

PROTOCOL FOR EVALUATION OF FUGITIVE DUST SOURCES OF LEAD AND ZINC AT RED DOG MINE

Prepared for:

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1.0 INTRODUCTION

The purpose of the study described in this protocol is to address the State of Alaska's (State) concerns on the relative contribution of the various fugitive sources to ambient dust levels. This "source contribution evaluation" involves a mine/mill wide inventory of potential fugitive dust sources followed by an evaluation, using an air dispersion model, of the relative concentration. The predicted concentrations will be compared to measured values where such data are available.

1.1 PROPOSED FUGITIVE DUST STUDY

The first step in the proposed fugitive dust study is to carry out a detailed evaluation of dust sources at the Red Dog Mine and Mill facility to assist in evaluation of the relative importance of the various dust sources and in the evaluation of any potential future dust control measures as may be proposed. This will be followed by an air dispersion model assessment to determine the relative concentrations of lead and zinc potentially attributable to mine sources. In addition, it is important to understand the proposed modeling is a special study intended for evaluation of potential impacts of the lead and zinc dust deposition on the surrounding tundra and is not intended to supplant or replace any analysis prepared in support of a PSD or other regulatory initiative. Finally, given the complex terrain and meteorological conditions at the Red Dog site, it is proposed that the CALMET/CALPUFF modeling system be used as the basis for the air dispersion component of the proposed study.

1.2 FACILITY DESCRIPTION AND OUTLINE OF PROPOSED PROJECT

The Red Dog facility has been mining and milling lead/zinc ore since late 1989. The ore the mine processes contains lead (5-10%) and zinc (20-25%). Zinc concentrate from the mill contains approximately 56% zinc and 3% lead, while lead concentrate from the mill contains approximately 55% lead and 12% zinc. The waste rock also has relatively high lead (1-2%) and zinc (1-5%) contents. The handling of these materials has resulted in deposition of lead and zinc particulate material in the areas surrounding the mine and mill sites. In the early years of operations, several sources of lead and zinc dust were not well controlled. Over the past 15 years, the mine and mill has made numerous modifications to ore storage, transportation and milling operations to reduce the release of lead and zinc dust, including:

Start of mining operations (late 1989)

Road Controls

- 1992 CaCl applications intensified for mill site roads and lay down areas
- July 1992 additional water truck for roads

Crushers

- Dec 1995 - existing 5000 cfm baghouse for jaw crusher with a new 7000 cfm baghouse
- Mar 2002 installed gyro crusher dump pocket dust control stilling curtains
- Jan- Nov 1995 crusher feed stockpiles moved into pit, and reintroduced Nov 2004

Coarse Ore Stockpile

- Coarse ore stockpile partially enclosed - 1990-1992 with tarping
- August 1992 coarse ore stockpile enclosure completed;

Concentrate Storage and Loadout

- Oct 1992 concentrate truck loading bay fully enclosed
- July 2001 summer concentrate truck wash system installed;
- Nov 2001 new concentrate truck trailers with improved cover system
- Nov 2001 stilling curtains installed in concentrate storage truck drive-through
- Oct 2003 relocated Mine CSB concentrate conveyor take-up pulley
- July 2004 Installed fans to draw entrained dust from concentrate truck loading operations

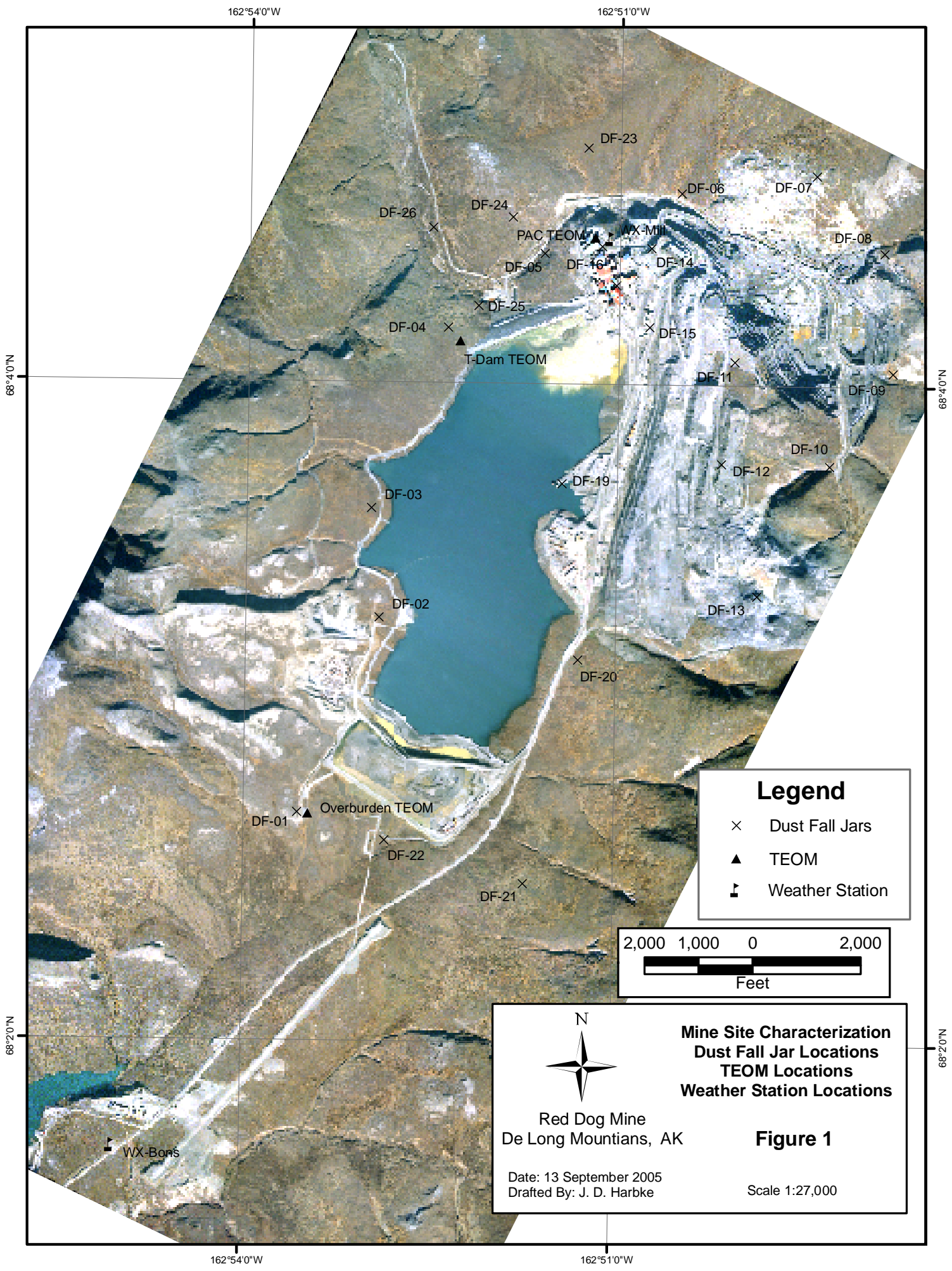
Tailings Impoundment

- Summer 2001 installed eight "windrows" comprised of waste rock 6' high 16' wide 150' long; added Soil-Sement palliative to a portion of beach
- Summer 2003 flooded tailings beach;

The Teck Cominco Red Dog mine conducted soil and vegetation investigations in 2003 and 2004 to better understand the spatial extent of the lead and zinc deposition. These studies identified areas surrounding the mine and mill sites that were being affected by lead and zinc deposition.

