# Fact Sheet

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**Proposed reissuance of a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants pursuant to the provisions of the Clean Water Act (CWA)**

## City and Borough of Juneau A-J Mine

### EPA Proposes To Reissue an NPDES Permit

EPA proposes to reissue an NPDES permit to the facility referenced above. The draft permit places conditions on the discharge of pollutants from the mine to waters of the United States. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged from the facility.

This Fact Sheet includes:

- information on public comment, public hearing, and appeal procedures
- a listing of proposed effluent limitations and other conditions for the facility
- a map and description of the discharge location
- technical material supporting the conditions in the permit

### Section 401 Certification

EPA is requesting that the Alaska Department of Environmental Conservation certify the NPDES permit for this facility, under Section 401 of the Clean Water Act (CWA). Comments regarding the certification should be directed to:

Alaska Department of Environmental Conservation
Industrial Wastewater Section
555 Cordova Street
Anchorage, AK 99501

## Public Comment

Persons wishing to comment on, or request a Public Hearing for the draft permit for this facility may do so in writing by the expiration date of the Public Comment period. A request for a Public Hearing must state the nature of the issues to be raised as well as the requester's name, address and telephone number. All comments and requests for Public Hearings must be in writing and should be submitted to EPA as described in the Public Comments Section of the attached Public Notice.

After the Public Notice expires, and all comments have been considered, EPA's regional Director for the Office of Water will make a final decision regarding permit issuance. If no substantive comments are received, the tentative conditions in the draft permit will become final, and the permit will become effective upon issuance. If comments are received, EPA will address the comments and issue the permit. The permit will become effective 30 days after the issuance date, unless an appeal is submitted to the Environmental Appeals Board within 30 days.

## Documents are Available for Review

The draft NPDES permit and related documents can be reviewed or obtained by visiting or contacting EPA's Regional Office in Seattle between 8:30 a.m. and 4:00 p.m., Monday through Friday at the address below. The draft permit, fact sheet, and other information can also be downloaded from the Region 10 website at "http://www.epa.gov/r10earth/water.htm."

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue, OW-130
Seattle, Washington 98101
(206) 553-6251 or
Toll Free 1-800-424-4372 (within Alaska, Idaho, Oregon and Washington)

The fact sheet and draft permits are also available at:

EPA Alaska Operations Office
Room 537 Federal Building
222 West 7th Avenue, #19,
Anchorage, Alaska 99513

and

EPA Alaska Operations Office
709 West 9th Street, Room 223
P.O. Box 20370
Juneau, Alaska, 99802-9998

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## Acronyms

| | |
|---|---|
| AAC | Alaska Administrative Code |
| ADEC | Alaska Department of Environmental Conservation |
| AML | Average Monthly Limit |
| BAT | Best Available Technology Economically Achievable |
| BCT | Best Conventional Pollutant Control Technology |
| BMP | Best Management Practices |
| BPJ | Best Professional Judgement |
| BPT | Best Practicable Control Technology Currently Available |
| $CaCO_3$ | Calcium Carbonate |
| CF | Conversion Factor |
| CFR | Code of Federal Regulations |
| CFS | Cubic feet per second |
| CT | Criteria Translator |
| CV | Coefficient of Variation |
| CWA | Clean Water Act |
| DMR | Discharge Monitoring Report |
| EFH | Essential Fish Habitat |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| GCDT | Gold Creek Drainage Tunnel (Outfall 001) |
| gpm | Gallons per minute |
| LTA | Long Term Average |
| MDL | Method Detection Limit |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| mgd | Million gallons per day |
| ml | milliliters |
| ML | Minimum Level |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | Nephelometric Turbidity Units |
| OW | EPA Office of Water |
| PQL | Practical Quantitation Limit |
| QAP | Quality Assurance Plan |
| RP | Reasonable Potential |
| RPM | Reasonable Potential Multiplier |
| RWC | Receiving Water Concentration |
| s.u. | Standard Units |
| TAH | Total Aromatic Hydrocarbons |
| TAqH | Total Aqueous Hydrocarbons |

| | |
|---|---|
| TBEL | Technology-Based Effluent Limit |
| TDS | Total Dissolved Solids |
| TR | Total Recoverable |
| TSD | Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001) |
| TSS | Total suspended solids |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | United States Geological Survey |
| WLA | Wasteload allocation |
| WQBEL | Water quality-based effluent limit |
| 1Q10 | 1 day, 10 year low flow |
| 7Q10 | 7 day, 10 year low flow |

# I. Applicant

This fact sheet provides information on the draft NPDES permit for the following entity:

City and Borough of Juneau Alaska-Juneau Mine
NPDES Permit # AK-004951-4

| Mailing Address: | Facility Address: |
|---|---|
| 155 South Seward Street | Last Chance Basin |
| Juneau, AK 99801 | Juneau, AK |

Contact:
Steve Gilbertson, Lands and Resources Manager
City and Borough of Juneau

# II. Facility Information

The City and Borough of Juneau Alaska-Juneau (A-J) mine is currently an inactive mine site. The only activities which will occur at the site during the coming five-year permit cycle are care and maintenance. The mine site has been closed and cleaned by Kvaerner Environmental. If the permittee wishes to perform other activities such as exploration, chip sampling, and milling, they must apply for and receive a modification to the NPDES permit. Table 1, below, describes the two permitted outfalls. A map showing the outfalls and sampling locations can be found in Appendix A.

**Table 1: Description of Outfalls**

| Outfall Number | Outfall Name | Average Flow | Description | Receiving Water |
|---|---|---|---|---|
| 001 | Gold Creek Drainage Tunnel (GCDT ) | <1-60 CFS | Historic mine workings intercept infiltration and runoff from precipitation and snow melt. Flow is discharged from tunnel portal. Discharge contains sediment from historic mine workings. | Gold Creek |
| 005 | “00” Adit | 0-0.045 CFS | Interception of shallow groundwater in historic mine workings. Discharge occurs only following precipitation events. | Gold Creek via Snowslide Gulch |

The discharges from the Gold Creek Drainage Tunnel (GCDT, Outfall 001) and the Double Zero (00) Adit (Outfall 005) are point source discharges to waters of the United States (Gold Creek). The water that discharges through the GCDT enters the mine through the glory holes, traverses the mine to the 4-level, then goes down the bean drops and into the GCDT which discharges to Gold Creek. A “bean drop” is a vertical, narrow shaft that allows mine water to flow from one mining level down to the one below. The GCDT was driven and completed in 1939 to facilitate effective drainage of the mine.

Table 2, on the following page, shows the average and maximum flow rate and concentrations of pollutants in the discharge from the GCDT since closure activities were completed in June of 2000. The maximum values for some pollutants are reported as being less than some value. The numeric values shown for these “non-detect” samples are the Reporting Limits (RLs) as stated by Analytica Alaska, the laboratory that the City and Borough of Juneau hired to analyze the water samples. If the RL for a given pollutant was less than the most stringent water quality criterion (with all metals expressed as total recoverable) the concentration was assumed to be one half of the RL for the purposes of reporting average values in this table, and for determining reasonable potential for the discharge to cause or contribute to a violation of Alaska’s water quality standards. If the RL was greater than the water quality criterion, the concentration was assumed to be equal to the RL. Table 2 also includes the effluent limits from the previous permit for comparative purposes. Since closure activities have concluded, the effluent from the GCDT has had relatively low levels of pollutants, and has never violated an effluent limit.

While the “00” Adit (Outfall 005) is a point source discharge to Gold Creek, it has not been sampled recently. This outfall is all but inaccessible and it is not possible to safely sample it. According to the 1998 BMP plan (Kvaerner, 1998), this discharge has existed since 1917 and has an established drainage channel, so there is minimal potential for erosion or water quality impacts. The water discharged from this outfall does not come into contact with the mine workings and flows only in response to precipitation events. Therefore, neither the previous permit nor the draft permit contains monitoring requirements or effluent limitations for this outfall. The draft permit requires Best Management Practices to reduce the potential for adverse water quality impacts from this outfall.

**Table 2: Levels of Pollutants in GCDT Discharge (Outfall 001) Since July 1, 2000**

| | Effluent Data | | Previous Effluent Limits | | Most Stringent Water Quality Criterion |
|---|---|---|---|---|---|
| **Parameter (units)** | **Average** | **Maximum** | **Average Monthly** | **Maximum Daily** | |
| Flow (mgd) | 3.9 | 8.4 | — | — | — |
| Aluminum (µg/L) | 4.15 | 7.9 | — | — | 87 |
| Arsenic (µg/L) | 0.83 | 1.22 | — | — | 50 |
| Cadmium (µg/L) | 0.15 | 0.26 | 50 | 100 | 0.19 |
| Copper (µg/L) | 0.18 | 0.286 | 150 | 300 | 6.26 |
| Iron (µg/L) | 7.5 | <15.00 | — | — | 1000 |
| Lead (µg/L) | 0.41 | 2.72 | 9.5 | 19.1 | 1.76 |
| Manganese (µg/L) | 0.23 | 0.34 | — | — | 200 |
| Mercury (µg/L) | 0.06 | <0.06 | 1 | 2 | 0.012 |
| Nickel (µg/L) | 6.15 | 11.10 | — | — | 35.2 |
| pH (standard units) | 6.5 - 8.5 | | 6.5 - 8.5 | | 6.5 - 8.5 |
| Selenium (µg/L) | 2.54 | 3.82 | — | — | 5 |
| Silver (µg/L) | 0.015 | <0.03 | — | — | 1.55 |
| Sulfate (mg/L) | 275 | 380 | — | 780 | 250 |
| Total Aromatic Hydrocarbons (µg/L) | 0.5 | <1 | — | 10 | 10 |
| Total Dissolved Solids (mg/L) | 500 | 660 | — | 1170 | 300 |
| Total Suspended Solids (mg/L) | 0.65 | <1.3 | 20 | 30 | — |
| Turbidity (NTU) | 0.43 | 2.4 | — | — | see section III.B. |
| Zinc (µg/L) | 45.1 | 115.0 | 171 | 241 | 80.7 |
| Metals measurements and criteria expressed in total recoverable. | | | | | |

## III. Receiving Water

The Gold Creek Drainage Tunnel (GCDT, Outfall 001) and the “00” Adit (Outfall 005) discharge to Gold Creek in the City and Borough of Juneau, Alaska.

### A. Low Flow Conditions

Daily streamflow data for Gold Creek were collected by the United States Geological Survey (USGS) at a station immediately downstream of Outfall 001 (Station #15049900) between 1984 and 1997. EPA's DFLOW computer program was used to calculate the lowest 1-day and 7-day average flows in Gold Creek expected to occur once every 10 years (the 1Q10 and 7Q10) from the USGS data. DFLOW calculated a 1Q10 of 4.31 CFS and a 7Q10 of 4.52 CFS.

