

**DRAFT ENVIRONMENTAL BASELINE STUDIES
2005 STUDY PLANS**

CHAPTER 2. METEOROLOGY

JUNE 2005

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ACRONYMS

AASHTO	American Association of State and Highway Transportation Officials
ABA	acid base accounting
ACHP	Advisory Council on Historic Preservation
ACLS	alternative cleanup levels
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
agl	above ground level
AHRS	Alaska Heritage Resource Survey
APE	area of potential effect
ARD/ML	acid rock leaching/metal leaching
ASCI	Alaska Stream Condition Index
BEESC	Bristol Environmental & Engineering Services Corporation
BMR	baseline monitoring report
CC	comprehensive stations with continuous stage monitoring
CH2M	CH2M HILL, Inc.
CIR	color infrared
CWOC	comprehensive stations without continuous stage monitoring
DECD	Alaska Department of Economic and Community Development
DNR	State of Alaska Department of Natural Resources
DO	dissolved oxygen
DOT&PF	State of Alaska Department of Transportation & Public Facilities
DQOs	data quality objectives
EC	environmental consequences
EIS	environmental impact statement
EPA	Environmental Protection Agency
EBD	environmental baseline document
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FSP	field sampling plan
GIS	geographic information system
GPS	global positioning system
HGM	hydrogeomorphic
IM	initial monitoring station
mg/L	milligrams per liter

mm	millimeters
MRLs	method reporting limits
NDM	Northern Dynasty Mines Inc.
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic & Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORP	oxidation reduction potential
PJD	preliminary jurisdictional determination
PSD	prevention of significant deterioration
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
SHPO	State Historic Preservation Officer
SOPs	standard operating procedures
SWANCC	Solid Waste Agency of Northern Cook County v. U.S. Army Corp of Engineers
SWE	snow-water equivalent
TPH	total petroleum hydrocarbons
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMP	water monitoring plan

2. METEOROLOGY

The methodology for collecting meteorological data at the mine site and the port site is generally the same, with the exception that evaporation data will not be collected at the port site. Hoefler Consulting Group (Hoefler) will lead the meteorology baseline study for the mine site, road, and port.

2.1 Objectives of Study

The objective of the meteorology baseline study is to collect data needed for engineering design and environmental purposes, including water balance studies, and for preparation of air-quality construction-permit applications for the mine and road/port sites. The data will be collected in accordance with Prevention of Significant Deterioration (PSD) permit requirements and guidance. Although the mine, road, and port facilities may not require a PSD permit, PSD-quality meteorological data will be collected to support the required computer-based dispersion modeling.

In addition, negotiations with affected government agencies (U.S. Environmental Protection Agency [EPA], Alaska Department of Environmental Conservation [ADEC], National Park Service [NPS], and U.S. Fish and Wildlife Service [USFWS]) may result in a requirement to collect background pollutant data. However, an initial year of meteorological data is needed to determine the location of monitoring equipment for collecting ambient air background data, if such collection is necessary.

2.2 Proposed Study Plan

2.2.1 Study Area/Scope

At present, the scope of this task involves primarily collection of continuous records of meteorological data at the mine and port sites, including precipitation, temperature, temperature difference, wind speed and direction, evaporation, solar radiation, relative humidity, and barometric pressure. In addition, evaporation data will be collected at the mine site when the air temperature is greater than 0°C.

Two meteorological monitoring stations were installed in 2004 and are currently operating. These stations are located in the general vicinity of the mill site/ore body (Met Station No. 1) and in the vicinity of a major tailings storage site (Met Station No.2, see Figure 2-1). These stations are collecting data for site characterization and water management studies. The use of two stations in the mine area will provide information regarding variations within the watershed, which are important from a water-balance perspective. These stations are generally designed and operated consistent with PSD guidance, except that the wind instrumentation at these stations is located at the 3-meter level, which is not consistent with PSD guidance. Therefore, the wind data collected at these stations will not be used to support any air permit applications.

The operation of these two stations is scheduled to continue through 2005. However, Northern Dynasty Mines Inc. (NDM) may elect to discontinue operation of the mill site/ore body station once the new 10-meter tower meteorological station to be located in the mine site area becomes operational.

Two additional meteorological stations will be installed in 2005: one in the mine site area and one in the port site area. Both stations will be fully consistent with PSD-monitoring guidance, including wind instrumentation located at 10 meters above grade. The data collected at these stations will be used to support site characterization and the computer-based dispersion-modeling element of any air permit application.

2.2.2 Methods/Approach

Approved procedures for collecting meteorological data, as well as background pollutant data for permitting purposes, are well documented in ADEC and EPA guidance documents. A quality assurance project plan (QAPP) will be developed that includes the elements suggested in the ADEC quality assurance (QA) plan for meteorological monitoring and the following ADEC guidance documents:

- *Elements for Ambient Air Monitoring Quality Assurance Project Plan (QAPP)* (September 2004).
- *Ambient Air and/or Meteorological Monitoring QAPP Checklist* (September 2004).
- *PSD Quality — Ambient Air Quality and Meteorological Monitoring Data Report Format* (Revised January 2005).