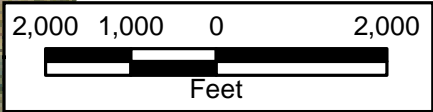
To more fully understand the extent of the deposition since the beginning of operations Teck Cominco has undertaken a program to develop a historic emission inventory and air dispersion modeling exercise as described in this protocol report. This will allow Teck Cominco to determine how much of the lead and zinc deposition may have been due to historic activities vs. current operations. Also, development of the emission inventory for existing operations will provide Teck Cominco with a tool to assist in decisions for prioritizing sources for potential application of dust control in the future. Together, these data are intended to provide the State with the information it needs concerning source contribution allocation and related fugitive dust issues.


The overall approach of this study protocol is to develop emission inventories for representative years (1990, 2000, 2003 and current) and to use an air dispersion model to calculate lead and zinc concentrations in air and deposition rates in the vicinity of the Red Dog Mine Site. Teck Cominco has air quality monitoring data from several locations which will allow for validation of the results of the emission summary/dispersion modeling. Teck Cominco also operates meteorological stations at the mill site and at the airport. (Figure 1).



Legend

- x Dust Fall Jars
- ▲ TEOM
- ▣ Weather Station




Mine Site Characterization
Dust Fall Jar Locations
TEOM Locations
Weather Station Locations

Red Dog Mine
 De Long Mountains, AK

Figure 1

Date: 13 September 2005
 Drafted By: J. D. Harbke

Scale 1:27,000

2.0 EMISSION INVENTORY METHODOLOGY

The following are potential sources of particulate matter (dust) containing lead and zinc from the Red Dog operations. The sources essentially track the process from the extraction of the ore and waste rock, to the transport of the concentrate away from the mill facility. Table 2.1 provides the emissions estimation method that is proposed to be used to develop the emissions inventory. Because activities have changed since the beginning of operations, several time periods will be evaluated. These were selected to reflect time frames when substantial changes were made that may have affected the future dust emissions. The emissions for each time frame will be used to develop a historic emissions inventory over the life of the mine. Figure 2 provides a general idea of the locations of the various potential fugitive dust sources. Figure 3 provides a conceptual mill process flow sheet which may be useful in considering the potential sources of fugitive dust in Tables 2.1 and 2.2. Some of the factors that will influence emissions for each time frame are:

1990 (2477 tonnes mined/day) to represent activities until 1992

- start of mining operations (late 1989)

2000 (8366 tonnes mined/day) to represent activities from 1993 through 2000

- 1992 CaCl applications intensified for mill site roads and lay down areas
- July 1992 additional water truck for roads
- Dec 1995 - existing 5000 cfm baghouse for jaw crusher with a new 7000 cfm baghouse
- Coarse ore stockpile partially enclosed - 1990-1992 with tarping
- August 1992 coarse ore stockpile enclosure completed;
- Oct 1992 concentrate truck loading bay fully enclosed

2003 (8650 tonnes mined/day) to represent activities from 2001 through 2003

- July 2001 summer concentrate truck wash system installed;
- Nov 2001 new style of concentrate haul truck and trailers fully utilized
- Nov 2001 stilling curtains installed in concentrate storage truck bay
- Summer 2001 installed eight "windrows" waste rock 6' high 16' wide 150' long; added Soil-Sement palliative to a portion of beach
- March 2002 installed gyro crusher drop box dust control stilling curtains
- Summer 2003 flooded tailings beach;

Current/Future

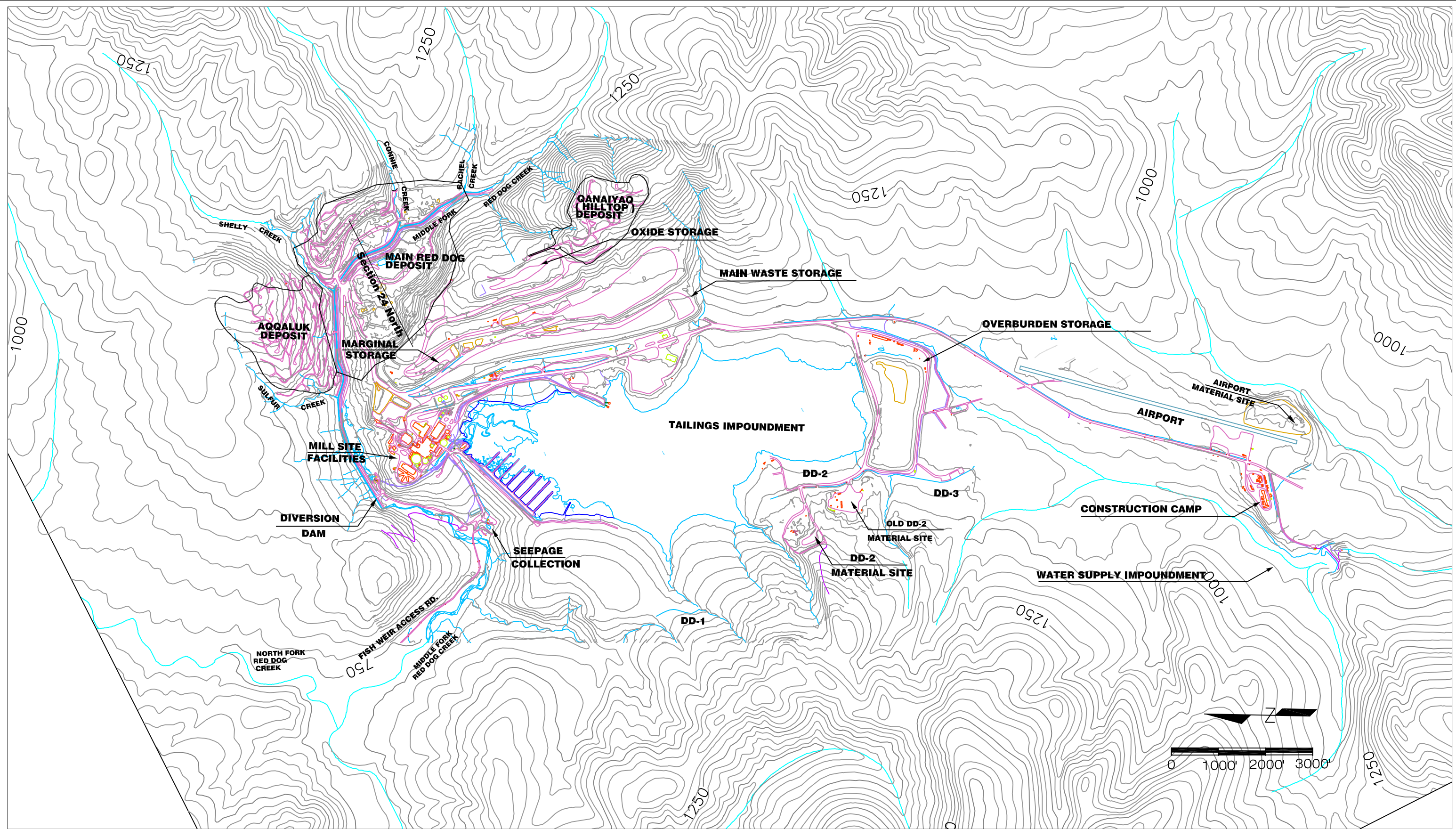
- July 2004 Installed fans to draw entrained dust from concentrate loadout
- Late 2004 - crusher feed stockpiles moved into pit
- Proposed baghouse dust control for crusher(s)