### B. Water Quality Standards

Federal regulations at 40 CFR 122.4(d) require that NPDES permits ensure compliance with the water quality standards of all affected States. A States's water quality standards are composed of use classifications, numeric and/or narrative water quality criteria, and an anti-degradation policy. The use classification system designates the beneficial uses (such as aquatic life habitat, water supply, recreation, etc.) that each water body is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the State to support the beneficial use classification of each water body. The anti-degradation policy represents a three-tiered approach to maintain and protect various levels of water quality and uses.

In Alaska, all waterbodies are protected for all designated uses, unless the water body has been specifically reclassified in Title 18 Alaska Administrative Code (AAC), Chapter 70.230(e) or a site-specific criterion is in effect. If a waterbody has been reclassified such that it is not expected to attain a particular designated use, the criteria intended to support that designated use do not apply to that waterbody. The most stringent statewide criterion which is applicable to a given waterbody will control, unless a site specific criterion is listed for the waterway in 18 AAC 70.236(b). Gold Creek has not been reclassified, but it has been given a site specific criterion of 300 mg/L for total dissolved solids (TDS), which EPA approved on April 3, 1998. Therefore, the most stringent statewide criteria apply to Gold Creek, except for the site-specific TDS criterion.

The most stringent narrative water quality criteria applicable to Gold Creek are as follows. The designated uses associated with the criteria are in parentheses.

*Petroleum Hydrocarbons, Oils and Grease (aquaculture, aquatic life, drinking, culinary and food processing water supply)*

Total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 μg/l. Total aromatic hydrocarbons (TAH) in the water column may not exceed 10 μg/l. There may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration. May not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.

*Residues: floating solids, debris, sludge, deposits, foam, scum, or other residues (aquatic life)*

May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substances, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines; cause leaching of toxic or deleterious substances; or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.

*Turbidity (contact recreation)*

May not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 15 NTU.

Table 3, below, outlines the numeric water quality criteria for the pollutants monitored under the draft permit. This table summarizes the relevant water quality criteria from the *Alaska Water Quality Standards* (18 AAC 70, 2003) and the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Materials* (ADEC, 2003). The most stringent criterion for a given pollutant (and the basis for water quality-based effluent limits, if applicable) is shaded. Aquatic life criteria for hardness-dependent metals (cadmium, copper, lead, nickel and zinc) were calculated using a hardness value of 62.7 mg/L as $CaCO_3$. This was the $5^{th}$ percentile of the hardness values from samples collected at monitoring station GCB, located just downstream from outfall 001. Please see Appendix C an explanation of hardness-dependent criteria. Under Section 401 of the Clean Water Act, ADEC must certify that the conditions in the draft permit will be protective of these water quality criteria.

**Table 3: Numeric Water Quality Criteria for Gold Creek**

| Pollutant (units) | Aquatic Life | | Water Supply[1] | Water Recreation[2] | Human Health[3] |
|---|---|---|---|---|---|
| | Acute Criterion | Chronic Criterion | | | |
| Aluminum, TR (µg/L) | 750 | 87 | 5000 | — | — |
| Cadmium, Dissolved (µg/L) | 1.28 | 0.18 | 5 | — | — |
| Copper, Dissolved (µg/L) | 8.66 | 6.01 | 200 | — | 1300 |
| Lead, Dissolved (µg/L) | 38.73 | 1.51 | 50 | — | — |
| Mercury, TR[6] (µg/L) | 2.4 | 0.012 | 2 | — | 0.14 |
| Nickel, Dissolved (µg/L) | 315.6 | 35.05 | 100 | — | 610 |
| pH (standard units) | 6.5 to 8.5[4] | | Same as aquatic life | 6.5 to 8.5[5] | — |
| Selenium[6] (µg/L) | 20 | 5 | 10 | — | 170 |
| Sulfate (mg/L) | — | | 250 | — | — |
| Total Dissolved Solids (mg/L) | 300 (site-specific) | | Same as aquatic life | — | — |
| Zinc, Dissolved (µg/L) | 78.92 | 79.57 | — | — | 9100 |

1. The water supply criterion listed for a given pollutant is the most stringent criterion among the following water supply subclasses: (i) Drinking, culinary and food processing; (ii) Agriculture, including irrigation and stock watering; (iii) Aquaculture; (iv) Industrial
2. The water recreation criterion listed for a given pollutant is the more stringent criterion among the subclasses of contact recreation and secondary recreation.
3. The human health criterion listed for a given pollutant is the more stringent of the criteria for consumption of water or the consumption of water and organisms.
4. May not vary more than 0.5 pH units from natural conditions
5. May not add buffering capacity to the water if natural conditions are outside this range.
6. ADEC has adopted new criteria for selenium and mercury, but EPA has not approved the new criteria for Clean Water Act purposes. The criteria listed are the older, EPA-approved criteria.

# IV. Effluent Limitations

## A. Basis for Permit Effluent Limits

In general, there are two types of effluent limits that may appear in an NPDES permit: technology-based and water quality-based. Technology-based effluent limits (TBELs) are promulgated by EPA and represent the minimum level of effluent quality attainable through application of the best available technology economically achievable (BAT), the best conventional pollutant control technology (BCT) or the best practicable control technology currently available (BPT). All discharges were required to comply with BPT guidelines by July 1, 1977 and to comply with BAT and BCT guidelines by March 31, 1989. The Clean Water Act requires that effluent limits be the more stringent of either technology-based or water quality-based limits.[1]

Where effluent guidelines have not been promulgated by EPA, the Act and NPDES regulations at 40 CFR § 125.3 require the permit writer to establish technology-based effluent limits on a case-by-case basis using Best Professional Judgement (BPJ).

### *1. Technology-Based Effluent Limits*

On December 3, 1982, EPA promulgated effluent guidelines for the Ore Mining and Dressing Point Source Category in 40 CFR Part 440 (Subpart J). These guidelines establish BAT and BPT technology-based limitations for mine drainage discharges from mines operated to obtain copper, lead, zinc, gold or silver bearing ores or any combination of these ores. However, these guidelines do not explicitly apply to the Alaska-Juneau mine, because the mine has been closed.

Since the drainage from the GCDT will contain pollutants in similar concentrations whether the mine is closed or active, these guidelines will be the basis for technology-based effluent limitations based on BPJ. Please see Appendix C for a detailed description of the technology-based limits applied to this permit. Once technology-based limits have been established, EPA must determine if the technology-based limits are stringent enough to protect ambient water quality. If they are not, EPA must develop more stringent water quality-based limits. In this case, the technology-based limit for total suspended solids (TSS) was the only technology-based limit which EPA determined would be protective of the water quality criteria for Gold Creek.

Technology-based limits may not limit every pollutant that is in an effluent. The effluent limit guidelines codified in 40 CFR 440.102(a) and 440.103(a) contain guidelines for copper, zinc, lead, mercury, cadmium, pH and total suspended solids (TSS). However, the effluent from the GCDT contains other pollutants, such as dissolved solids, sulfate, and selenium. When technology-based limits do not exist for a particular pollutant expected to be present in an effluent, EPA determines if the discharge has reasonable potential to cause or contribute to a violation of the State's water quality standards for that pollutant. If reasonable potential exists, EPA will impose water quality-based effluent limits for the pollutant. Please see Appendix D for detailed reasonable potential calculations.

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[1] Sections 301(b), 304, 401 and 402 provide the basis for the effluent limits and other conditions in the proposed permit. Water quality based limits are authorized under Section 301(b)(1)(c) of the Water Quality Act of 1987, NPDES regulations at 40 CFR 122.44(d) and the State of Alaska Water Quality Standards (18 AAC 70.020).

### *2. Water Quality-Based Effluent Limits*

Section 301(b)(1)(C) of the CWA requires the development of limitations in permits necessary to meet water quality standards by July 1, 1977. Discharges to State waters must also comply with limitations imposed by the State as part of its certification of NPDES permits under section 401 of the CWA.

The NPDES regulation 40 CFR 122.44(d)(1) implementing section 301(b)(1)(C) of the CWA requires that permits include limits for all pollutants or parameters which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any State or Tribal water quality standard, including narrative criteria for water quality.

When evaluating the effluent to determine if water quality-based effluent limits are needed based on chemical specific numeric criteria, a projection of the receiving water concentration (downstream of where the effluent enters the receiving water) for each pollutant of concern is made. This process is called a "reasonable potential analysis." The concentration of the pollutant in the effluent and receiving water and, if appropriate, the dilution available from the receiving water, are factors used to project the receiving water concentration. If the projected concentration of a given pollutant in the receiving water exceeds the numeric criterion, then there is a reasonable potential that the discharge may cause or contribute to an excursion above the applicable water quality standard, and a water quality-based effluent limit is required.

The regulations require that this evaluation be made using procedures which account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant in the effluent, species sensitivity (for toxicity), and where appropriate, dilution in the receiving water. The limits must be stringent enough to ensure that water quality criteria are met, and must be consistent with any available wasteload allocation.

### *3. Mixing Zones*

Sometimes it is appropriate to allow a small area of the receiving water to provide dilution of the effluent for the purposes of calculating water quality based effluent limits. These areas are called mixing zones. Mixing zone allowances will make the water quality-based effluent limits less stringent. Mixing zones can be used only when there is adequate receiving water flow volume and the concentration of the pollutant in the receiving water is below the numeric water quality criterion necessary to protect the designated uses of the water body. Mixing zones must be authorized by the Alaska Department of Environmental Conservation. The water quality-based effluent limits in the draft permit (except for pH) have been calculated using a mixing zone, since a mixing zone was granted for the previous permit and EPA expects that ADEC will grant a mixing zone for this permit cycle as well. If ADEC does not grant a mixing zone for one or more pollutants, the water quality-based effluent limits will be recalculated such that the criteria are met before the effluent is discharged to the receiving water.

Normally, when EPA calculates the dilution available within a mixing zone using a steady-state mass balance (as was done in this case), EPA will use the maximum effluent flow rate paired with the 1Q10 low flow (for acute criteria) and 7Q10 low flow (for chronic and single-value criteria) to determine the dilution available from the receiving stream. Since the effluent flow from the GCDT and flow in Gold Creek are both dependent on precipitation and snow melt, it is unlikely that a maximum effluent flow rate would occur at the same time as a 1Q10 or 7Q10 low flow in the receiving stream. Therefore, EPA determined it would be more appropriate to use a regression analysis of the dilution ratio for Outfall 001 during low flows to estimate the dilution available from the receiving stream at the 1Q10 and 7Q10 stream flow rates, assuming that the discharge from Outfall 001 is rapidly and completely mixed with the receiving stream. This analysis showed that the dilution ratio would be approximately 3.4:1 at the 1Q10 flow rate and 3.5:1 at the 7Q10 flow rate. These dilution ratios are slightly lower (more stringent) than the 3.9:1 dilution used in the previous permit. Please see Appendix B for the details of the dilution factor calculation.