The QAPP will also be consistent with the following EPA guidance documents:

- *Ambient Monitoring Guidelines for Prevention of Significant Deterioration* (EPA-450/4-87-07).
- *Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV-Meteorological Measurements* (EPA/600/R-94/038d-April 1994).
- *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA 454/R-99-005, February 2000).

Agency approval of the locations for the mill-site/ore-body station and the port-site 10-meter tower is critical for obtaining valid data for dispersion modeling. The locations of these meteorological stations will be determined following review of this document and subsequent discussions among NDM, ADEC, EPA, and NPS. NDM believes this step is very important in the data -collection program because without agreement on the locations, the data may not be accepted for use in the computer-based dispersion-modeling required for the air-quality construction-permit application. NDM will proceed with station installations once written approval for the monitoring locations is obtained from these agencies.

Meteorological instrumentation manufactured by Met One Instruments and Campbell Scientific will be used. All instrumentation will meet or exceed EPA PSD specifications for meteorological data collection. At a minimum, the following meteorological parameters will be measured at all stations:

- Wind speed (meters per second).
- Wind direction (degrees).
- Standard deviation of wind direction fluctuations (degrees).
- Air temperature at 2 meters (degrees Celsius).

The following additional parameters will be measured at the existing meteorological stations:

- Total precipitation (millimeters of liquid water).
- Evaporation, summer only (millimeters of liquid water).

The following additional parameters will be measured at the new mill site PSD meteorological monitoring station:

- Air temperature at 10 meters (degrees Celsius).
- Air temperature difference (degrees Celsius).
- Solar radiation (watts per square meter).
- Relative humidity (percent).
- Barometric pressure (millibars).

The following additional parameters will be measured at the new port PSD meteorological monitoring station:

- Air temperature at 10 meters (degrees Celsius).
- Air temperature difference (degrees Celsius).
- Solar radiation (watts per square meter).
- Relative humidity (percent).
- Barometric pressure (millibars).
- Total precipitation (millimeters of liquid water).

The collection of upper-air data, including mixing height and wind aloft, is not planned for 2005. Discussions will be conducted with ADEC and EPA to determine if representative upper-air data from another location can be used, if on-site air data are required, or if some other alternative to upper-air data collection can be identified.

Similarly, the collection of ambient pollutant data is not planned for 2005. Ambient pollutant monitoring may be undertaken after the project emissions inventory is developed and discussions with ADEC, NPS, and EPA are conducted.

2.2.3 Major Activities

The following major activities are planned:

- Continue operating the Met 1 and Met 2 monitoring stations, including routine calibrations and audits.
- Finalize the QAPP for the Met 1 and Met 2 monitoring stations.
- Conduct a site visit with ADEC, EPA, and NPS representatives to select the locations for the mill site and port PSD-monitoring stations.

- Install the mill site and port PSD-monitoring stations (towers, meteorological instrumentation, communications equipment, instrument shelter, and electrical power supplies).
- Conduct an initial performance audit after completion of each new installation to ensure the sensors and systems are operating within EPA and ADEC guidelines. During installation, train a local field operator to conduct a review of the site in accordance with EPA and ADEC guidelines as described in the standard operating procedures (SOPs) in the approved monitoring plan.
- Operate the mill site and port PSD meteorological stations, including routine calibrations and audits.
- Prepare QAPPs for the mill site and port PSD monitoring stations. Submit the QAPPs to ADEC for review and approval.
- Remotely access the meteorological data from all stations daily and perform a review of the data to detect any problems. The local field operator will conduct routine inspections of the stations' equipment to verify proper operation of the equipment and security of the site. During these inspections, maintenance will be performed on the power supply, proper operation of the instruments will be verified, routine quality control (QC) checks will be performed, and general conditions of the site will be observed. Troubleshooting and additional technical support will be provided as needed to achieve maximum data recovery and to compile a quality data set.
- Process and validate data on a weekly basis. Weekly processing will ensure problems associated with data collection will be addressed in a timely manner. Data processing, validation, and screening will be performed in accordance with the EPA and ADEC guidance documents and as described for QA in the QAPP.
- Summarize the data in quarterly data reports that will include documentation of the QA activities performed during the reporting period. QA activities include calibrations, audits, and data completeness checks.
- Provide an annual data report within 45 days of the end of 2005.
- For each station, conduct a minimum of three audits over the course of the first 12-month monitoring period in accordance with EPA criteria defined in *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Methods*, April 1994 (EPA/600/R-94/038d), and *Meteorological Program Guidance For Regulatory Modeling Applications*, February 2000 (EPA 454/R-99-005). EPA guidance suggests conducting audits within 30 days of station start-up, every 6 months during operation, after major downtime or repairs, if the station is relocated, and within 30 days before station shutdown.