AP-42 is a U.S.EPA standard reference for emission factors, and will be used to develop emissions of total dust. Appropriate lead and zinc concentrations based on records of site operations will be applied to each source to determine the lead and zinc emissions from each source. Historic roadbed soil analysis for lead, zinc, and particle size fraction will be utilized to assist in emissions estimation. It is also planned to collect additional samples from several of the

roads and areas for a current particle size assessment. Figure 4 shows the locations at which samples of road dust have previously been collected. The main sources/activities identified to date and the appropriate U.S. EPA AP-42 section are provided in Tables 2.1 and 2.2 for the mine and mill respectively.

Table 2.1 Mine Operations

Activity		Emission Estimation Method
Mining Activities		
1	Drilling (ore and waste)	AP-42 Drilling – Section 11.9
2	Blasting (ore and waste)	AP-42 Blasting – Section 11.9
3	Dozer activity in Blast Area (ore and waste)	AP-42 Dozer Equation – Section 11.9
4	Loading of haul trucks in Blast Area (ore and waste)	AP-42 Drop Equation – Section 13.2.4
5	Loader travel in Blast Area (ore and waste)	AP-42 Travel on Unpaved Roads – Section 13.2.2
6	Haul truck travel in Blast Area (ore and waste)	AP-42 Travel on Unpaved Roads – Section 13.2.2
Ore Handling		
7	Haul truck travel from Blast Area to Ore Storage Area	AP-42 Travel on Unpaved Roads – Section 13.2.2
8	Haul truck unloading at Ore Storage Area	AP-42 Drop Equation – Section 13.2.4
9	Haul truck travel in Ore Storage Area	AP-42 Travel on Unpaved Roads – Section 13.2.2
10	Dozer activity on Ore Storage Stockpile	AP-42 Dozer Equation – Section 11.9
11	Ore Storage Stockpile – Wind Erosion	AP-42 Wind Erosion – Section 13.2.5
12	Loading of haul trucks in Ore Storage Area	AP-42 Drop Equation – Section 13.2.4
13	Loader travel in Ore Storage Area	AP-42 Travel on Unpaved Roads – Section 13.2.2
14	Haul truck travel from Ore Storage Area to Crushers	AP-42 Travel on Unpaved Roads – Section 13.2.2
15	Haul truck travel in Crusher Area	AP-42 Travel on Unpaved Roads – Section 13.2.2
16	Unloading haul truck to each crusher	AP-42 Drop Equation – Section 13.2.4 (currently controlled by sheds) Stilling curtains installed Baghouses to be installed in the future
17	Unloading loader bucket to each crusher (during applicable time periods)	AP-42 Drop Equation – Section 13.2.4
18	Loader travel in Crusher Area (during applicable time periods)	AP-42 Travel on Unpaved Roads – Section 13.2.2
Waste Rock Handling		
19	Haul truck travel from Blast Area to Waste Rock Storage Area	AP-42 Travel on Unpaved Roads – Section 13.2.2
20	Dozer activity on Waste Rock Storage Area	AP-42 Dozer Equation – Section 11.9
21	Haul truck unloading at Waste Rock Storage Area	AP-42 Drop Equation – Section 13.2.4
22	Waste Rock Storage Area – Wind Erosion	AP-42 Wind Erosion – Section 13.2.5



				4		Approved By:			Title: Figure 2 Red Dog Mine Aerial Site View			
				3		Checked By:			MWO or Job No.	Date:	Scale:	Rev.
				2		Drawn By:	SOH			04/26/02	NTS	1
1	Add Preliminary Solid Waste Boundary	10/11/02	SOH	1		Designed By:						
No.	Revision Description	Date	By	No.	Dwg. No.	Reference Drawings	Engineering Review					