### B. Proposed Effluent Limits

Table 4, below, outlines the proposed effluent limits that are in the draft permit for Outfall 001. Effluent limits from the previous permit are included for comparison purposes. Most of the proposed effluent limits are as stringent or more stringent than those in the previous permit. Based on the available monitoring data collected since closure activities were complete, EPA believes the permittee will be able to meet the more stringent effluent limits without additional treatment. Effluent limits which are less stringent in the draft permit than in the previous permit or which have been eliminated in the draft permit are discussed in section C, Anti-Backsliding. Detailed calculations for the water quality-based effluent limits can be found in Appendices E and F.

**Table 4: Effluent Limits for Outfall 001**

| Parameter | Units | Draft Permit | | Previous Permit | |
|---|---|---|---|---|---|
| | | Average Monthly Limit | Maximum Daily Limit | Average Monthly Limit | Maximum Daily Limit |
| Cadmium | µg/L | 0.55 | 1.10 | 50 | 100 |
| Copper | µg/L | 14.7 | 29.5 | 150 | 300 |
| Lead | µg/L | 4.21 | 8.45 | 9.5 | 19.1 |
| Mercury | µg/L | 0.034 | 0.069 | 1 | 2 |
| Oil and Grease | visual | No Visible Sheen | | No Visible Sheen | |
| pH | s.u. | 6.5 to 8.5 | | 6.5 to 8.5 | |
| Selenium | µg/L | 14.4 | 28.8 | — | — |
| Sulfate | mg/L | — | — | — | 780 |
| Total Aromatic Hydrocarbons | µg/L | — | — | — | 10 |
| Total Dissolved Solids | mg/L | 775 | 1556 | — | 1170 |
| Total Suspended Solids | mg/L | 20 | 30 | 20 | 30 |
| Zinc | µg/L | 134 | 269 | 170.6 | 241.1 |
| Metals limits expressed as total recoverable. | | | | | |

In addition to the numeric effluent limits in the above table, the permittee must not discharge any floating solids, visible foam in other than trace amounts, or oily wastes that produce a sheen on the surface of the receiving water.

Because the effluent limits in the draft permit are based on current water quality standards or technology-based limits that have been shown to not cause or contribute to an exceedance of water quality standards, EPA does not anticipate that the discharge authorized in the draft permit will result in degradation of the receiving water.

### C. Anti-Backsliding

The draft permit eliminates the effluent limits for total aromatic hydrocarbons (TAH) and sulfate which were in the previous permit, and it contains less stringent effluent limits for total dissolved solids than did the previous permit. Effluent limitations for all other pollutants are as stringent or more stringent than those in the previous permit. Section 303(d)(4) of the Clean Water Act states that, for water bodies where the water quality meets or exceeds the level necessary to support the water body’s designated uses, water quality-based effluent limits may be revised as long as the revision is consistent with the State’s antidegradation policy. EPA believes that the less stringent effluent limits will be protective of Alaska's federally approved water quality standards for Gold Creek, and that they are therefore consistent with Alaska's antidegradation policy. EPA is requesting that ADEC certify that the less stringent effluent limitations and the elimination of the TAH limitation are protective of Alaska's water quality standards under Section 401 of the CWA. The following discussion details the justifications for the less stringent effluent limits used in the draft permit.

### *1. Total Aromatic Hydrocarbons*

The previous permit contained a maximum daily effluent limit of 10 µg/L for TAH and no average monthly limit. At the time the previous permit was issued, closure activities had not yet concluded at the mine. Gasoline, diesel fuel, lubricating oils and other chemicals were being stored at the mine site. Since closure activities concluded in June of 2000, there has been no storage of fuel or other chemicals at the mine site. The removal of these fuels and chemicals represents a material and substantial alteration. At the present time, there is no known source of hydrocarbons in the A-J Mine.

Further, TAH has not been detected in the effluent from outfall 001 since the mine closure was completed. The laboratory which performed the analysis of the effluent samples for TAH stated that the practical quantitation limit (PQL) for TAH was 1 µg/L. For the purposes of performing a reasonable potential analysis, EPA has assumed that the concentration of TAH in the "non-detect" samples was equal to 0.5 µg/L, or one half of the PQL. The very low concentration of TAH in the discharge from outfall 001 is considered new information which would have justified the omission of the effluent limitation for TAH. Based on the recent monitoring data and the absence of a source of TAH, EPA has determined that the discharge from Outfall 001 does not have the reasonable potential to cause or contribute to a water quality standards violation for TAH. Therefore, an effluent limitation for TAH is not necessary.

### *2. Sulfate*

Alaska's water quality standards have been revised since the previous permit was issued. The most stringent water quality criterion for sulfates is now 250 mg/L, as opposed to 200 mg/L when the previous permit was issued. Currently, the most stringent water quality criterion for sulfate is a drinking water criterion, intended to protect human health. The previous permit contained a water quality-based maximum daily effluent limit of 780 mg for sulfate and no average monthly limit. The previous maximum daily effluent limit was equal to the wasteload allocation (WLA). While the *Technical Support Document for Water Quality-based Toxics Control* (TSD) ( EPA, 1991) mentions this approach as a possible method of deriving effluent limits for aquatic life, it does not recommend this approach for deriving effluent limits based on human health criteria.

Human health criteria are based on long-term exposure to the pollutant, rather than the relatively short-term exposure used to develop aquatic life criteria. The goal of a water quality based effluent limit based on a human health criterion is to ensure that the wasteload allocation is met on an average basis. Therefore, the TSD recommends that effluent limits based on human health criteria be calculated by setting the average monthly limit equal to the WLA, and calculating a maximum daily limit based on the expected variability of the effluent. Using this approach yields average monthly and maximum daily limits for sulfate of 861 mg/L and 1728 mg/L. Please see Appendix F for a detail of the calculations.

The calculated average monthly and maximum daily effluent limits for sulfate are numerically larger than the calculated effluent limitation for total dissolved solids. Total dissolved solids is a measure of all of the dissolved ions in a sample. Sulfate is just one particular ion which could be present, therefore it is impossible for the concentration of sulfate in any given sample to be higher than the concentration of total dissolved solids. Therefore, the effluent limits for total dissolved solids will be protective of the water quality criterion for sulfate and an effluent limit for sulfate is not necessary.

*3. Total Dissolved Solids*

The previous permit contained a water quality-based maximum daily effluent limit of 1170 mg for total dissolved solids (TDS). The proposed average monthly and maximum daily limits for TDS are 775 and 1556 mg/L, respectively. The previous maximum daily effluent limit was equal to the wasteload allocation (WLA). While the TSD mentions this approach as a possible method of deriving effluent limits for aquatic life, it discourages it because it does not consider effluent variability and, as such, it has a potential to be overly stringent.

Using the procedures recommended by the TSD, which consider effluent variability, yields the higher maximum daily effluent limit for sulfate. Please see Appendix E for a detail of the calculations.

*4. Zinc*

The previous permit contained a water quality-based average monthly effluent limit of 170.6 µg/L and a maximum daily limit of 241.1 µg/L. The proposed average monthly and maximum daily limits for zinc are 134 and 269 µg/L, respectively. Since the previous permit was written, the water quality criteria for zinc have changed. The current zinc criteria are an acute criterion of 78.92 µg/L and a chronic criterion of 79.57 µg/L, as dissolved metal. Using the procedures recommended by the TSD and the current water quality criteria yields the higher maximum daily effluent limit for zinc.

## V. Monitoring Requirements

### A. Basis for Effluent and Surface Water Monitoring

Section 308 of the CWA and federal regulation 40 CFR 122.44(i) require monitoring in permits to determine compliance with effluent limitations. Monitoring may also be required to gather effluent and surface water data to determine if additional effluent limitations are required and/or to monitor effluent impacts on receiving water quality. The permittee is responsible for conducting the monitoring and for reporting results on Discharge Monitoring Reports (DMRs) and surface water monitoring reports to the U.S. Environmental Protection Agency (EPA), with copies to ADEC.

### B. Effluent Monitoring

Monitoring frequencies are based on the nature and effect of the pollutant, as well as a determination of the minimum sampling necessary to adequately characterize the discharge. The draft permit retains the annual monitoring frequency that was required under the previous permit because this is the minimum monitoring frequency allowed by the CWA and there have been no violations or other bases for increasing the monitoring frequency. The draft permit requires the permittee to take the annual samples during the low-flow season, between January 1 and April 30, in order to best characterize the discharge and its effect on the receiving water. The discharge from the GCDT is continuous, despite the fact that the source of the water is rainfall and snow melt, because the water has a long residence time in the mine workings prior to discharge. Discharge monitoring reports and surface water monitoring reports shall be submitted by May 31 of each year. Permittees have the option of taking more frequent samples than are required under the permit. These samples can be used for averaging if they are analyzed using EPA-approved methods (generally found in 40 CFR 136) and if the Method Detection Limits are less than the effluent limits.

Table 5 presents the monitoring requirements in the draft permit for the City and Borough of Juneau A-J Mine. The sampling location must be after the last treatment unit and prior to discharge to the receiving water. The monitoring samples must not be influenced by combination with other effluent.

The draft permit does not require monitoring for every pollutant which was monitored under the previous NPDES permit. Monitoring for arsenic, iron, manganese, silver and total aromatic hydrocarbons have been eliminated because technology-based effluent limits are not in effect for these pollutants, and previous monitoring data has shown that the discharge from Outfall 001 does not have the reasonable potential to cause or contribute to a water quality standards violation for these pollutants.

| Table 5: Monitoring Requirements for Outfall 001 | | | |
|---|---|---|---|
| **Parameter** | **Units** | **Sample Frequency** | **Sample Type** |
| Alkalinity | mg/L | Annual | Grab |
| Aluminum | µg/L | Annual | Grab |
| Cadmium | µg/L | Annual | Grab |
| Copper | µg/L | Annual | Grab |
| Flow | mgd | Annual | measure |
| Hardness | mg/L as $CaCO_3$ | Annual | Grab |
| Lead | µg/L | Annual | Grab |
| Mercury | µg/L | Annual | Grab |
| Nickel | µg/L | Annual | Grab |
| Oil and Grease | visible sheen | Annual | Grab |
| pH | standard units | Annual | Grab |
| Selenium | µg/L | Annual | Grab |
| Sulfate | mg/L | Annual | Grab |
| Total Dissolved Solids (TDS) | mg/L | Annual | Grab |
| Total Suspended Solids (TSS) | mg/L | Annual | Grab |
| Turbidity | NTU | Annual | Grab |
| Zinc | µg/L | Annual | Grab |

### C. Surface Water Monitoring

Three monitoring stations have been established in Gold Creek as required by the previous NPDES permit. Station GCR is located just upstream of the discharge from Outfall 001 and downstream from Outfall 005. Station GCB is located just downstream of outfall 001, and serves to confirm that the discharge from outfall 001 does not cause a violation of Alaska's water quality standards. The third station, GCF, is located just downstream from the historical Outfall 002 (Deep North Orebody pumping station). Outfall 002 is no longer in use and the permittee has not requested that a discharge be permitted from this outfall. Since the draft permit does not allow a discharge from Outfall 002, EPA has determined that water quality monitoring at station GCF is no longer necessary. Please see Appendix A for a map of the ambient monitoring stations. Table 6, below, gives the monitoring requirements for stations GCR and GCB.

