runoff. Another source control measure currently being implemented includes the oxide-stockpile reclamation project which will reduce/mitigate generation of acid rock drainage (ARD) to the tailings pond. This project was initiated in 2008 and is more than 95% complete. Additionally, the proposed permit requires Teck to develop a TDS Management Plan (Section 1.A.7.f), which must be approved by EPA and the department, and which will provide information on actions Teck will take to provide enhanced treatment and/or source control

For lead, selenium and zinc, these pollutants are associated with the mined ore and waste rock. As a consequence, they are found in the tailings, waste rock drainage to the tailings impoundment, and tailings impoundment discharge. The HDS treatment process represents the most commonly used, reasonable, and effective method for removal of these metals at hard rock mines, such as Red Dog.

For cyanide, this pollutant is used in the lead extraction process as a pyrite (iron) depressant. The mine has investigated alternatives to the use of cyanide in the mill with unacceptable results. Small concentrations of WAD cyanide found in the effluent (less than 15µg/L) are at levels that are not considered to be treatable with available water treatment technology. Some degradation of cyanide occurs in the tailings pond through oxidation. From August 1998 through September 2005, 97 WAD cyanide analyses were conducted on samples collected at Station 10. All 97 samples were reported at levels below the minimum level of quantification (ML) for the WAD cyanide analytical method, and 74 of the samples were reported as less than the method detection limit (MDL) for the WAD cyanide analytical method. Identical results have been documented in Ikalukrok Creek and the Wulik River. A combined 217 samples have been collected and analyzed by the WAD cyanide method at Stations 150, 160, and 2 since August 1998. Results from all samples were reported at levels below the minimum level of quantification (ML), and 189 of the samples were reported as less than the method detection limit (MDL). (EPA, 2006)

In addition, from August 2003 through October 2008, 64 WAD cyanide analyses were conducted on samples collected at Station 151 (located at the downstream edge of the Main Stem mixing zone). Station 151 is upstream of Station 10 and provides a more conservative representation of WAD cyanide concentrations in the Main Stem, as Station 151 is less subject to influence by ambient runoff contribution (and resulting dilution) than is downstream Station 10. Again, all 64 Station 151 samples were reported at levels below the ML for the WAD cyanide analytical method, and 53 of the samples were reported as less than the MDL for the WAD cyanide analytical method.

As demonstrated by the monitoring results described above, the department finds that the treatment for WAD cyanide that occurs in the tailings pond is effective and reasonable for the concentrations present.

For ammonia, traditional water treatment methods for reducing the concentration in effluent (air stripping, biological treatment, chlorination, etc.) are not practicable at the mine, given the volumes and concentrations present. Source control is the most effective and reasonable method for reducing ammonia concentrations in the effluent. The primary source of ammonia in the effluent results from blasting with an ammonium nitrate and fuel oil mixture in wet blast holes in

the mine pit. When placed in wet holes the ammonium nitrate dissolves into the groundwater in the vicinity of the blast hole. Mine drainage water, including the groundwater encountered in blast holes, is collected in the mine drainage sump, which is then pumped into the tailings pond. Since 1999 the mine has implemented the use of an emulsified blasting agent that results in minimal ammonium nitrate dissolving into the groundwater and subsequently entering the mine drainage sump. This source control technique has resulted in decreasing effluent ammonia concentrations since 1999. Condition 5 of this Section 401 Certification contains a specific best management practice (BMP) requirement carried forward to Section I.H.2.i.(vi) of the permit requiring the permittee to develop a BMP to ensure that best blasting practices are used in any wet blast holes to minimize the amount of blasting agent that dissolves in the groundwater in the vicinity of the blast hole.

After review of the applicable statutory and regulatory requirements, including 18 AAC 70 and 18 AAC 72, the department finds that the treatment measures used by the discharger to remove, reduce, and disperse pollutants represent the most effective, technologically and economically feasible techniques for controlling the quality of the mine effluent, and that these treatment measures meet the highest applicable statutory and regulatory requirements.

2. The department authorizes the effluent limits and monitoring requirements contained in the NPDES Permit Part I.A.1 – Table 1.

Rationale: In accordance with State Regulations, 18 AAC 15.090, the department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records, reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure all applicable criteria will be met. The effluent limits included in the permit provide assurance that WQS are being met.

