | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | |
| 0% | 0.037 | 0.005 | 0.032 | 0.004 | 0.026 | 0.004 | 0.020 | 0.003 | 0.015 | 0.003 | 0.012 | 0.003 |
| 20% | 0.036 | 0.005 | 0.030 | 0.004 | 0.025 | 0.004 | 0.019 | 0.003 | 0.014 | 0.003 | 0.011 | 0.003 |
| 40% | 0.035 | 0.005 | 0.029 | 0.004 | 0.024 | 0.004 | 0.018 | 0.003 | 0.012 | 0.003 | 0.010 | 0.003 |
| 60% | 0.033 | 0.005 | 0.028 | 0.004 | 0.022 | 0.004 | 0.017 | 0.003 | 0.011 | 0.003 | 0.008 | 0.003 |
| 80% | 0.032 | 0.005 | 0.027 | 0.004 | 0.021 | 0.004 | 0.015 | 0.003 | 0.010 | 0.003 | 0.007 | 0.003 |
| 90% | 0.032 | 0.005 | 0.026 | 0.004 | 0.020 | 0.004 | 0.015 | 0.003 | 0.009 | 0.003 | 0.006 | 0.003 |
| Spring 2001 | | | | | | | | | | | | |
| 0% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.007 | 0.001 | 0.005 | 0.001 | 0.004 | 0.000 |
| 20% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.006 | 0.001 | 0.005 | 0.001 | 0.004 | 0.000 |
| 40% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.006 | 0.001 | 0.004 | 0.001 | 0.004 | 0.000 |
| 60% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.006 | 0.001 | 0.004 | 0.001 | 0.003 | 0.000 |
| 80% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.006 | 0.001 | 0.004 | 0.001 | 0.003 | 0.000 |
| 90% | 0.012 | 0.004 | 0.010 | 0.003 | 0.008 | 0.002 | 0.006 | 0.001 | 0.004 | 0.001 | 0.003 | 0.000 |

Gray boxes indicate exceedance of PRG

Shading was based on PRGs shown in Table C-1

Reductions in concentrations based on Fall 2000 and Spring 2001 sampling

TABLE C-7
Load Difference for Selected Stations in the Bucktail Creek Region

| Stations | | Cobalt Load Difference (kg/day) | Copper Load Difference (kg/day) |
|---------------------------|-------------|---------------------------------------|---------------------------------------|
| BTSW-01 to SFSW-02 | Fall 2000 | -0.265 | -0.003 |
| | Spring 2001 | -0.529 | -0.749 |
| SFSW-02 to SFSW-01 | Fall 2000 | -0.011 | 0.112 |
| | Spring 2001 | -0.201 | -0.170 |
| SFSW-01 to BDSW-03 | Fall 2000 | 0.035 | 0.074 |
| | Spring 2001 | 0.303 | 0.865 |
| BDSW-03 to PASW-04 | Fall 2000 | 2.962 | 0.052 |
| | Spring 2001 | 7.082 | 1.077 |

TABLE C-8
Concentrations in Bucktail Creek Region with Reductions in Bucktail Creek

| | Date and Time | 0% | | 20% | | 40% | | 60% | | 80% | | 90% | |
|--------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Cobalt | Copper |
| Fall 2000 | | | | | | | | | | | | | |
| BTSW-01 | 9/19/00 3:15 PM | 1.200 | 0.492 | 0.960 | 0.394 | 0.720 | 0.295 | 0.480 | 0.197 | 0.240 | 0.098 | 0.120 | 0.049 |
| SFSW-02 | 9/19/00 5:00 PM | 0.055 | 0.058 | 0.044 | 0.046 | 0.033 | 0.035 | 0.022 | 0.023 | 0.011 | 0.012 | 0.006 | 0.006 |
| SFSW-01 | 9/19/00 5:20 PM | 0.056 | 0.104 | 0.045 | 0.083 | 0.034 | 0.062 | 0.022 | 0.042 | 0.011 | 0.021 | 0.006 | 0.010 |
| BDSW-03 | 9/19/00 7:15 PM | 0.011 | 0.021 | 0.009 | 0.017 | 0.007 | 0.013 | 0.004 | 0.008 | 0.002 | 0.004 | 0.001 | 0.002 |
| PASW-04 | 9/20/00 8:00 AM | 0.023 | 0.003 | 0.018 | 0.002 | 0.014 | 0.002 | 0.009 | 0.001 | 0.005 | 0.001 | 0.002 | 0.000 |
| Spring 2001 | | | | | | | | | | | | | |
| BTSW-01 | 5/17/01 1:25 PM | 1.170 | 1.100 | 0.936 | 0.880 | 0.702 | 0.660 | 0.468 | 0.440 | 0.234 | 0.220 | 0.117 | 0.110 |
| SFSW-02 | 5/17/01 2:40 PM | 0.105 | 0.086 | 0.084 | 0.069 | 0.063 | 0.052 | 0.042 | 0.034 | 0.021 | 0.017 | 0.011 | 0.009 |
| SFSW-01 | 5/17/01 3:20 PM | 0.098 | 0.080 | 0.078 | 0.064 | 0.059 | 0.048 | 0.039 | 0.032 | 0.020 | 0.016 | 0.010 | 0.008 |
| BDSW-03 | 5/17/01 5:30 PM | 0.010 | 0.011 | 0.008 | 0.009 | 0.006 | 0.007 | 0.004 | 0.004 | 0.002 | 0.002 | 0.001 | 0.001 |
| PASW-04 | 5/17/01 9:30 PM | 0.008 | 0.003 | 0.006 | 0.002 | 0.005 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 |