**Table 6: Monitoring Requirements for Stations GCR and GCB**

| Parameter | Units | Sample Frequency | Sample Type |
|---|---|---|---|
| Alkalinity[1] | mg/L | Annual | Grab |
| Aluminum | µg/L | Annual | Grab |
| Cadmium | µg/L | Annual | Grab |
| Copper | µg/L | Annual | Grab |
| Flow[2] | mgd | Annual | Measure |
| Hardness[1] | mg/L as CaCO3 | Annual | Grab |
| Lead | µg/L | Annual | Grab |
| Mercury | µg/L | Annual | Grab |
| Nickel | µg/L | Annual | Grab |
| Oil and Grease | visible sheen | Annual | Grab |
| pH | s.u. | Annual | Grab |
| Selenium | µg/L | Annual | Grab |
| Sulfate | mg/L | Annual | Grab |
| Total Dissolved Solids (TDS) | mg/L | Annual | Grab |
| Turbidity | NTU | Annual | Grab |
| Zinc | µg/L | Annual | Grab |

**Notes:** The permittee must sample the receiving water on the same day as the effluent sampling, when practicable. The permittee must sample the receiving water during the low flow season, between January 1 and April 30 of each year.

1. The permittee must monitor for hardness and alkalinity at station GCR only.
2. The permittee must monitor for flow at only one location. Any of the three established monitoring stations is acceptable.

# VI. Other Permit Conditions

## A. Quality Assurance Plan

Federal regulations at 40 CFR 122.41(e) require the permittee to develop procedures which ensure that monitoring data is accurate and to explain data anomalies if they occur. The previous permit required the development of a Quality Assurance Plan (QAP), which was subsequently approved by EPA and ADEC. The draft permit requires that the Plan be updated and implemented within 180 days of the effective date of the final permit to reflect the new monitoring requirements, and that the Plan be kept on site and made available to EPA and ADEC upon request.

## B. Best Management Practices Plan

Federal regulations at 40 CFR 122.44(k) require the permittee to develop a Best Management Practices (BMP) Plan in order to prevent or minimize the potential for the release of pollutants to waters of the United States through plant site runoff, spillage or leaks, or erosion. The permittee has developed a BMP Plan (Kvaerner Environmental, 1998) which was approved by EPA and ADEC on June 15, 1998.

The draft permit requires that the BMP plan be updated to reflect the reduced level of activity at the mine site. The draft permit contains certain BMP conditions which must be included in the revised BMP plan. The draft permit requires the permittee to complete and implement the update of the BMP plan within 180 days of the effective date of the final permit.

## C. Additional Permit Provisions

Sections III, IV, and V of the draft permit contain standard regulatory language that must be included in all NPDES permits. Because they are regulations, they cannot be challenged in the context of an NPDES permit action. The standard regulatory language covers requirements such as monitoring, recording, and reporting requirements, compliance responsibilities, and other general requirements.

# VII. Other Legal Requirements

## A. Endangered Species Act

The Endangered Species Act (ESA) requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) if their actions could beneficially or adversely affect any threatened or endangered species. In a phone conversation on January 13, 2004, Ed Grossman of the Juneau Field Office of the U.S. Fish and

Wildlife Service stated that there are no listed or threatened species present near the A-J Mine. The USFWS reference number for this determination is 03-31V.

On February 9, 2004, EPA received a letter from James W. Balsiger of the Juneau office of NOAA Fisheries. The letter stated that the endangered humpback whale and the threatened Steller sea lion are the only listed species under NOAA Fisheries jurisdiction that are likely to occur in the area. NOAA has extended its concurrence with the biological assessment made in the fact sheet for the A-J Mine's previous NPDES permit, that the issuance of an NPDES permit to the A-J Mine is not likely to adversely affect the humpback whale and Steller Sea Lion.

### B. Essential Fish Habitat

Essential fish habitat (EFH) is the waters and substrate (sediments, etc.) necessary for fish to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires EPA to consult with NOAA Fisheries when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH. While Gastineau Channel (which Gold Creek flows into) has been classified as EFH for several species, Gold Creek has not. The effluent limits on the discharges authorized in the draft permit will protect the water quality of Gold Creek; thus, they will not degrade the water quality of Gastineau Channel. EPA has determined that the discharge from the A-J Mine will not affect any EFH species in the vicinity of the discharge; therefore consultation is not required for this action.

### C. State Certification

Section 401 of the CWA requires EPA to seek State certification that the permit will be protective of the State water quality standards before issuing a final permit. As a result of the certification, the State may require more stringent permit conditions or additional monitoring requirements to ensure that the permit complies with water quality standards.

### D. Coastal Zone Management Act

On September 16, 2002, this project was found to be consistent with the Alaska Coastal Management Program (ACMP). According to the current regulations, 11 AAC 110.830, projects found to be consistent do not have to undergo another consistency determination process unless a modification is proposed.

Although the draft permit conditions are different from the conditions in the previous permit, Alaska regulations at 11 AAC 110.820(k)(3) and (4) state that modifications that decrease the impact of the project without a change in purpose or that are within the scope of the original project that was reviewed are not subject to further consistency review.

The level of activity at the mine site is the same as it was when the project was last reviewed in 2002. The draft permit authorizes the discharge of only those pollutants resulting from processes, waste streams and operations identified in the most recent application. For most pollutants, effluent limits in the draft permit are as stringent or more stringent than those in the previous permit. The maximum daily effluent limits for TDS and zinc are less stringent than in the previous permit, but they have been shown not to cause or contribute to an exceedance of the water quality standards. Those effluent limits and monitoring requirements that have been eliminated in the draft permit have been shown to be unnecessary, since the A-J mine discharge either has no reasonable potential to cause or contribute to an exceedance of water quality standards for the pollutants in question, or because effluent limits for other pollutants implicitly limit the pollutant (sulfate is controlled by the TDS limit).

EPA believes that the modifications proposed from the previous permit to the draft permit are within the scope of the previous project review, and that the more stringent effluent limits in the draft permit will decrease the impact of the project. Therefore, pursuant to 11 AAC 110.820(k)(3) and (4), consistency review is not required for this permit reissuance. The Alaska Coastal Management Program Office of Project Management and Permitting has concurred with this determination in a letter dated July 27, 2004.

### E. Permit Expiration

The permit will expire five years from the effective date.

## VIII. References

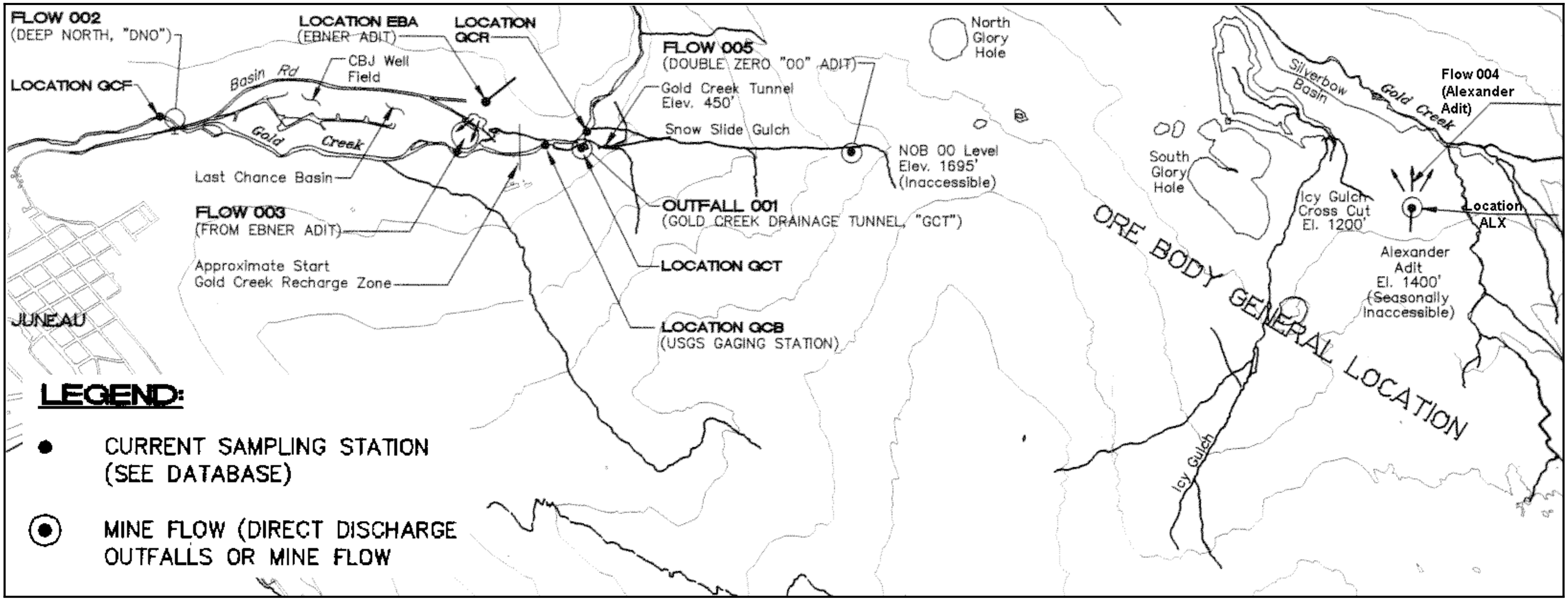
AAC. 2003. *Water Quality Standards.* Alaska Department of Environmental Conservation, Title 18, Chapter 70.

ADEC. 2003. *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.* Alaska Department of Environmental Conservation.

EPA. 1991. *Technical Support Document for Water Quality-based Toxics Control.* US Environmental Protection Agency, Office of Water, EPA/505/2-90-001.