3. NPDES Permit part I.A.7.a shall maintain the following language:

After the commencement of discharge, the permittee shall limit the TDS load discharged from Outfall 001 so as to maintain in-stream TDS concentrations at or below:

(1) 1500 mg/L at the edge of the mixing zone in the Main Stem of Red Dog Creek,

(2) 1000 mg/L at the edge of the mixing zone in Ikalukrok Creek throughout the discharge season, and

(3) 500 mg/L from July 25th through the end of the discharge season at Station 160.

Rationale: The TDS SSC allows TDS concentrations up to 1500 mg/L in the Main Stem without timing restrictions. The department finds that the in-stream TDS limits are required to ensure that existing uses are protected.

Rationale: In 1999, the department changed the WQC under 18 AAC 70.020(b)(Note 12) for inorganic dissolved solids, regulated as TDS. This criterion is in effect in Ikalukrok Creek for the areas listed above:

> *Total Dissolved Solids (TDS) in concentrations up to 1000 mg/L in Ikalukrok Creek are in effect from the confluence of Ikalukrok Creek with the Main Stem to the Wulik River, **except** during chum salmon and/or Dolly Varden spawning in Ikalukrok Creek, when the aquatic life criterion of 500 mg/L will apply at Station 160.*

Rationale: In accordance with 18 AAC 70.020(b)(4) and note 12, the TDS concentration at Station 160 shall remain at or below 500 mg/L from July 25th through the end of the discharge season to ensure no adverse effect.

In accordance with State Regulations 18 AAC 15.090, the department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

4. Permit part I.E – Bioassessment Program Requirements could be removed from the NPDES Permit. The bioassessment program in Red Dog Creek is part of a larger monitoring program that requires aquatic and biomonitoring in Red Dog and Bons Creek drainages. To keep that larger program consistent and intact, it is being incorporated into the department's Waste Management Permit, and duplication here could lead to future inconsistencies. Nonetheless, the following table could be inserted into the NPDES Permit.

Bioassessment Sites	
Sample Site	**Factors Measured**
North Fork	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Main Stem	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use
Ikalukrok Creek	Periphyton (as chlorophyll-a concentrations) Aquatic invertebrates: taxonomic richness and abundance Fish presence and use

Rationale: In accordance with State Regulations 18 AAC 70.240, the department has authority to ensure that existing uses of the waterbody outside the mixing zone are maintained and fully protected. The specified monitoring will provide evidence to the department that the effluent

treatment and mixing zone sizes are adequate to protect all existing and designated uses in the receiving water. The entire biomonitoring program contained in the current NPDES Permit is also required in the Monitoring Plan associated with the Waste Management Permit issued by the department for the management of tailings, waste rock and other wastes at the facility.

In accordance with State Regulations 18 AAC 15.090, the department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records and reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure that all applicable criteria will be met.

In accordance with Federal Regulation 40 CFR 124.53(e)(3) the department shall include a statement of the extent to which each condition of the permit may be made less stringent without violating the requirements of State law. These statements are included above where it states that a change to the draft permit "could" be made in the final permit.

5. The NPDES Permit shall be updated to include the following permit part I.H.2.i.(vi): Ensure that best blasting practices are used in any wet blast holes to minimize the amount of blasting agent that dissolves into the groundwater in the vicinity of the blast hole.