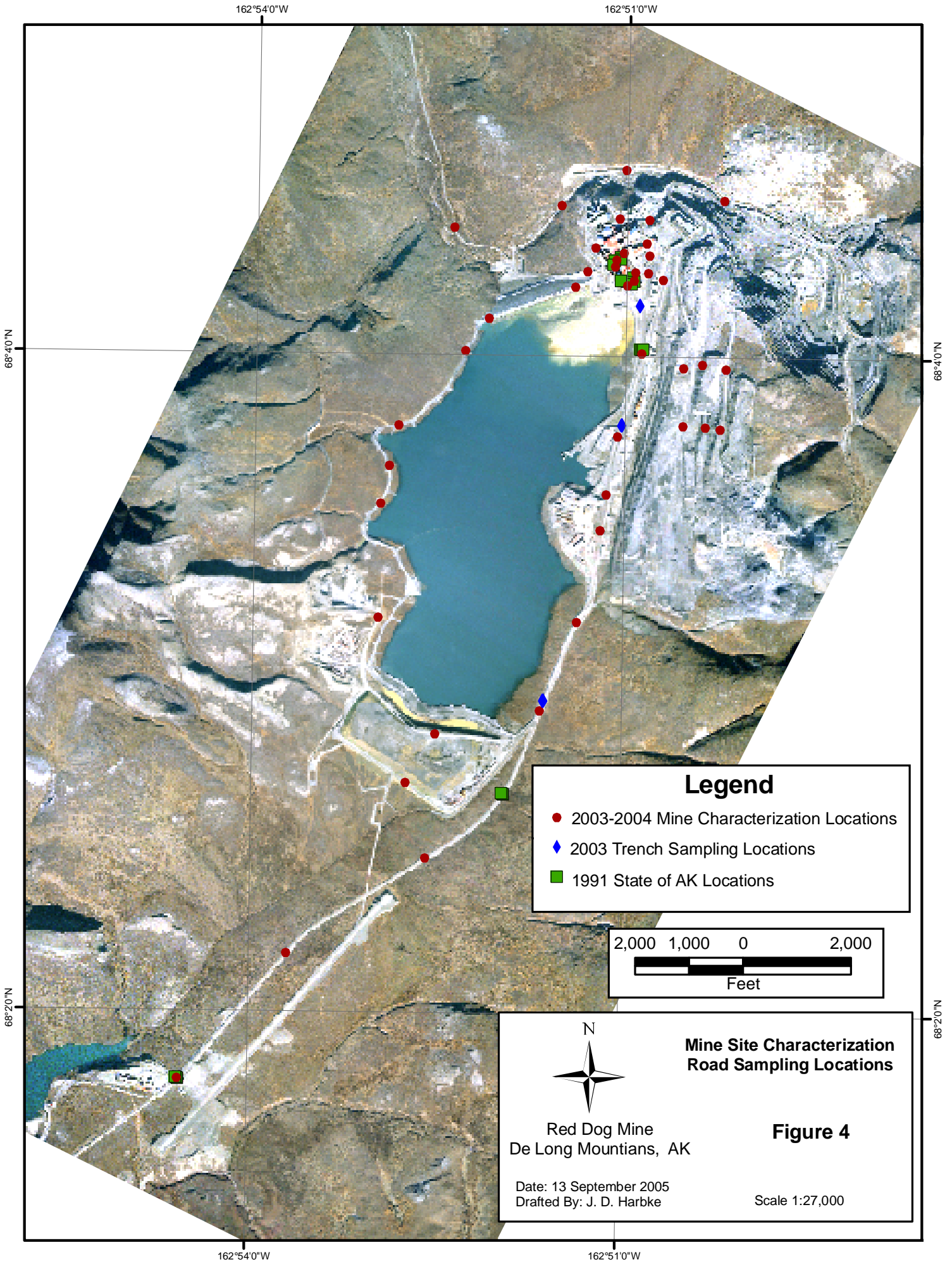


Table 2.2 Mill Operations

Activity		Emission Estimation Method
Crushers		
23	Jaw Crusher Baghouse	Source test emission data
24	Gyratory Crusher Baghouse	Source test emission data
Enclose Ore Stockpile (fully enclosed by 2000)		
25	Fugitive releases from building – prior to full enclosure, dozer work on stockpile would have been a significant contributor.	<ol style="list-style-type: none"> 1. Prior to full enclosure – AP-42 Drop Equation – Section 13.2.4 uncontrolled and AP-42 Dozer Equation – Section 11.9 2. Post enclosure – Estimate of air concentration within building (industrial hygiene measurements) and building ventilation and exhausts from release points.
SAG Mill		
26	SAG Scrubber A	Source test emission data
27	SAG Scrubber B	Source test emission data
28	Fugitive releases from buildings	Estimate of air concentration within building (industrial hygiene measurements) and building ventilation and exhausts from release points.
29	Bucking Room Baghouse	Source test emission data
Concentrate Storage Building (CSB)		
30	Fugitive releases from building	Estimate of air concentration within building (industrial hygiene measurements) and building ventilation and exhausts from release points.
31	CSB loadout – improvements made to loadout control in each time frame	AP-42 Drop Equation – Section 13.2.4 control for enclosure
32	Concentrate truck travel	Road bed and snow samples to be collected and used in conjunction with AP-42 Travel on Unpaved Roads – Section 13.2.2
Tailings Beach		
33	Wind blown tailings – flooded after 2002	AP-42 Wind Erosion – Section 13.2.5 – area of exposed beach off aerial photos. Windrows installed Soil~Sement utilization

3.0 AIR DISPERSION MODELING METHODOLOGY

3.1 MODEL SELECTION

The Red Dog Mine is located in the DeLong Mountains in the Western Brooks Range with elevations ranging from 780 feet to 1500 feet above sea level. The local terrain is characterized as both simple (terrain below stack top) and complex (terrain above stack top); although for this assessment, essentially all points of release would be considered fugitive and hence at ground surface or entrained in the wake of complex flow around buildings. Specific point sources, such as the baghouses and scrubbers will be modelled as point sources considering building wake effects.

The U.S. EPA Guideline on Air Quality Models (40 CFR 51, Appendix W) currently recommends two dispersion models to evaluate impacts on these types of terrain. The Industrial Source Complex Short-Term 3 (ISCST3) model is recommended for simple terrain, and the Complex Terrain Dispersion Model (CTDM Plus) for complex terrain. In very rugged hilly or mountainous terrain, the U.S.EPA Guideline states that CALPUFF modeling system may be more appropriate than the steady-state straight-line transport models (ISCST3 and CTDM Plus). The U.S. EPA states that the CALPUFF modeling system may be applied on a case-by-case basis for air quality estimates in such complex non-steady-state meteorological conditions. Such a situation applies at the Red Dog mine/mill site for the purposes of this study. One of the key aspects of this study is to evaluate lead/zinc dust deposition within and immediately adjacent to the building complex, and throughout the complex valley system within the air permit boundary, where pockets of dust deposition can occur. CALPUFF has more sophisticated dispersion algorithms for this type of analysis, which is not typically required for permitting.

For the Red Dog modeling analysis, SENES proposes to use the CALMET/CALPUFF modeling system. CALMET is a meteorological model that produces hourly, three dimensional gridded wind fields from available meteorological, terrain and land use data. CALPUFF is a non-steady state puff dispersion model that utilizes the CALMET wind fields and accounts for spatial changes in meteorology, variable surface conditions, and plume interaction with terrain. CALPUFF can handle both the simple and complex terrain.

The use of CALPUFF for this application is, according to the proposed Guideline, an alternative refined model. SENES proposes that CALPUFF can be used because:

- i. CALPUFF has received considerable peer review both in a formalized EPA process (Allwine et al, 1998) and in statements made at the 7th Modeling Conference. Each of the reviews urged the use of CALPUFF at distances shorter than 50 kilometers.
- ii. CALMET and CALPUFF have been shown to be applicable to complex situations such as that at the Red Dog Mine site which is not conducive to straight-line Gaussian techniques.

- iii. The Red Dog Mine site has collected more than one year of onsite meteorological data. This data includes two meteorological towers, one with 30-meter height instrumented with temperature, wind speed, wind direction and sigma theta located at the mill and a second (10 m) tower located at the airport. The location of these stations is illustrated in Figure 1. There is at least a one year period, which contains sufficiently continuous data to use in model analysis. Thus, local meteorological data is available and adequate to provide local inputs for CALMET/CALPUFF use. In addition upper air data is available for Kotzebue (26616).
- iv. Comparisons between ISC and CALPUFF for short-range uses, each of these comparisons has shown that CALPUFF often predicts higher concentrations than ISC. This is because of CALPUFF's treatment of calm winds and stagnation conditions. It can therefore be expected that CALMET/CALPUFF will not be biased toward underestimates in this application. In addition, Teck Cominco has collected ambient air quality data at sites generally downwind of the mill site, but inside the ambient air boundary that can be used for benchmarking the results of air dispersion modeling (Figure 5).
- v. This protocol outlines the specific use for this application.

3.2 CALMET

The CALMET model will be used to develop as a minimum, a one-year data set of hourly wind fields for use by the CALPUFF dispersion model to use as reference meteorology for evaluating the air dispersion characteristics for the 3 reference time periods. In addition, in order to facilitate model comparison, it is anticipated the hourly meteorological field will be developed over the domain for hours corresponding to the monitoring data. The CALMET wind field grid will have a 100-meter spacing and cover a 20 by 20-kilometer area centered on the Red Dog mill site. The Red Dog Ambient Air/Permit Boundary, shown in Figure 6 is the primary study area for modeling purposes. The quite large domain for meteorological evaluation was selected to include the prominent terrain features including the DeLong Mountain Range, thus, the entire basin and valley system is included in the development of the wind fields.