Kvaerner Environmental. 1998. *Best Management Practices Plan: NPDES Permit No. AK-004951-4.* June 11.

# Appendix A: Facility Map



# Appendix B: Calculation of Dilution Factor

As discussed in section III.A., when wasteload allocations and reasonable potential determinations are made based on a steady-state analysis, EPA normally calculates a dilution factor by pairing the maximum effluent flow rate with the 1Q10 (for acute aquatic life criteria) and 7Q10 (for chronic aquatic life and single-value criteria) low flows of the receiving stream. However, since both the effluent and receiving water flows are dependent on precipitation and snow melt, a maximum effluent flow rate is extremely unlikely to occur at the same time as a 1Q10 or 7Q10 low flow in the receiving stream. Therefore, a dilution factor based on the 1Q10 or 7Q10 and the maximum effluent flow rate would be overly stringent.

EPA has used the regression tool in the Lotus 1-2-3 spreadsheet program to correlate the dilution factor for the Gold Creek Drainage Tunnel discharge to the flow in Gold Creek during low flows. EPA considered only stream flows of less than 100 CFS. The results of the analysis are summarized in table B-1. The column labeled "Measured Dilution Factor" shows the actual dilution available in Gold Creek, based on the measured effluent and receiving water flows for a given day, assuming that the effluent is rapidly and completely mixed with the receiving stream. The dilution factor is calculated from the following equation:

$$D = \frac{Q_e + Q_u}{Q_e} \qquad \text{(Equation B-1)}$$

where,
$Q_d$ = Receiving water flow rate downstream of the effluent discharge = $Q_e + Q_u$
$Q_e$ = Effluent flow rate
$Q_u$ = Receiving water flow rate upstream of the discharge

The results show that the relationship between the dilution factor and the stream flow in CFS is linear, with a slope of 0.473 and a y-intercept of 1.37. The column labeled "Calculated Dilution Factor" shows the dilution factors that the regression model predicts, based on the stream flow. The column labeled "Design Dilution Factor" shows the dilution factors that the model predicts for a stream flow equal to the 1-day, 10 year low flow and the 7-day, 10 year low flow (1Q10 and 7Q10). These are the "critical" dilution factors used to determine reasonable potential for the discharge to cause or contribute to a water quality standards violation, and to calculate wasteload allocations. The "Design Dilution Factors," are 3.41 at the 1Q10 flow rate (4.31 CFS), and 3.51 at the 7Q10 flow rate (4.52 CFS).

**Table B-1: Dilution Factor vs. Receiving Water Flow**

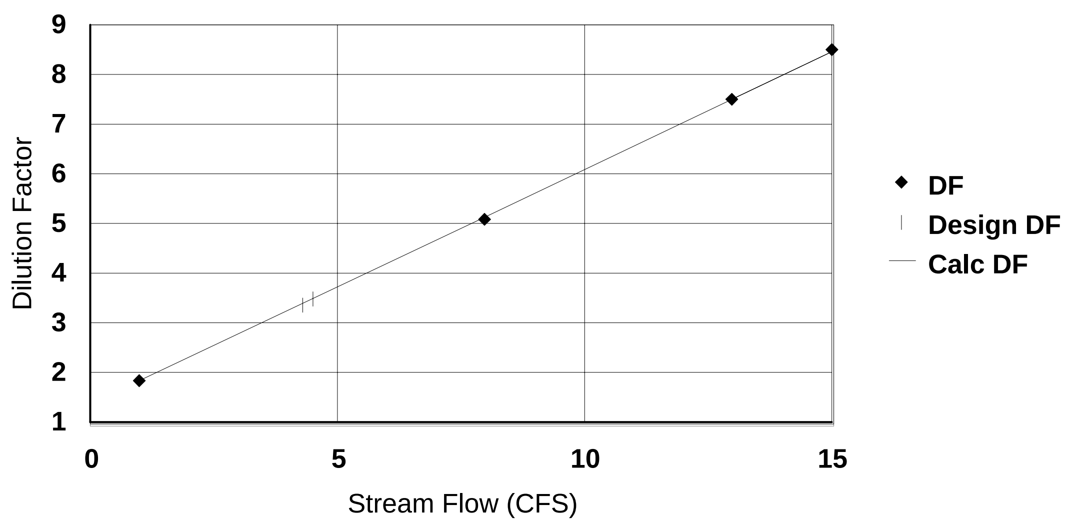
| Date or Critical Flow | Stream (CFS) | Effluent (CFS) | Measured Dilution Factor | Design Dilution Factor | Calculated Dilution Factor |
|---|---|---|---|---|---|
| 12/27/2000 | 13 | 2.0 | 7.50 | — | 7.52 |
| 03/15/2001 | 15 | 2.0 | 8.50 | — | 8.46 |
| 12/12/2001 | 8 | 2.0 | 5.10 | — | 5.15 |
| 03/13/2002 | 1 | 1.2 | 1.87 | — | 1.84 |
| 1Q10 | 4.31 | — | — | 3.41 | — |
| 7Q10 | 4.52 | — | — | 3.51 | — |

**Regression Output:**

| | |
|---|---|
| Constant | 1.370 |
| Std Err of Y Est | 0.0496 |
| R Squared | 0.9998 |
| No. of Observations | 4 |
| Degrees of Freedom | 2 |
| X Coefficient(s) | 0.473 |
| Std Err of Coef. | 0.005 |

**Figure B-1**

**Dilution Factor Regression**



# Appendix C: Basis for Effluent Limitations

The following discussion explains in more detail the derivation of technology and water quality-based effluent limits. Part A discusses technology-based effluent limits, Part B discusses water quality-based effluent limits, and Part C discusses facility specific limits.

## A. Technology-Based Effluent Limits

Table C-1, below, summarizes the BPT and BAT effluent limits codified in 40 CFR 440.102(a) and 440.103(a).

**Table C-1: Technology-Based Effluent Limits [40 CFR 440.102(a) and 440.103(a)]**

| Parameter (units) | Maximum Daily Limit | Average Monthly Limit |
|---|---|---|
| Cadmium (µg/L) | 100 | 50 |
| Copper (µg/L) | 300 | 150 |
| Lead (µg/L) | 600 | 300 |
| Mercury (µg/L) | 2 | 1 |
| pH (s.u.) | 6.0 to 9.0 | |
| Total Suspended Solids (mg/L) | 30 | 20 |
| Zinc (µg/L) | 1500 | 750 |
| Metals in total recoverable. | | |

In this permit, all of the technology-based effluent limits are superseded by more stringent water quality-based effluent limits, with the exception of Total Suspended Solids (TSS). The draft permit contains the above technology-based effluent limit for TSS because Alaska's water quality standards contain neither a numeric nor a narrative water quality criterion for TSS.

## B. Water Quality-Based Effluent Limits

The first step in developing a water quality-based effluent limit is to develop a wasteload allocation (WLA) for the pollutant. A wasteload allocation is the concentration or loading of a pollutant that the permittee may discharge without causing or contributing to an exceedance of water quality standards in the receiving water.

In cases where a mixing zone is not authorized, either because the receiving water already exceeds the criterion, the receiving water flow is too low to provide dilution, or the State does not authorize one, the criterion becomes the WLA. Establishing the criterion as the wasteload allocation ensures that the permittee will not contribute to an exceedance of the criterion. The wasteload allocation for pH has been determined in this way because the State does not generally authorize a mixing zone for pH. The following discussion details the specific water quality-based effluent limits in the draft permit.

### *1. Hardness-Dependent Metals*

The toxicities of some metals vary with the hardness of the water. Therefore, the water quality criteria for these metals also vary with hardness. EPA uses the hardness of the receiving water when mixed with the effluent to determine the water quality criteria for such metals. Since toxicity decreases (and numeric water quality criteria increase) as hardness increases, EPA uses the $5^{th}$ percentile hardness as a reasonable worst-case assumption. EPA has used the hardness of the water collected at sampling station GCB, located just downstream of Outfall 001, as a reasonable estimate of the mixed hardness. The $5^{th}$ percentile of the hardness values of the samples collected at this station was 62.7 mg/L as $CaCO_3$. Water quality criteria for cadmium, copper, lead, nickel, silver, and zinc have been calculated using this hardness value. Table C-2 details the formulae used to calculate the water quality criteria for these metals.

The aquatic life water quality criteria for the hardness dependent metals are expressed as dissolved metal. Effluent concentrations and NPDES permit limits must be expressed as total recoverable metals. The dissolved metal is the concentration of the metal that will pass through a 0.45 micron filter. Total recoverable metal is the concentration in an unfiltered sample. To account for the difference between total recoverable concentrations and dissolved criteria, “translators” are used in the reasonable potential (and permit limit derivation) equations. Translators can either be site specific numbers or default numbers. EPA guidance related to the use of translators in NPDES permits is found in *The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion* (EPA 823-B-96-007, June 1996). In the absence of site specific translators, this guidance recommends the use of water quality criteria conversion factors as the default translators. Because site-specific translators were not available, EPA has used the conversion factors in the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (ADEC, 2003) in the reasonable potential and effluent limit calculations for the A-J Mine discharges.

| Table C-2: Hardness-Dependent Metals Criteria Detail | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Equations[1,2,3,4] | | Conversion Factors[5] when hardness[3] is 62.7 | | Dissolved criteria when hardness[3] is 62.7 | |
| | Acute | Chronic | Acute | Chronic | Acute | Chronic |
| Cadmium | $e^{1.0166[\ln(\text{hardness})]-3.924}$ | $e^{0.7409[\ln(\text{hardness})]-4.719}$ | 0.964 | 0.929 | 1.28 | 0.19 |
| Copper | $e^{0.9422[\ln(\text{hardness})]-1.7}$ | $e^{0.8545[\ln(\text{hardness})]-1.702}$ | 0.960 | 0.960 | 8.66 | 6.01 |
| Lead | $e^{1.273[\ln(\text{hardness})]-1.460}$ | $e^{1.273[\ln(\text{hardness})]-4.705}$ | 0.859 | 0.859 | 48.73 | 1.51 |
| Nickel | $e^{0.846[\ln(\text{hardness})]+2.255}$ | $e^{0.846[\ln(\text{hardness})]+0.0584}$ | 0.998 | 0.997 | 315.6 | 35.05 |
| Silver | $e^{1.72[\ln(\text{hardness})]-6.52}$ | — | 0.850 | — | 1.55 | — |
| Zinc | $e^{0.8473[\ln(\text{hardness})]+0.884}$ | $e^{0.8473[\ln(\text{hardness})]+0.884}$ | 0.978 | 0.986 | 78.92 | 79.57 |

Source: *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*. ADEC, 2003.
Notes:
1. "e" is the exponential constant, approximately equal to 2.718
2. "ln" is the natural logarithm (base e)
3. hardness is measured in mg/L as $CaCO_3$
4. These equations compute the criteria as total recoverable metal
5. Multiplying the results of the equations by these conversion factors yields the dissolved criteria.