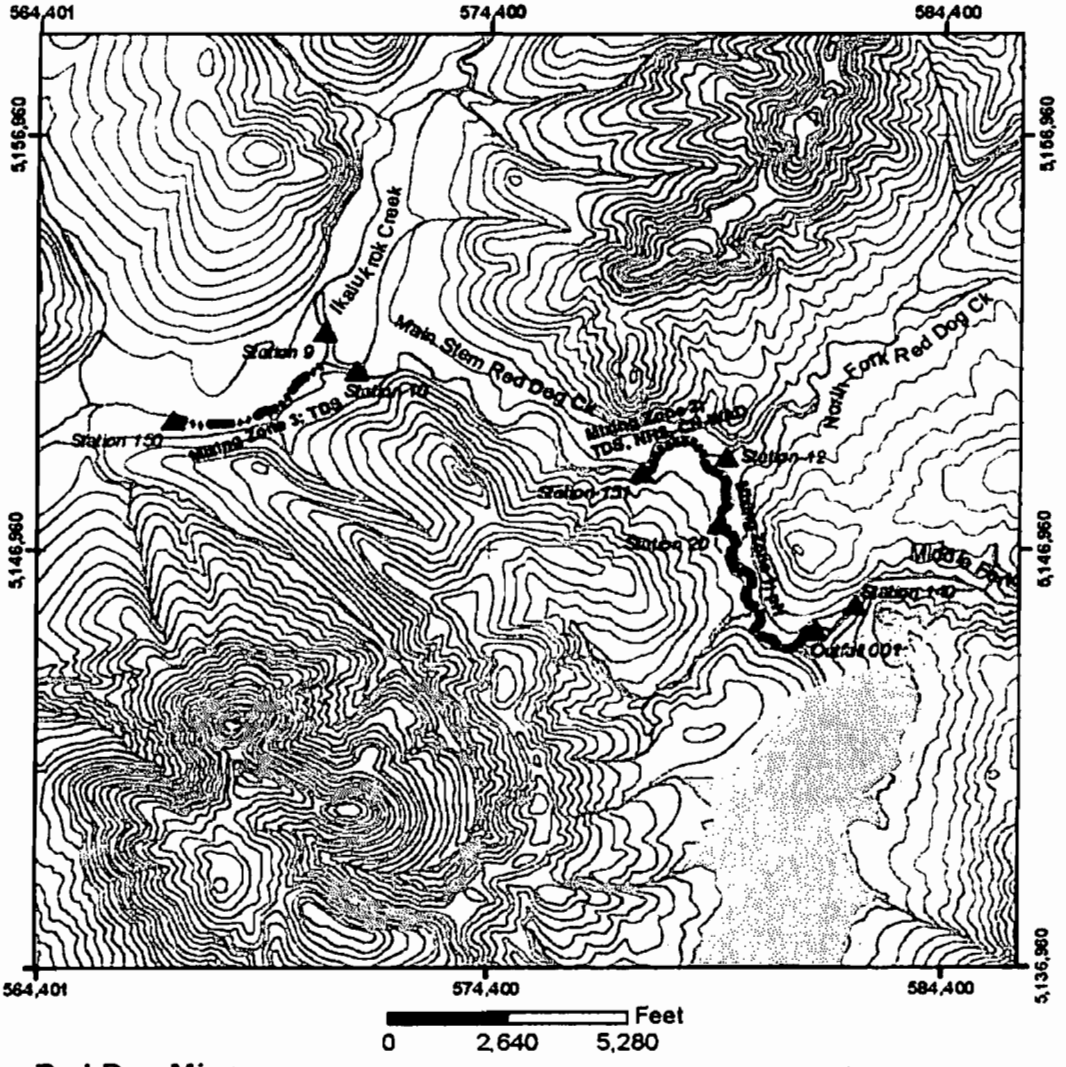
Rationale: In accordance with State Regulations, 18 AAC 15.090, the department may attach terms and conditions to a permit, variance, or approval, including operating, monitoring, inspection, sampling, access to records, reporting requirements, and the posting of a performance bond or other surety, that it considers necessary to ensure all applicable criteria will be met. The department considers this requirement necessary to ensure that appropriate source control measures are undertaken to minimize the amount of ammonia in the effluent.