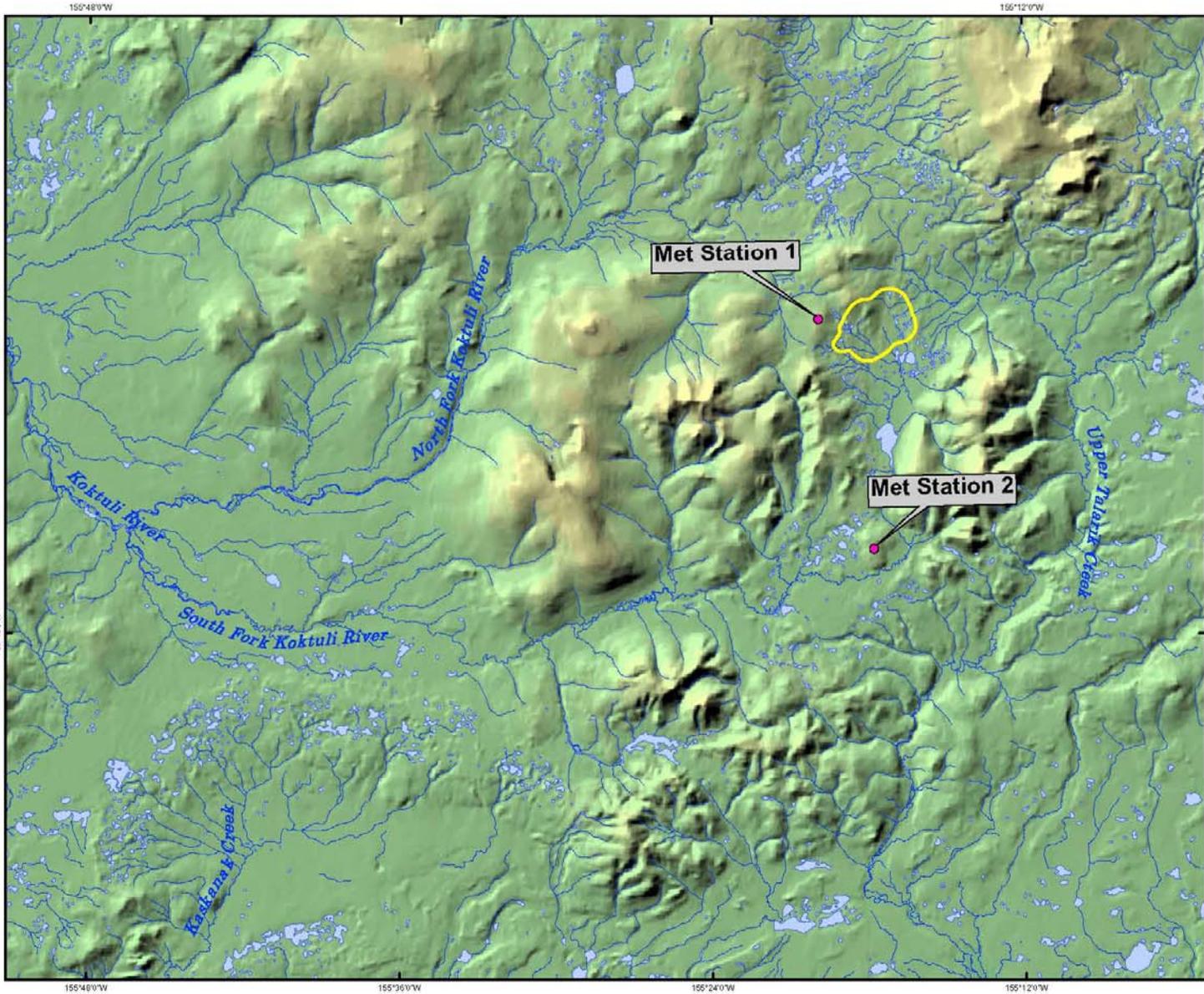
2.3 Deliverables

The following deliverables will be prepared during monitoring for meteorological parameters at mine and port sites:

- 2004 progress report.
- 2005 plan of study.
- Initial environmental evaluation report.

- Station-specific QAPPs developed following ADEC and EPA guidance, supplemented by conversations with agency representatives or the engineering design team, as appropriate.
- Quarterly data reports summarizing data collected and associated quality assurance activities.
- Annual data report submitted within 45 days of the end of 2005.

FIGURES



Northern Dynasty Mines Inc.



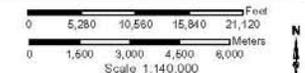
Pebble Gold-Copper Project

Meteorological Station Locations

FIGURE 2-1

Legend

-  Orebody
-  Meteorological Stations



Alaska State Plane Zone 5 (units feet)
1983 North American Datum

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