Analysis of effluent and receiving water data, and, if appropriate, the technology-based effluent limits for these metals showed that the discharge from the GCDT would have the reasonable potential to cause a violation of the hardness-dependent water quality criteria for cadmium, copper, lead and zinc. Therefore, the draft permit contains water quality-based effluent limits for these metals.

### *2. Hardness-Independent Metals*

The EPA-approved water quality criteria for aluminum, mercury, and selenium are expressed as total recoverable metal and are independent of hardness. The water quality criteria for these metals are the same for all fresh water in Alaska, unless a site-specific criterion is in effect, or the waterbody has been reclassified such that it is not protected for a particular use.

EPA did not approve two portions of Alaska's latest water quality standards revision. One revision would have based the acute aquatic life criterion for selenium on the fraction of selenium present as selenite or selenate. Depending on the fractions, the acute criterion could have been as low as 12.83 µg/L or as high as 185.9 µg/L. The acute selenium criterion currently in effect for Clean Water Act purposes is 20µg/L. In this case, the acute criterion for selenium has no effect on the effluent limits, because the chronic criterion of 5 µg/L produces the most limiting long term average (LTA) regardless of whether the old or new criterion is used to calculate the acute LTA. Please see Appendix C for a detail of the calculations.

In addition, EPA did not approve a revision to the water quality criteria for mercury. The revision would have made the acute criterion 1.4 µg/L and the chronic criterion 0.77 µg/L, expressed as dissolved metal. The mercury criteria currently in effect for Clean Water Act purposes are an acute criterion of 1.4 µg/L and an chronic criterion of 0.012 µg/L, expressed as total recoverable metal.

Analysis of effluent and receiving water data, and, if applicable, the technology-based effluent limits for these metals showed that the discharge from the GCDT would have the reasonable potential to cause a violation of the hardness-independent water quality criteria for mercury and selenium. Therefore, the draft permit contains water quality-based effluent limits for these metals.

### *3. pH*

The most stringent water quality criterion for pH is for the protection of aquatic life and aquaculture water supply. The pH criterion for these uses states that the pH must be no less than 6.5 and no greater than 8.5 standard units, and may not vary more than 0.5 pH units from the natural conditions. The discharge from the GCDT has been of very moderate pH since mine closure was completed (average pH was 7.9, median was 8.0). The pH of the water in Gold Creek upstream of the GCDT was similar to the GCDT effluent (the average and median upstream pH was 7.8). Since the pH of the effluent is similar to the pH of the receiving water, EPA does not expect the effluent to change the pH of Gold Creek by more than 0.5 standard units. Mixing zones are generally not granted for pH, therefore the most stringent water quality criterion must be met before the effluent is discharged to the receiving water. The draft permit requires that the effluent have a pH of no less than 6.5 and no greater than 8.5 standard units.

### *4. Oil and Grease, Residues*

The most stringent water quality criterion for oil and grease is for the protection of water supply. The criterion for the protection of aquaculture water supply states that total aqueous hydrocarbons (TAqH) in the water column may not exceed 15 µg/l, total aromatic hydrocarbons (TAH) in the water column may not exceed 10 µg/l, and that there may be no concentrations of petroleum hydrocarbons, animal fats, or vegetable oils in shoreline or bottom sediments that cause deleterious effects to aquatic life. Surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration. The criterion for drinking water supply also states that oil and grease may not exceed concentrations that individually or in combination impart odor or taste as determined by organoleptic tests.

The most stringent criterion for residues is for the protection of aquatic life habitat. The Alaska water quality standards require that floating solids, debris, sludge, deposits, foam, scum and other residues may not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. Also, they may not, alone or in combination with other substances, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines; cause leaching of toxic or deleterious substances; or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines.

The previous permit contained a water quality-based effluent limit for total aromatic hydrocarbons, but since closure activities have completed, concentrations of total aromatic hydrocarbons in the discharge have been below reporting levels. Therefore the draft permit does not retain the water quality-based effluent limit for TAH. The draft permit addresses the oil and grease and residues criteria by requiring that there be no visible sheen on the effluent from the GCDT and no floating solids or visible foam in other than trace amounts.

### *5. Total Dissolved Solids (TDS) and Sulfate*

A site-specific TDS criterion is in effect for Gold Creek. The site-specific criterion is 300 mg/L. A reasonable potential analysis showed that the discharge from the GCDT would have the reasonable potential to cause or contribute to a violation of the site-specific criterion for TDS. Therefore, the draft permit contains a water quality-based effluent limit for TDS.

The most stringent water quality criterion for sulfate is part of the Total Dissolved Solids criterion, and is 250 mg/L. A reasonable potential analysis showed that the discharge from the GCDT would have the reasonable potential to cause or contribute to a violation of the water quality criterion for sulfate. However, the calculated effluent limits for sulfate are numerically larger than the effluent limits for total dissolved solids. As discussed in section IV.C, the total dissolved solids effluent limits will be protective of the sulfate criterion and an effluent limit for sulfate is not necessary.

# Appendix D: Reasonable Potential Calculations

The following describes the process EPA has used to determine if the discharges authorized in the draft permit have the reasonable potential to cause or contribute to a violation of Alaska's Federally approved water quality standards. EPA uses the process described in the Technical Support Document for Water Quality-based Toxics Control (EPA, 1991) to determine reasonable potential.

To determine if there is "reasonable potential" to cause or contribute to an exceedance of water quality criteria for a given pollutant , EPA compares the maximum projected receiving water concentration to the criteria for that pollutant. If the projected receiving water concentration exceeds the criteria, there is reasonable potential, and a water quality-based effluent limit must be included in the permit. This section discusses how the maximum projected receiving water concentration is determined.

## A. Mass Balance

For discharges to flowing water bodies, the maximum projected receiving water concentration is determined using the following mass balance equation:

$$C_dQ_d = C_eQ_e + C_uQ_u \qquad \text{(Equation D-1)}$$

where,

$C_d$ = Receiving water concentration downstream of the effluent discharge (that is, the concentration at the edge of the mixing zone)
$C_e$ = Maximum **projected** effluent concentration
$C_u$ = 95$^{th}$ percentile measured receiving water upstream concentration
$Q_d$ = Receiving water flow rate downstream of the effluent discharge = $Q_e + Q_u$
$Q_e$ = Effluent flow rate
$Q_u$ = Receiving water low flow rate upstream of the discharge (1Q10 or 7Q10)

When the mass balance equation is solved for $C_d$, it becomes:

$$C_d = \frac{C_eQ_e + C_uQ_u}{Q_e + Q_u} \qquad \text{(Equation D-2)}$$

The above form of the equation is based on the assumption that the discharge is rapidly and completely mixed with the receiving stream. If the mixing zone is based on less than complete mixing with the receiving water, the equation becomes:

$$C_d = \frac{C_eQ_e + C_u(Q_u \times MZ)}{Q_e + (Q_u \times MZ)} \qquad \text{(Equation D-3)}$$

Where MZ is the fraction of the receiving water flow available for dilution. In this case, the mixing zone is based on complete mixing of the effluent and the receiving water, and MZ is equal to unity (1).

If a mixing zone is not allowed, dilution is not considered when projecting the receiving water concentration and,

$$C_d = C_e \qquad \text{(Equation D-4)}$$

Equation 2 can be simplified by introducing a "dilution factor,"

$$D = \frac{Q_e + Q_u}{Q_e} \qquad \text{(Equation D-5)}$$

As discussed in Appendix B, there are two values for the dilution factor: one based on the 1Q10 flow rate in the receiving stream and used to determine reasonable potential and wasteload allocations for acute aquatic life criteria, and one based on the 7Q10 flow rate to determine reasonable potential and wastelaod allocations for all other criteria. The dilution factor was calculated to be 3.51 at the 7Q10 flow rate and 3.41 at the 1Q10 flow rate.

After simplification, Equation 2 becomes:

$$C_d = \frac{C_e - C_u}{D} + C_u \qquad \text{(Equation D-6)}$$

If the criterion is expressed as dissolved metal, the concentrations must be converted from total recoverable metal to dissolved metal, as shown in Equation D-7.

$$C_d = CF\left[\frac{C_e - C_u}{D} + C_u\right] \qquad \text{(Equation D-7)}$$

Where $C_e$ and $C_u$ are expressed as total recoverable metal, $C_d$ is expressed as dissolved metal, and CF is the larger of the two conversion factors for the acute and chronic criteria.

Equations D-6 and D-7 are the forms of the mass balance equation which were used to determine reasonable potential and calculate wasteload allocations.

## B. Maximum Projected Effluent Concentration

For pollutants subject to technology-based effluent limits, the technology-based maximum daily limit was used as the maximum projected receiving water concentration ($C_e$). The technology-based effluent limit was used in this manner because water quality-based effluent limits are required only when a discharge of the pollutant at the technology-based limit has the reasonable potential to violate water quality standards. Technology-based limits for metals are expressed as total recoverable.

For other parameters, EPA has used the procedure described in section 3.3 of the TSD, "Determining the Need for Permit Limits With Effluent Monitoring Data." In this procedure, the maximum projected effluent concentration in the mass balance equation is represented by the 99$^{th}$ percentile of the effluent data.

Since there are a limited number of data points available, the 99$^{th}$ percentile is calculated by multiplying the maximum reported effluent concentration by a "reasonable potential multiplier" (RPM). The RPM is the ratio of the 99$^{th}$ percentile concentration to the maximum reported effluent concentration. The RPM is calculated from the coefficient of variation (CV) of the data and the number of data points. The CV is defined as the ratio of the standard deviation of the data set to the mean, but when fewer than 10 data points are available, the TSD recommends assuming that the CV is equal to 0.6. Using the equations in section 3.3.2. of the TSD, the reasonable potential multiplier (RPM) is calculated as follows. The following discussion presents the equations used to calculate the RPM, and works through the calculations for the RPM for total dissolved solids (TDS) as an example. Reasonable potential calculations for all pollutants can be found in Table D-1.

First, the percentile represented by the highest reported concentration is calculated.

$$p_n = (1 - \text{confidence level})^{1/n} \quad \text{(Equation D-8)}$$

where,
$p_n$ = the percentile represented by the highest reported concentration
$n$ = the number of samples

There were nine TDS samples collected from the effluent, therefore:

$$p_n = (1-0.99)^{1/9}$$
$$p_n = 0\ .599$$

This means that we can say, with 99% confidence, that the maximum reported effluent TDS concentration is greater than the 59.9$^{th}$ percentile.