December 15, 2009
12/15/2009
Date

Sharmon Stambaugh
Program Manager
Wastewater Discharge Program

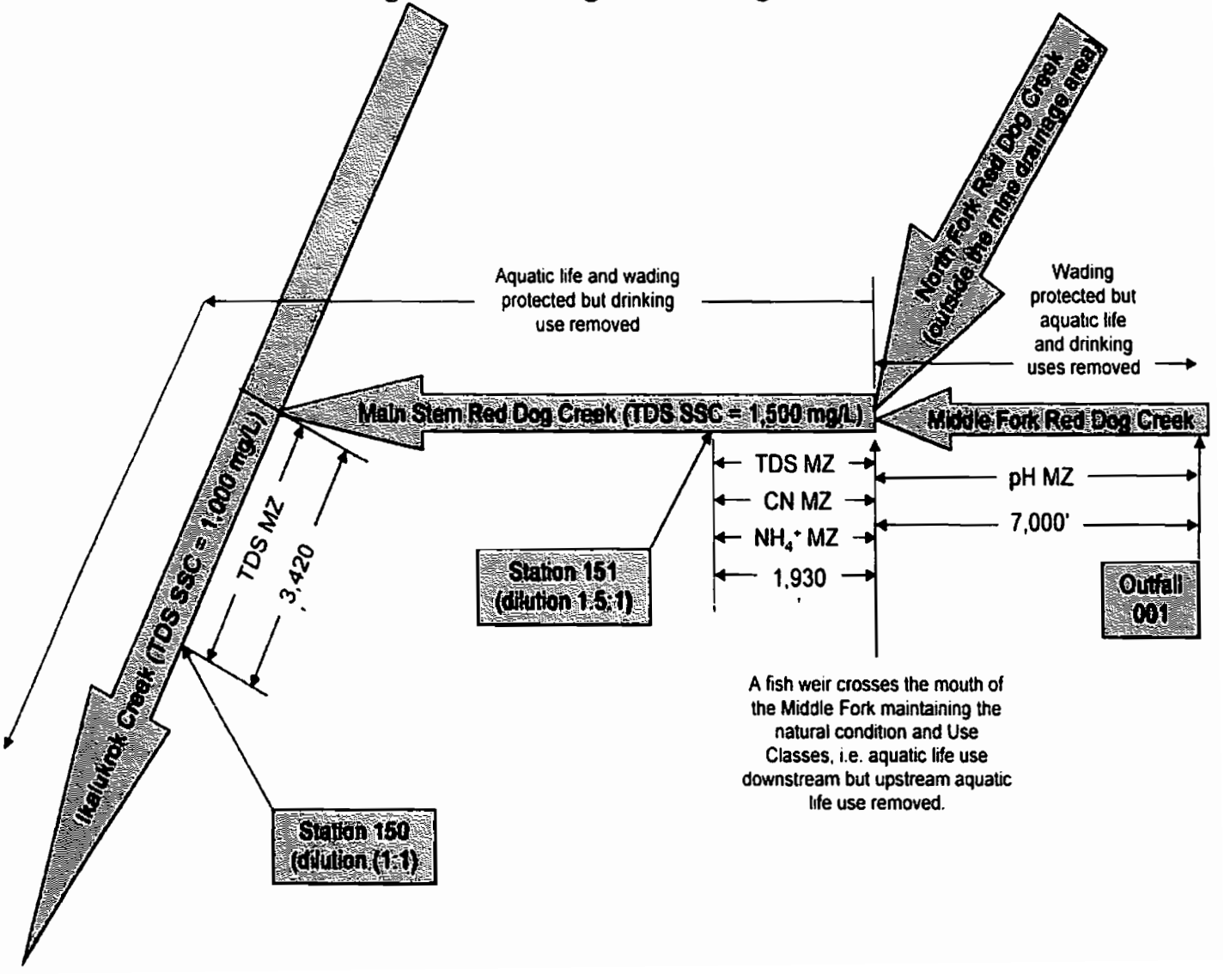
Attachment A

Red Dog Mine Mixing Zones



Attachment B

Diagram of Red Dog Mine Mixing Zones



APPENDIX A
ANTIDEGRADATION ANALYSIS OF THE CERTIFICATE OF REASONABLE ASSURANCE FOR NPDES PERMIT AK-003865-2

The antidegradation policy of the Alaska Water Quality Standards (18 AAC 70.015) states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected. This appendix analyzes and provides rationale for the department's decisions in Section 401 Certification with respect to the antidegradation policy.

The department's approach to implementing the antidegradation policy found in 18 AAC 70.015 is based on the requirements in 18 AAC 70 and Chapter 4 of EPA's Water Quality Standards Handbook (Second Edition 1993). Using these requirements and policies, the department determines whether a waterbody or portion of a waterbody is classified as Tier 1, Tier 2, or Tier 3. Antidegradation analysis was applied on a pollutant-by pollutant basis. For Tier 2 water, antidegradation analysis under 18 AAC 70.015(a)(2) was applied to permit limits that were relaxed or others which the department concludes should be subjected to antidegradation analysis.

The waters of Red Dog Creek are atypical of most undeveloped Arctic streams because of the high concentrations of cadmium, lead, and zinc that enter the Lower Middle Fork of Red Dog Creek (Lower Middle Fork) as it flows through a highly mineralized orebody. The unique character of the Red Dog mineralization and its interaction with ground and surface waters was recognized in scientific studies of the area in the late 1970s and early 1980s (e.g. Ward and Olson 1980). Natural levels of metals were known to be unusually high, and fish kills in the Main Stem of Red Dog Creek (Main Stem) were documented. From 1981 through 1984, Cominco Alaska funded a series of baseline studies to document water quality and biological conditions in Red Dog Creek, Ikalukrok Creek, and the Wulik River (Houghton 1983, Peterson and Nichols 1983). In 1982, the department funded a detailed toxicological, biophysical, and chemical assessment of Red Dog Creek (EVS Consultants, Ltd. 1983). These studies formed the basis for addressing aquatic and water quality impacts associated with the development of the Red Dog Mine Project in the 1984 Environmental Impact Statement.