Twelve vertical layers will be included for the wind field. The proposed layer heights are:

Level	Heights (m)	Middle Level Height (m)
1	0-20	10
2	20-50	35
3	50-100	75
4	100-200	125
5	200-300	250
6	300-400	350
7	400-500	450
8	500-800	650
9	800-1000	900
10	1000-1500	1250
11	1500-2000	1750
12	2000-2300	2650

The mixing heights in “A Mixing Height Study for North America (1987-1991) were reviewed to ensure that the top of the grid is well above the expected climatological mixing heights. This pattern of rising layers follows the guidance from the user’s manual in terms of gradually increasing layer depth with height.

The CALMET model requires as input, a control file that defines the wind field grid parameters and model option switches, surface and upper air meteorological data, land use data and terrain data. A description of the meteorological data proposed for use in this analysis is provided below:

3.2.1 Meteorology

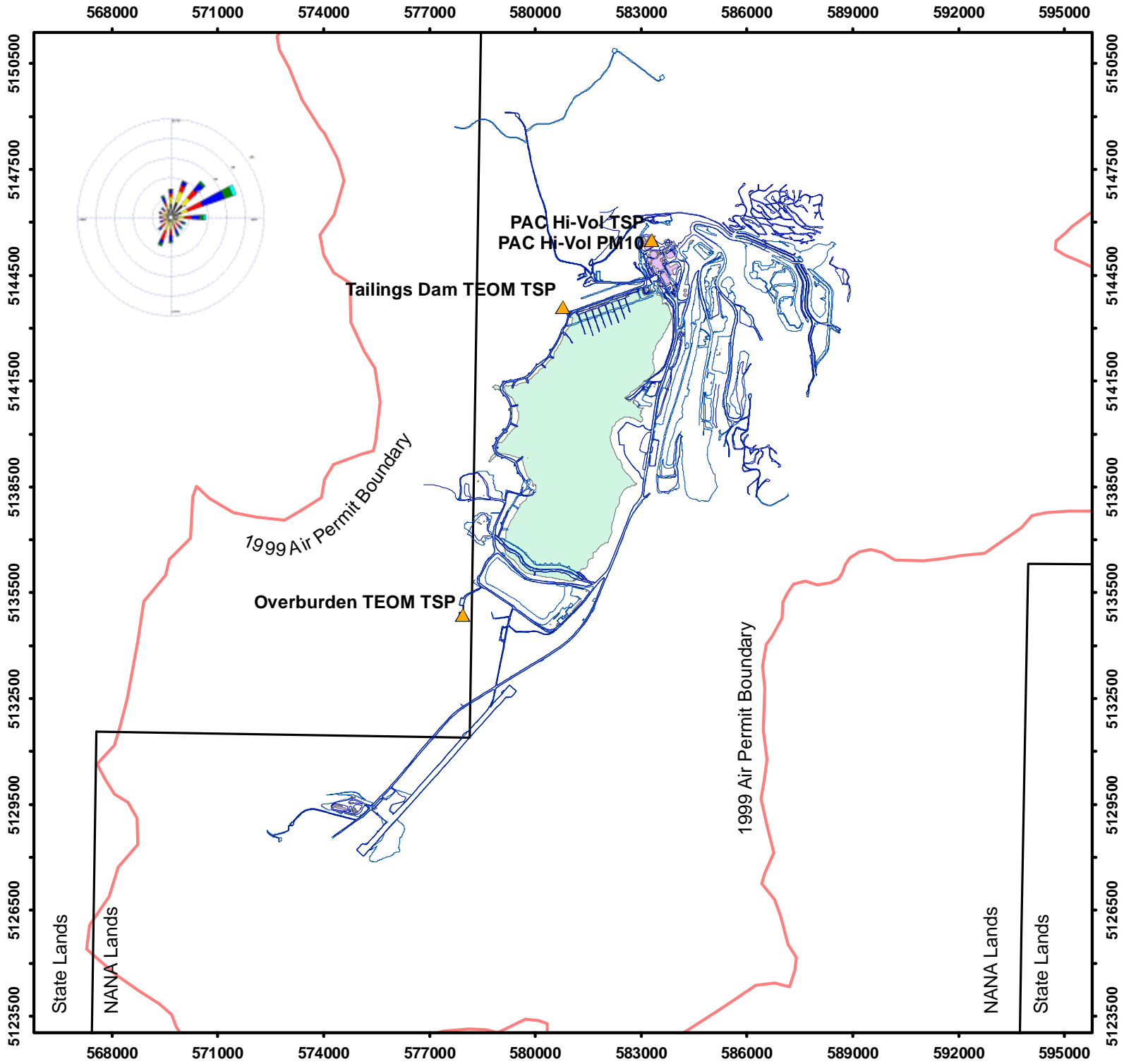
The CALMET model uses all available meteorology data within a defined modeling domain to compute gridded wind fields. CALMET requires, at a minimum, one surface station and one upper air (sounding) station. Red Dog has two on-site meteorological stations, one close to the airport, and one at the mill. CALMET requires that at least two upper air soundings are available, daily, and there is wind and temperature data at the bottom and top layer of the modeling domain. The most recent full-year hourly meteorological data sets (January 1, 2003 – December 31, 2004) from the on-site stations and upper air data from Kotzebue will be used to create a surface data set.

3.2.2 Terrain Data

Gridded terrain data for the modeling domain are available in 1 deg digital elevation models (DEMs) files (~90m resolution), and detailed site elevations will be incorporated in the CALMET modeling . The 1-deg DEMs are available through the United States Geological Survey (USGS) Internet site. The DEM data will be processed into CALMET formats using the terrain-processing program TERREL that is provided with the CALMET/CALPUFF modeling system. An illustrative map of the near field terrain data is shown in Figure 7.

3.2.3 Land Use Data

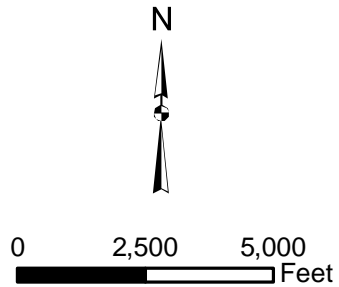
Land use data are not available in this region from the USGS. Nonetheless, local knowledge based on the site visits indicates that land use in the area can be modeled as tundra, wetland, land surface disturbed by mining, and the flooded tailings pond, which will be modelled as a water body. The tailings beach, which has been exposed during different time-frames will also be considered. The initial land use data was created for the modeling through external processing and the final input in the CALMET is presented in Figure 8. This initial data will be updated with additional wetland and surface water body information prior to modelling. The land use categories for use in CALMET are based on the USGS land use classification system. These are listed in Table 3.1. Beyond this near field area, land use is all tundra or mined areas.