The reasonable potential multiplier (RPM) is the ratio of the 99$^{th}$ percentile concentration (at the 99% confidence level) to the maximum reported effluent concentration. This is calculated as follows:

$RPM = C_{99}/C_p$ (Equation D-9)

Where,
$C = \exp(z\sigma - 0.5\sigma^2)$ (Equation D-10)

where,
$\sigma^2 = \ln(CV^2 + 1)$ (Equation D-11)
$\sigma = \sqrt{\sigma^2}$
CV = coefficient of variation = (standard deviation) ÷ (mean)
z = the inverse of the normal cumulative distribution function at a given percentile

In the case of TDS:

CV = coefficient of variation = 0.6
$\sigma^2 = \ln(CV^2 + 1) = 0.307$
$\sigma = \sqrt{\sigma^2} = 0.555$
z = 2.326 for the 99th percentile = 0.252 for the 59.9th percentile

$C_{99} = \exp(2.326 \times 0.555 - 0.5 \times 0.307) = 3.12$
$C_{59.9} = \exp(0.252 \times 0.555 - 0.5 \times 0.307) = 0.986$

$RPM = C_{99}/C_{59.9} = 3.12/0.986$
**RPM = 3.16**

The maximum projected effluent concentration is determined by simply multiplying the maximum reported effluent concentration by the RPM:

$C_e = (RPM)(MRC)$ (Equation D-12)

where MRC = Maximum Reported Concentration

In the case of TDS,

**$C_e$ = (3.16)(660 mg/L) = 2085 mg/L**

## C. Maximum Projected Receiving Water Concentration

The discharge has reasonable potential to cause or contribute to an exceedance of water quality criteria if the maximum projected concentration of the pollutant at the edge of the mixing zone exceeds the criterion. The maximum projected receiving water concentration is calculated from Equation D-6:

$$C_d = \frac{C_e - C_u}{D} + C_u \qquad \text{(Equation D-6)}$$

Or, if the criterion is expressed as dissolved metal, the maximum projected receiving water concentration is calculated from Equation D-7:

$$C_d = CF\left[\frac{C_e - C_u}{D} + C_u\right]$$

(Equation D-7)

Where $C_e$ and $C_u$ are expressed as total recoverable metal, $C_d$ is expressed as dissolved metal, and CF is the larger of the two conversion factors for the acute and chronic criteria.

In the case of TDS,

$$C_d = \frac{2085 - 41.9}{3.507} + 41.9$$

$$\mathbf{C_d = 624.5\ mg/L}$$

In the case of TDS, the projected receiving water concentration (624.5 mg/L) is greater than the criterion (300 mg/L), therefore a water quality-based effluent limit is required.

Tables D-1 and D-2, on the following pages, summarize the reasonable potential calculations for all pollutant parameters monitored under the previous permit. The table also shows whether monitoring should be required for those pollutants. If the maximum projected receiving water concentration for a given pollutant was less than 10% of the most stringent water quality criterion, the draft permit does not require monitoring for those pollutants.

| Table D-1: Reasonable Potential Calculations: Metals With Dissolved Criteria | | | | | | |
|---|---|---|---|---|---|---|
| **Common to All Parameters** | | | | | | |
| Confidence Level | Z-Score of Confidence Level | | Acute Dilution Factor | | Chronic/Single Value Dilution Factor | |
| 0.99 | 2.326 | | 3.407 | | 3.507 | |
| **All concentrations are in µg/L** | | | | | | |
| | Pb | Zn | Cd | Cu | Ni | Ag |
| Data Source | TBEL[1] | TBEL[1] | TBEL[1] | TBEL[1] | Effluent | Effluent |
| Acute Conversion Factor | 0.859 | 0.978 | 0.964 | 0.960 | 0.998 | 0.850 |
| Chronic Conversion Factor | 0.859 | 0.986 | 0.929 | 0.960 | 0.997 | N/A |
| 95th Percentile Ambient Conc. | 0.349 | 2.280 | 0 | 0.495 | 1.17 | 0 |
| Max Reported Effluent Conc. | N/A | N/A | N/A | N/A | 11.08 | 0.01 |
| Average Effluent Conc. | N/A | N/A | N/A | N/A | 6.14 | 0.01 |
| Standard Deviation of Effluent Conc. | N/A | N/A | N/A | N/A | 4.59 | 0.00 |
| Number of samples (n) | N/A | N/A | N/A | N/A | 3 | 2 |
| Coefficient of Variation | N/A | N/A | N/A | N/A | 0.600 | 0.600 |
| Sigma | N/A | N/A | N/A | N/A | 0.55 | 0.55 |
| Sigma^2 | N/A | N/A | N/A | N/A | 0.307 | 0.307 |
| Percentile of Largest Value | N/A | N/A | N/A | N/A | 0.215 | 0.100 |
| Z-Score of Percentile of Largest Value | N/A | N/A | N/A | N/A | -0.788 | -1.282 |
| $C_{99}$ | N/A | N/A | N/A | N/A | 3.12 | 3.12 |
| $C_n$ | N/A | N/A | N/A | N/A | 0.554 | 0.421 |
| Reasonable Potential Multiplier (RPM) | N/A | N/A | N/A | N/A | 5.622 | 7.394 |
| Maximum Projected Effluent Conc. | 515 | 1467 | 93 | 288 | 62.3 | 0.094 |
| Maximum Acute RWC | 151.5 | 432.1 | 27.2 | 84.9 | 19.0 | 0.03 |
| Maximum Chronic/Single Value RWC | 147.2 | 420.0 | 26.5 | 82.5 | 18.5 | 0.03 |
| Acute Aqua Life Criterion | 38.73 | 78.92 | 1.28 | 8.66 | 315.55 | 1.55 |
| Chronic Aqua Life Criterion | 1.51 | 79.57 | 0.18 | 6.01 | 35.05 | N/A |
| Most Stringent Single-Value Criterion[2] | 50 | 2000 | 5 | 200 | 100 | N/A |
| **Reasonable Potential?** | **YES** | **YES** | **YES** | **YES** | **NO** | **NO** |
| **Monitoring Required?** | **YES** | **YES** | **YES** | **YES** | **YES** | **NO** |

1. "TBEL" means technology-based effluent limit. The technology-based maximum daily effluent limit is used as the maximum projected effluent concentration (see part B, Maximum Projected Effluent Concentration, above).
2. The single value criteria listed are in total recoverable. All other metals concentrations in this table are in dissolved. The dissolved aquatic life criteria are more stringent in every

case.

**Table D-2: Reasonable Potential Calculations: All Other Pollutants**

| Common to All Parameters | | | |
|---|---|---|---|
| Confidence Level | Z-Score of Confidence Level | Acute Dilution Factor | Chronic/Single Value Dilution Factor |
| 0.99 | 2.326 | 3.407 | 3.507 |

**All concentrations are in µg/L except sulfate and TDS, which are in mg/L, and turbidity, which is in NTU**

| | Sulfate | TDS | As | Mn | Al | Fe | Hg | Se | Turb. | TAH |
|---|---|---|---|---|---|---|---|---|---|---|
| Data Source | Effluent | Effluent | Effluent | Effluent | Effluent | Effluent | TBEL[1] | Effluent | Effluent | Effluent |
| 95th Percentile Ambient Conc. | 6.16 | 41.875 | 1.99 | 2.327 | 26.9 | 52.6 | 0 | 0 | 1.42 | 0 |
| Max Reported Effluent Conc. | 380 | 660 | 1.22 | 0.34 | 7.90 | 8 | N/A | 3.82 | 2.40 | 0.5 |
| Average Effluent Conc. | 275 | 500 | 0.83 | 0.23 | 4.21 | 8 | N/A | 2.54 | 0.43 | 0.5 |
| Standard Deviation of Effluent Conc. | 79 | 124 | 0.54 | 0.15 | 3.06 | 0 | N/A | 1.74 | 0.46 | 0 |
| Number of samples (n) | 9 | 9 | 3 | 3 | 3 | 2 | N/A | 3 | 26 | 8 |
| Coefficient of Variation | 0.600 | 0.600 | 0.600 | 0.600 | 0.600 | 0.600 | N/A | 0.600 | 1.064 | 0.600 |
| Sigma | 0.555 | 0.555 | 0.55 | 0.55 | 0.55 | 0.55 | N/A | 0.55 | 0.87 | 0.55 |
| Sigma^2 | 0.307 | 0.307 | 0.307 | 0.307 | 0.307 | 0.307 | N/A | 0.307 | 0.757 | 0.307 |
| Percentile of Largest Value | 0.599 | 0.599 | 0.215 | 0.215 | 0.215 | 0.100 | N/A | 0.215 | 0.838 | 0.562 |
| Z-Score of Percentile of Largest Value | 0.252 | 0.252 | -0.788 | -0.788 | -0.788 | -1.282 | N/A | -0.788 | 0.985 | 0.157 |
| $C_{99}$ | 3.12 | 3.12 | 3.12 | 3.12 | 3.12 | 3.12 | N/A | 3.12 | 5.18 | 3.12 |
| $C_n$ | 0.986 | 0.986 | 0.554 | 0.554 | 0.554 | 0.421 | N/A | 0.554 | 1.614 | 0.935 |
| Reasonable Potential Multiplier (RPM) | 3.159 | 3.159 | 5.622 | 5.622 | 5.622 | 7.394 | N/A | 5.622 | 3.212 | 3.330 |
| Maximum Projected Effluent Conc. | 1200 | 2085 | 6.86 | 1.91 | 44.42 | 55 | 2.00 | 21.5 | 7.709 | 1.665 |
| Maximum Acute RWC | N/A | N/A | 3.4 | 2.2 | 32.0 | 53.4 | 0.6 | 6.3 | 3.27 | 0.49 |
| Maximum Chronic/Single Value RWC | 346.7 | 624.5 | 3.4 | 2.2 | 31.9 | 53.4 | 0.6 | 6.1 | 3.21 | 0.47 |
| Acute Aqua Life Criterion | N/A | N/A | 340 | N/A | 750 | N/A | 2.40 | 12.83 | N/A | N/A |
| Chronic Aqua Life Criterion | N/A | N/A | 150 | N/A | 87 | 1000 | 0.012 | 5 | N/A | N/A |
| Most Stringent Single-Value Criterion | 250 | 300 | 50 | 50 | 5000 | 5000 | 0.14 | 10 | 5.66 | 10 |
| **Reasonable Potential?** | **YES[2]** | **YES** | **NO** | **NO** | **NO** | **NO** | **NO** | **YES** | **NO** | **NO** |
| **Monitoring Required?** | **YES** | **YES** | **NO** | **NO** | **YES** | **NO** | **YES** | **YES** | **YES** | **NO** |

Note: Metals concentrations (As, Mn, Al, Fe, Hg, and Se) are in total recoverable.
1. "TBEL" means technology-based effluent limit. The technology-based maximum daily effluent limit is used as the maximum projected effluent concentration (see part B, Maximum Projected Effluent Concentration, above).