Water in the Middle Fork of Red Dog Creek (Middle Fork), beginning adjacent to the highly mineralized orebody, was naturally degraded and remained in this condition downstream to the confluence with the South Fork of Red Dog Creek (South Fork) (Peterson and Nichols 1983). The Middle Fork flowed directly over heavily mineralized rock, and the creek received surface and groundwater draining from the orebody, which contained high metal and sulfide concentrations (U.S. Environmental Protection Agency and U.S. Department of the Interior. 1984). Recovery of water quality began at the confluence of the Middle Fork and the South Fork, but was not particularly significant until flow from the North Fork of Red Dog Creek (North Fork) diluted the Middle Fork to form the Main Stem.

As discussed above, Red Dog and Ikalukrok Creeks have been documented to have naturally occurring water quality conditions that precluded some designated uses, which have been removed (see 18 AAC 70.230(e)(8) and (18-20)). Specifically, the Lower Middle Fork of Red

Dog Creek (Lower Middle Fork) is only classified for contact recreation (wading only), industrial, and secondary recreation (except fishing) uses. This segment is considered a "Tier I" waterbody under 18 AAC 70.015(a)(1), therefore protection of existing uses is the threshold for compliance with Alaska's antidegradation policy. All of the requirements in the permit will ensure protection of these uses. This includes the mixing zone for pH, which will not affect either the instream levels or the existing recreational/contact uses of the segment. The actual contact uses generally only include sampling by mine and agency personnel that will not be impacted by the elevated pH in the immediate vicinity of the discharge.

The Main Stem is classified for growth and propagation of fish, shellfish, and other aquatic life. Aquatic biomonitoring at the Red Dog Mine began in 1990 and has continued annually since then. As noted above, monitoring conducted prior to mining activities showed water quality and aquatic life impacts extending into the Main Stem. Aquatic biomonitoring and ambient water quality monitoring conducted during mine operations demonstrates that the effluent from the facility does not harm existing aquatic life in the Main Stem or Ikalukrok Creeks. These results are summarized in the Comparison of Mainstem Red Dog Creek Pre-Mining and Current Conditions (Scannell, 2005) and the Supplemental Environmental Impact Statement associated with the 2009 NPDES Permit reissue.

Conservatively, the department assumes that the Main Stem and Ikalukrok Creek are Tier II waterbodies. This antidegradation analysis considers changes made in the 2009 permit that relax comparable effluent limits included in the 1998 permit, except, as discussed below, with respect to certain aspects of the total dissolved solids (TDS) limits. The department found the TDS limits consistent with the antidegradation policy pursuant to its Section 401 Certification of the 2003 modification of the 1998 permit. The 1998 permit limits were previously found to be consistent with the State's antidegradation policy.

The specific changes made to effluent limits that are subject to antidegradation analysis include:

- The permit includes more stringent limits for cadmium, copper, and pH than the 1998 permit and the permit includes new limits for nickel and aluminum without a mixing zone. For these pollutants, the permit is more stringent than the previous permit and no antidegradation analysis is required.

- The permit's selenium average monthly effluent limit (AMEL) is more stringent than the 1998 permit, i.e. 4.4 compared to 4.9 µg/L. The selenium maximum daily effluent limit (MDEL) is less stringent than the 1998 permit, i.e. 7.2 compared to 5.6 µg/L. These minor and offsetting changes are the result of statistical variability in data sets used to determine effluent limits. Although, it is the department's judgment that these changes will not affect the levels of these pollutants in the discharge, antidegradation review will be undertaken later in this appendix for the less stringent selenium MDEL.

- The permit's lead AMEL is less stringent than the 1998 permit, i.e. 8.5 compared to 8.1 µg/L, and the lead MDEL is more stringent than the 1998 permit, 18.3 µg/L compared to 19.6 µg/L. These minor and offsetting changes are the result of statistical variability in data sets used to determine effluent limits. Although, it is the department's judgment