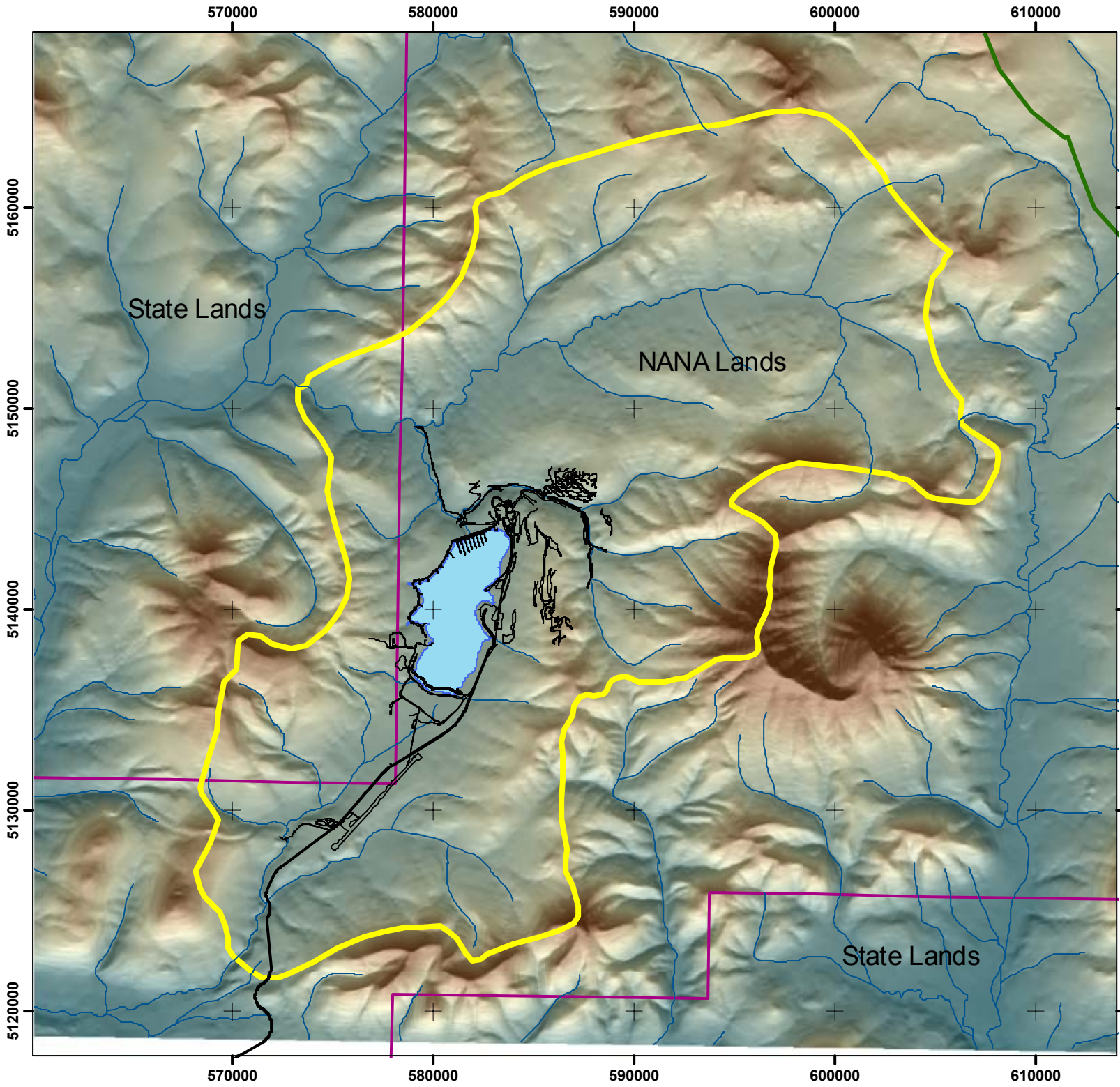


Teck Cominco Alaska Red Dog Mine Site




▲ Mine Air Monitoring Locations

Figure 5





Teck Cominco Alaska Red Dog Mine Area Alaska

-  Ambient Air Boundary
-  State / NANA Boundary
-  Noatak National Preserve

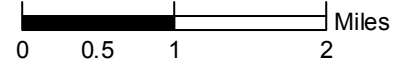


Figure - 6

Figure 7. Terrain Data In CALMET Modeling Domain

Terrain - Combined DEM and Site Fine Terrain for CALMET Input
100 by 100 m resolution - Modelling Domain 20 by 20 km