2. Although the discharge from the GCDT has reasonable potential to cause or contribute to an exceedance of the water quality criterion for sulfate, the effluent limits for TDS will be protective of the sulfate criterion.

# Appendix E: WQBEL Calculations - Aquatic Life Criteria

The following calculations demonstrate how the water quality-based effluent limits (WQBELs) in the draft permit were calculated. The WQBELs for cadmium, copper, lead, mercury, selenium, TDS and zinc are intended to protect aquatic life criteria. WQBELs intended to protect human health criteria are calculated slightly differently, as shown in Appendix F. The following discussion presents the general equations used to calculate the water quality-based effluent limits, then works through the calculations for the lead WQBEL, as an example. The calculations for all WQBELs based on aquatic life criteria are summarized in Table E-1.

## A. Calculate the Wasteload Allocations (WLAs)

Wasteload allocations (WLAs) are calculated using the same mass balance equations (Equations D-6 and D-7) used to calculate the concentration of the pollutant at the edge of the mixing zone in the reasonable potential analysis. To calculate the wasteload allocations, $C_d$ is set equal to the acute or chronic criterion and the equation is solved for $C_e$. The calculated $C_e$ is the acute or chronic WLA. Equation D-6 is rearranged to solve for the WLA, becoming:

$$C_e = WLA = D \times (C_d - C_u) + C_u \qquad \text{(Equation E-1)}$$

Alaska's water quality criteria for some metals are expressed as the dissolved fraction, but Federal regulation 40 CFR 122.45(c) requires that effluent limits be expressed as total recoverable metal. Therefore, EPA must calculate a wasteload allocation in total recoverable metal which will be protective of the dissolved criterion. This is accomplished by dividing the WLA expressed as dissolved by the criteria translator, as shown in equation E-2. As discussed in Appendix C, the criteria translator (CT) is equal to the conversion factor for that particular criterion.

$$C_e = WLA = [D \times (C_d - C_u) + C_u]/CT \qquad \text{(Equation E-2)}$$

In the case of lead, for the acute criterion,

$$WLA_a = [3.407 \times (38.73 - 0.349) + 0.349]/0.859$$
$$\mathbf{WLA_a = 152.7\ \mu g/l}$$

For the chronic criterion,

$$WLA_c = [3.507 \times (1.509 - 0.349) + 0.349]/0.859$$
$$\mathbf{WLA_c = 5.14\ \mu g/l}$$

The next step is to compute the "long term average" concentrations which will be protective of the WLAs. This is done using the following equations from EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD):

$LTA_a = WLA_a \times \exp(0.5\sigma^2 - z\sigma)$ (Equation E-2)
$LTA_c = WLA_c \times \exp(0.5\sigma_4^2 - z\sigma_4)$ (Equation E-3)

where,

$\sigma^2 = \ln(CV^2 + 1)$
$\sigma = \sqrt{\sigma^2}$
$\sigma_4^2 = \ln(CV^2/4 + 1)$
$\sigma = \sqrt{\sigma_4^2}$
$z = 2.326$ for 99th percentile probability basis

In the case of lead,

$\sigma^2 = \ln(0.6^2 + 1) = 0.307$
$\sigma = \sqrt{\sigma^2} = 0.555$
$\sigma_4^2 = \ln(0.6^2/4 + 1) = 0.0862$
$\sigma = \sqrt{\sigma_4^2} = 0.2936$
$z = 2.326$ for 99th percentile probability basis

Therefore,

$LTA_a = 152.7\ \mu g/L \times \exp(0.5 \times 0.307 - 2.326 \times 0.555)$
$\mathbf{LTA_a = 49.0\ \mu g/L}$

$LTA_c = 5.14\ \mu g/L \times \exp(0.5 \times 0.0862 - 2.326 \times 0.294)$
$\mathbf{LTA_c = 2.71\ \mu g/L}$

The LTAs are compared and the more stringent is used to develop the daily maximum and monthly average permit limits as shown below. For lead, the chronic LTA is more stringent.

For TDS, there is only a single value criterion intended to protect aquatic life. In this case, the TSD recommends considering the single criterion a chronic criterion, and calculating a chronic WLA and LTA from this criterion. The chronic LTA is then the limiting LTA and the permit limits are calculated from this LTA as usual. The effluent limits for TDS have been calculated in this way.

## B. Derive the maximum daily and average monthly effluent limits

Using the TSD equations, the MDL and AML effluent limits are calculated as follows:

$MDL = LTA \times \exp(z_m\sigma - 0.5\sigma^2)$ (Equation E-4)
$AML = LTA \times \exp(z_a\sigma_n - 0.5\sigma_n^2)$ (Equation E-5)

where σ, and σ² are defined as they are for the LTA equations (E-2 and E-3) and,
$\sigma_n^2 = \ln(CV^2/n + 1)$
$\sigma = \sqrt{\sigma_n^{\,2}}$
$z_a = 1.645$ for 95th percentile probability basis
$z_m = 2.326$ for 99th percentile probability basis
n = number of sampling events required per month (minimum of 4)

In the case of lead,

MDL = 2.71 µg/L × exp(2.326 × 0.555 - 0.5 × 0.307)
**MDL = 8.45 µg/L**

AML = 2.71 µg/L × exp(1.645 × 0 .294 - 0.5 × 0.086)
**AML = 4.21 µg/L**

| Table E-1: Limits Based on 2-Value Aquatic Life Criteria | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Statistical variables for permit limit calculation** | | | | | | | |
| | Coeff. Var. (CV) | AML Prob'y Basis | MDL Prob'y Basis | # of Samples per Month | Acute Dil'n Factor | Chronic Dil'n Factor | |
| PARAMETER | *decimal* | *decimal* | *decimal* | *n* | | | |
| All | 0.60 | 0.95 | 0.99 | 4.00 | 3.407 | 3.507 | |
| **Waste Load Allocation (WLA) and Long Term Average (LTA) Calculations** | | | | | | | |
| | WLA Acute | WLA Chronic | LTA Acute | LTA Chronic | LTA Coeff. Var. (CV) | LTA Prob'y Basis | Limiting LTA |
| PARAMETER | *µg/L* | *µg/L* | *µg/L* | *µg/L* | *decimal* | *decimal* | *µg/L* |
| Cadmium | 4.52 | 0.67 | 1.45 | 0.354 | 0.60 | 0.99 | 0.354 |
| Copper | 29.49 | 20.67 | 9.47 | 10.90 | 0.60 | 0.99 | 9.47 |
| Lead | 152.65 | 5.14 | 49.0 | 2.71 | 0.60 | 0.99 | 2.71 |
| Mercury | 8.18 | 0.04 | 2.63 | 0.022 | 0.60 | 0.99 | 0.022 |
| Selenium | 43.72 | 17.53 | 21.9 | 9.25 | 0.60 | 0.99 | 9.25 |
| TDS (mg/L) | N/A | 947.05 | N/A | 499.5 | 0.60 | 0.99 | 499.5 |
| Zinc | 269.36 | 277.14 | 86.5 | 146.2 | 0.60 | 0.99 | 86.5 |
| **Effluent Limit Calculation Summary** | | | | | | | |
| | Metal Criteria Translator | | Ambient Concentration | Water Quality Criterion Acute | Water Quality Criterion Chronic | **Average Monthly Limit (AML)** | **Maximum Daily Limit (MDL)** |
| PARAMETER | Acute | Chronic | *µg/L* | *µg/L* | *µg/L* | **µg/L** | **µg/L** |
| Cadmium | 0.964 | 0.929 | 0.000 | 1.279 | 0.178 | **0.55** | **1.10** |
| Copper | 0.960 | 0.960 | 0.495 | 8.659 | 6.012 | **14.7** | **29.5** |
| Lead | 0.859 | 0.859 | 0.349 | 38.73 | 1.509 | **4.21** | **8.45** |
| Mercury | 1.000 | 1.000 | 0.000 | 2.400 | 0.0120 | **0.034** | **0.069** |
| Selenium | 1.000 | 1.000 | 0.000 | 20.00 | 5.00 | **14.4** | **28.8** |
| TDS (mg/L) | 1.000 | 1.000 | 41.875 | N/A | 300 | **775** | **1556** |
| Zinc | 0.978 | 0.986 | 2.312 | 78.92 | 78.92 | **134** | **269** |

# Appendix F: WQBEL Calculations - Human Health

The most stringent water quality criterion for sulfate is a drinking water supply criterion for the protection of human health. As discussed in section IV.C. and in Appendix C, the effluent limit for sulfate is not necessary but the calculations are presented here for information purposes.

The technical support document recommends using a different procedure for deriving permit limits from water quality criteria designed to protect human health than those designed to protect aquatic life from the toxic effects of pollutants. The TSD recommends setting the AML equal to the WLA, and calculating an MDL based on effluent variability from the following relationship:

$$\frac{MDL}{AML} = \frac{\exp(z_m s - 0.5s^2)}{\exp(z_a s_n - 0.5{s_n}^2)}$$

Where:

CV = Coefficient of variation = 0.600
$\sigma^2 = \ln(CV^2 + 1) = 0.307$
$\sigma_n{}^2 = \ln(CV^2/n + 1) = 0.0862$
n = number of sampling events per month (minimum of 4 samples assumed if sample frequency is less than 4 per month)
$z_m$ = 2.326 for 99th percentile probability basis
$z_a$ = 1.645 for 95th percentile probability basis

Therefore, the ratio of the MDL to the AML is 2.01. The effluent limits for sulfate are as follows:

| **Table F-1: Limits Based on Human Health Criteria** | | | | | |
|---|---|---|---|---|---|
| **Statistical variables for permit limit calculation** | | | | | |
| PARAMETER | Coeff. Var. (CV) | AML Prob'y Basis | MDL Prob'y Basis | # of Samples per Month | Chronic Dil'n Factor |
| Sulfate | 0.60 | 0.95 | 0.99 | 4.00 | 3.507 |
| **Effluent Limit Calculation Summary** | | | | | |
| | Ambient Concentration | Water Quality Criterion | WLA | **Average Monthly Limit (AML)** | **Maximum Daily Limit (MDL)** |
| PARAMETER | *mg/L* | *mg/L* | *mg/L* | **mg/L** | **mg/L** |
| Sulfate | 6.160 | 250 | 861.25 | **861** | **1728** |