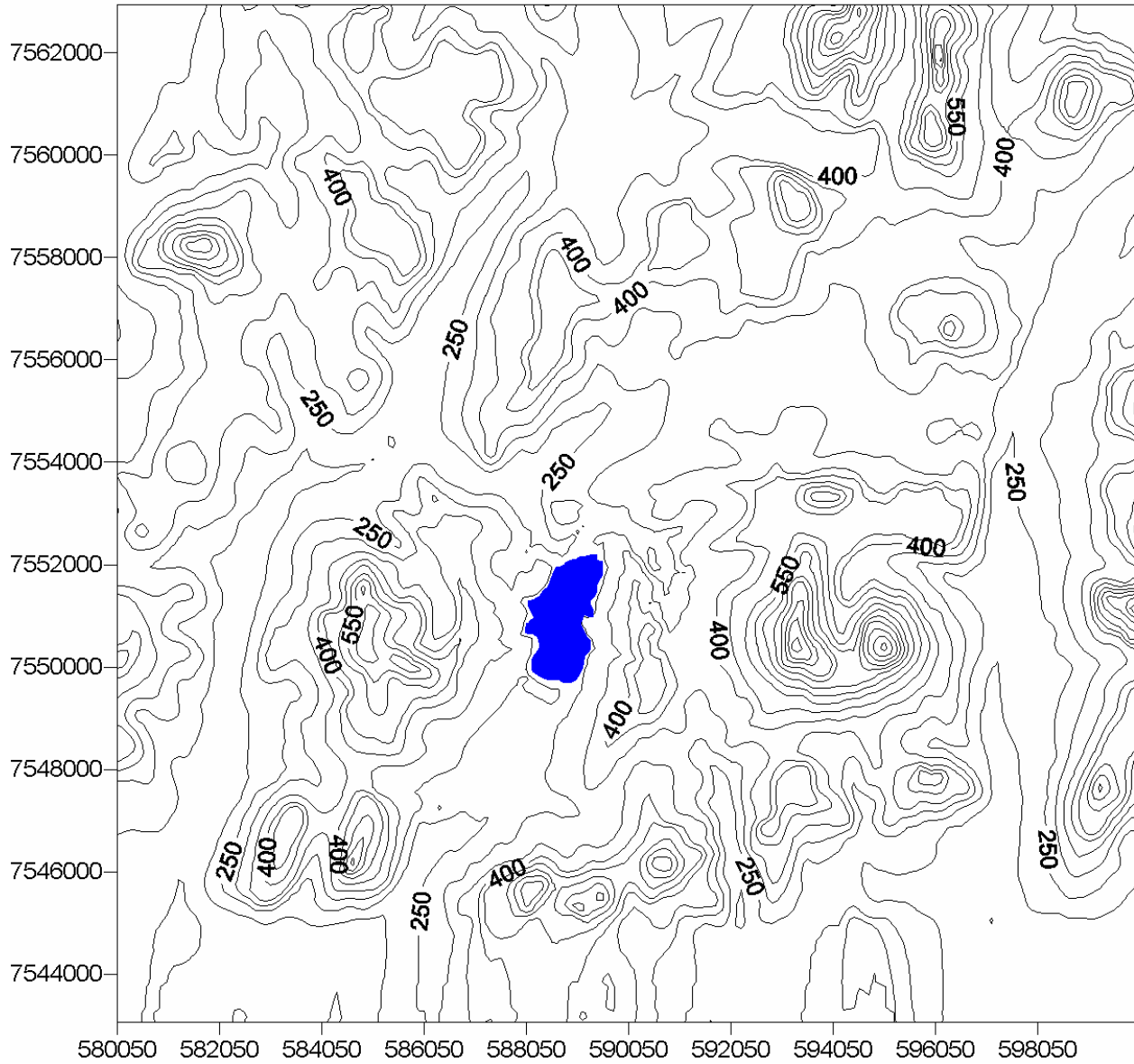


Figure 8 - Land Use Categories Surrounding the Red Dog Site

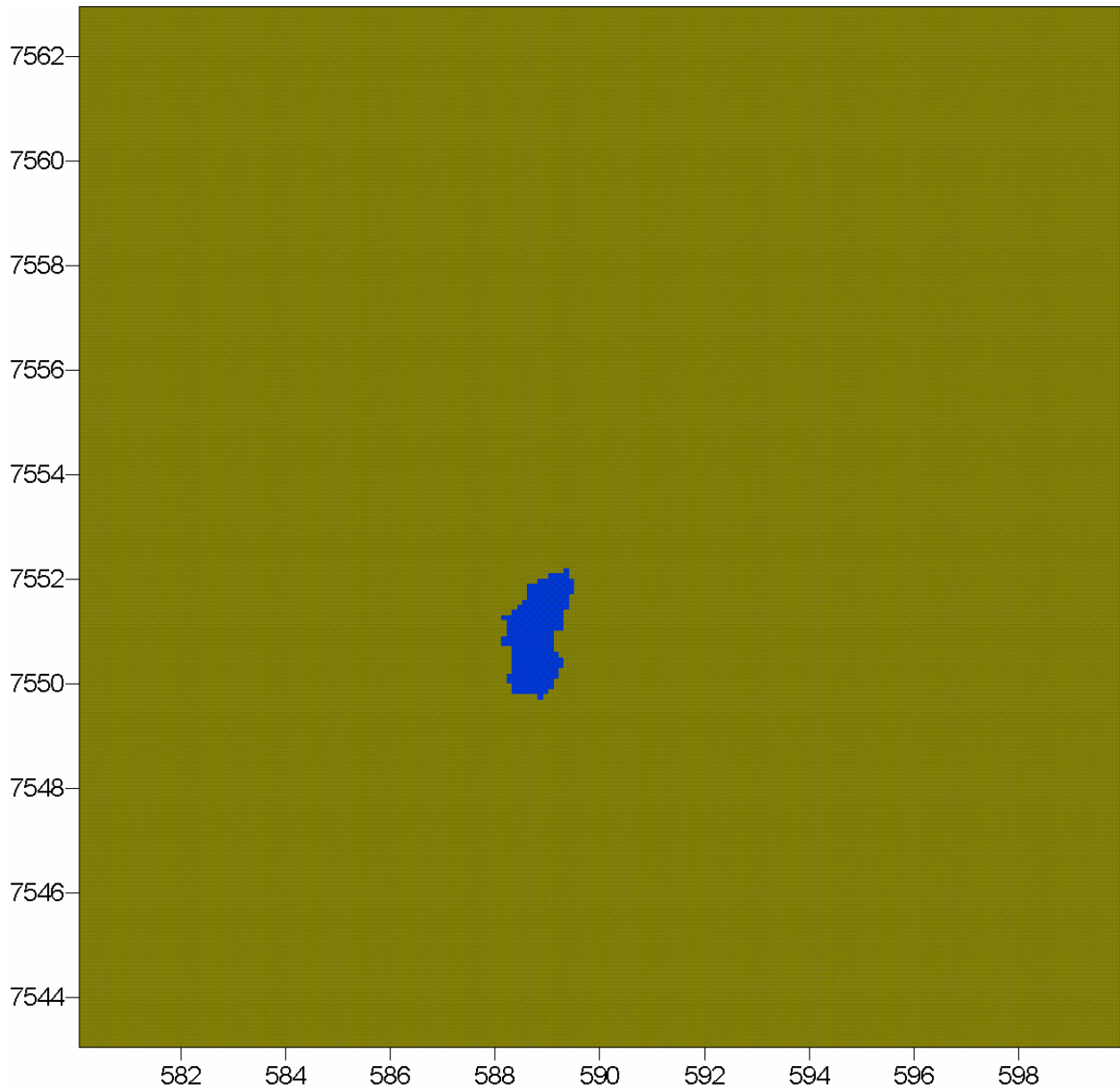


Table 3.1
 CALMET Land Use Categories Based on the U.S. Geological Survey
 Land Use and Land Cover Classification System (52-Category System)

	Level I		Level II
10	Urban or Built-up Land	11 12 13 14 15 16 17	Residential Commercial and Services Industrial Transportation, Communications and Utilities Industrial and Commercial Complexes Mixed Urban or Built-up Land Other Urban or Built-up Land
20	Agricultural Land — Unirrigated	21 22 23 24	Cropland and Pasture Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas Confined Feeding Operations Other Agricultural Land
20	Agricultural Land — Irrigated	21 22 23 24	Cropland and Pasture Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas Confined Feeding Operations Other Agricultural Land
30	Rangeland	31 32 33	Herbaceous Rangeland Shrub and Brush Rangeland Mixed Rangeland
40	Forest Land	41 42 43	Deciduous Forest Land Evergreen Forest Land Mixed Forest Land
50	Water	51 52 53 54 55	Streams and Canals Lakes Reservoirs Bays and Estuaries Oceans and Seas
60	Wetland	61 62	Forested Wetland Nonforested Wetland
70	Barren Land	71 72 73 74 75 76 77	Dry Salt Flats Beaches Sandy Areas Other than Beaches Bare Exposed Rock Strip Mines, Quarries, and Gravel Pits Transitional Areas Mixed Barren Land
80	Tundra	81 82 83 84 85	Shrub and Brush Tundra Herbaceous Tundra Bare Ground Wet Tundra Mixed Tundra
90	Perennial Snow or Ice	91 92	Perennial Snowfields Glaciers

3.2.4 CALMET Switches

The switches in Input Groups 1 - 4 are set as required for the nature of the run, the grid sizes, and the outputs desired. Input Group 5 contains the windfield model options. Those that do not follow the default recommendations are:

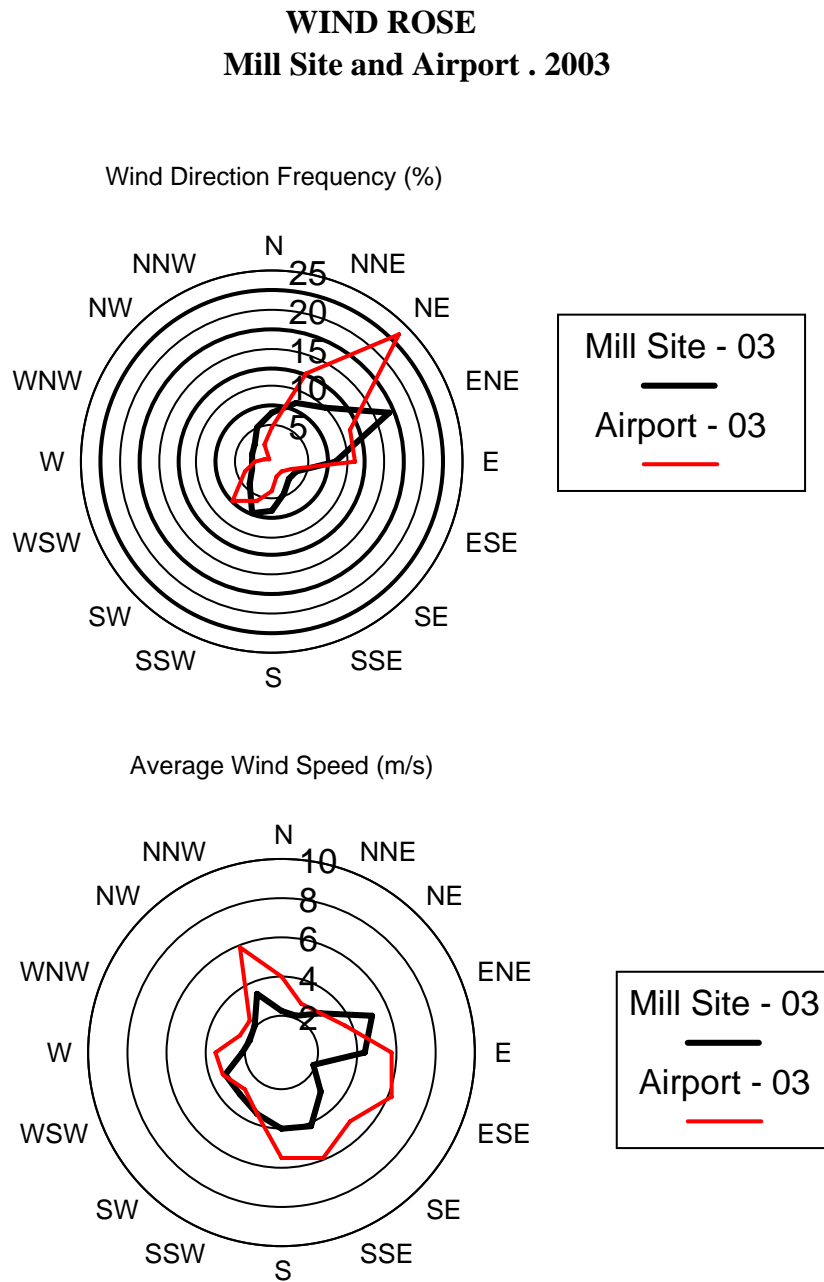
- INPUT Group 1..... Defaults + Data Entry
- INPUT Group 2..... Defaults + Data Entry

- INPUT Group 3..... Defaults + Output Options
- INPUT Group 4..... Defaults
- INPUT Group 5.....
 - 1KINE = 0 which is the correct default (model output of default value in error) and kinematic effects are not computed.
 - RMIN2 set to 20 which allows surface winds at Mine Site to be extrapolated but not at the plant meteorological site.
 - RMAX1 set to 10 kilometers, RMAX2 was set to 500 meters to insure that surface terrain had adequate influence over the windfield.
 - TERRAD set at 10 kilometers, again so that the terrain would have adequate influence.
 - R1 and R2 are set at 1 in order to enhance the effect of the upper layer windfield.
 - NINTR2 set at 2 because there are 2 meteorological data sets
- INPUT Group 6
 - MNMDAV set to 10 kilometers to enhance the special averaging of windy heights.
 - ZIMIN and ZIMINW are set to 20 meters instead of 50 meters to be more conservative.
 - NVMTS set to 2 because there are only two upper air stations.
 - SIGMAP set to 30 kilometers although precipitation is not being used.
- INPUT Group 7..... Station Variables
- INPUT Group 8..... Upper Air Stations
- INPUT Group 9..... Precipitation Stations (not used)

The above settings were determined based on comparison of the measured wind conditions at the measurement sites with the CALMET predicted winds and professional experience.

CALMET results will be compared to meteorological observations at the Mill and Airport stations. Figure 9 represents the wind roses for 2003 based on hourly meteorological observations (subject to modification).

Figure 9 - Annual Winds Roses for Mill and Airport Meteorological Stations



3.3 CALPUFF MODELING

The CALPUFF dispersion model will be used to assess the air concentrations and deposition rate of lead and zinc from the Red Dog Mine for current conditions. Once it is determined that the model is performing well, emissions from the different historic time frames will also be modeled. To evaluate the performance of the air dispersion model, predicted air concentrations will be compared to results from sampling programs (Figure 5) for a representative number of meteorological conditions and subject to a statistical analysis of model performance. At this time it is proposed to use the CALPUFF deposition algorithms to calculate deposition rate. Particle size distributions will be developed from on-site data, where available. Otherwise, default particle size distributions will be developed using particle data provided in U.S.EPA AP-42.

The CALPUFF model utilizes parameterized source information and CALMET derived wind fields to estimate pollutant concentrations at receptor points located within the CALMET grid. A brief description of the model input requirements is outlined below.

3.3.1 Source Parameters

Essentially all of the sources are fugitive in nature. The source parameters will be fully defined as part of the development of the emission estimates for the different time frames.

3.3.2 Receptors

The initial modeling receptor grid proposed for these analyses will consist of a fine grid near the mine and mill operations and a coarser grid further out. The fine grid will consist of receptors placed at 100-meter intervals along the Red Dog Air Quality Boundary and up to 1 km from the mine and mill. In addition, a number of specific receptors locations (i.e. monitoring stations) will be identified by Red Dog personnel. A 250-meter increment Cartesian receptor spacing will be used from 1 km to 2.5 km, 500-meter spacing out to the ambient air boundary and approximately 1 km beyond the boundary. Should the maximum impacts be predicted at the coarser grid receptors, the area around the highest and second highest receptors will be further refined to 100-meter spacing to identify the location of maximum impacts.

Each receptor point will be modeled with a representative terrain elevation. The terrain elevations will be extracted from the CALMET input files. Each receptor point is defined as a UTM coordinate with its respective terrain elevation in meters. The resulting receptor file compared well when checked against USGS topographical maps for accuracy.

3.3.3 Model Options

The CALPUFF model provides multiple options for evaluating modeling scenarios. For the Red Dog analysis the model is proposed to run using model default settings for most parameters.

4.0 BACKGROUND CONCENTRATIONS

Teck Cominco collected ambient air samples in Noatak (located approximately 35 miles S of the mine and Kivalina (located approximately 45 miles SW of the mine) for one year. The results of these monitoring programs are assumed to provide background ambient air concentrations for a point of comparison.

5.0 PRESENTATION OF RESULTS

The results of the study will be fully documented in a report which describes the study methodology, all data and assumptions, and results. At this time, the presentation of results will include:

- A. Tabular format of first highest and second highest plus associated background concentration for comparison to the NAAQS for lead.
- B. Isopleths for concentration and deposition
- C. Electronic copies of CALMET and CALPUFF output files