FINAL REPORT

SOIL SAMPLING PROGRAM
NANISIVIK TOWN SITE
NANISIVIK, NUNAVUT

August, 2002

EBA Engineering Consultants Ltd.

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SOIL SAMPLING PROGRAM
NANISIVIK TOWN SITE, NANISIVIK MINE,
NUNAVUT

Project No. 1740015.001

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SOIL SAMPLING PROGRAM
NANISIVIK TOWN SITE, NANISIVIK MINE, NUNAVUT

Submitted To:

Department of Sustainable Development

Prepared by:

EBA ENGINEERING CONSULTANTS LTD.
YELLOWKNIFE, NORTHWEST TERRITORIES

Project No. 1740015.001

EBA Engineering Consultants Ltd.

Creating and Delivering Better Solutions

August 12, 2002

EBA File No: 1740015.001

Department of Sustainable Development
Government of Nunavut
P.O.Box 1000, Stn 1150
Iqaluit, Nunavut
X0A 0H0

Attention: Mr. Bernie MacIsaac
Senior Advisor, Mineral, Oils and Gas Division

Dear Mr. MacIsaac:

Re: Final Report, Soil Sampling Program, Nanisivik Town Site, Nanisivik Mine, Nunavut.

Please find enclosed three copies of the above final report summarizing our comments regarding the soil sampling program which was undertaken at the above location. The sampling program was undertaken in accordance with EBA's letter of May 31, 2002, submitted to your office, which outlined the Terms of Reference for the study,

We trust that the enclosed information meets with your requirements at this time. Please do not hesitate to contact our office should there be questions or concerns regarding the contents.

Yours truly,
EBA Engineering Consultants Ltd.,

R. Brent Murphy, M.Sc., P.Geol.
Project Director, NWT/NUNAVUT

RBM/JC/bw/…

Attachments

EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) was retained by the Government of Nunavut, Department of Sustainable Development, to undertaken a soil sampling and analytical program at Nanisivik Townsite, within a parcel of land referred to as the "Block Transfer", associated with the Nanisivik Mine.

The purpose of the investigation was to identify potential metals enrichment of surficial soils resulting from mine operations. The results of the soils analysis were used to undertake a human health risk assessment associated with current soils quality. It is to be understood that human health risk assessments are driven by land use. At the time of this undertaking, future land use for the Block Transfer site had not been determined. Therefore, this report presents the results of the initial soils quality assessment program and the summary of potential health risks associated with current land use only.

During this program, a total of 132 soil samples were collected and submitted for laboratory analysis for metals. The analytical protocol selected, in consultation with the analytical laboratory, EnviroTest Laboratories (ETL) of Edmonton, was US EPA Method 3051 (ICP-MS). This method was selected on the basis of low detection limits. The samples were collected throughout the townsite and located on a grid-base system. Each sample location was further surveyed using GPS. Samples were collected from the upper 0.05 m of the soil profile. Two background soil sample locations were also selected. These sites are located topographically upgradient of both the mine and townsite. The analytical data obtained from these locations was used to establish baseline levels of metals in the Nanisivik environment.

Industry standard sampling protocols were employed throughout the project. Care was taken to prevent cross contamination of soil samples and to maintain sample integrity. However, for the purposes of this investigation, legal sampling protocols were not invoked.

Analytical results were interpreted spatially, both horizontally and vertically, using a geostatistical-based modeling program. The analytical results identified metals enrichment of surficial soils located within the confines of the townsite. The analytical program and the methodology selected focused on zinc, lead, cadmium and copper levels in the surficial soil samples.

The metal distribution pattern depicted locations with elevated concentrations of metals within two to three separate anomalies identified along a creek bed at the extreme western portion of the townsite. Additionally, several other discrete surface anomalies were identified scattered throughout the northern portion of the townsite located in the vicinity of the cafeteria and office building. The concentration of zinc, lead and cadmium generally exceeded the CCME criteria for residential land use.

A comparison of metal concentrations in the background samples, with metal levels in the surface samples collected from the townsite, indicated that overall, the background

sample sites contained lower metal concentrations at surface and exhibited less variability with depth. On this basis, it was concluded that the metal levels contained within the background soil samples are probably indicative of naturally occurring levels in the surrounding environment.

During the study, several potential anthropogenic (man-induced) sources of metals were identified in the surface soils collected from the townsite, all of which require further evaluation in future studies to determine their potential contribution to the metal enrichment of the soils. The potential sources include transport of concentrate dust from the dock and/or mill area by vehicle tires and/or wind, and dust deposition from the tailings deposition area by wind.

An evaluation of the human health risks associated with the identified metal levels was completed by ETL. They determined that the metal levels identified within the surface soils at the townsite would normally be considered toxic. This conclusion has not considered the local climate or environment where surface soils are immobilized by freezing for two thirds of the year. The metal concentrations found in soil samples collected at the Nanisivik town site followed a pattern consistent with areas affected by zinc mining.

The natural occurrence of zinc and lead within the environment in frequent outcrops at the Nanisivik area may preclude direct application of the CCME Guidelines for site remediation criteria. Site-specific remediation criteria based on identified land use must be developed that will fully evaluate transport mechanisms, receptors and exposure levels. In addition, any remediation criteria will have to take into consideration not only human health risks but ecological risks as well.

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1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was requested to complete an initial soil sampling of the surface soils situated at the Nanisivik townsite within the parcel of land referred to as the "Block Transfer", and associated with the Nanisivik Mine. Preliminary preparations to undertake the project were initiated on May 30, 2002 following a telephone conversation with a Government of Nunavut (GN) representative. Approval to proceed was received from GN on June 5, 2002 and the project was undertaken in accordance with a letter prepared by EBA on May 31, 2002, which outlined a "generalized" Terms of Reference.

The objective of the sampling/analytical program was to determine the existing inorganic (i.e. metal) loads within the surficial soils situated throughout the townsite so that a determination of the potential health risks associated with any proposed alternate use of the townsite could be initiated.

The overall risk to human health depends upon the land use of the townsite, both current and future use. It is understood that no particular future land use has been identified for the townsite. Accordingly, the potential health risks identified must be considered generalized until the future land use is decided upon and the results of a risk assessment to develop site specific remediation for the mine site is completed.

This report presents the results of the initial soil sampling program and a summary of the potential generalized health risks associated with the current metal levels identified in the soil.

2.0 SCOPE OF WORK

The scope of work established in consultation with the GN comprised a soil sampling program, and a data report. In addition, the services of a toxicologist were retained to assist in the identification and evaluation of the potential health effects that may result from the soil metal levels identified within the townsite. A copy of the generalized scope of work submitted to the client is presented as Appendix A and it includes the following objectives:

- Develop a grid-based soil sampling program;
- Collect surficial soil samples throughout the townsite;
- Have samples analyzed for metals concentrations;
- Locate sampling point on a survey map;
- Provide six testpits for soil profile description;
- Summarize results of field investigation;

- Provide site description;
- Describe sampling and analytical protocols;
- Provide geo-statistical interpretation of analytical data; and
- Provide initial human health risk assessment.

A total of one hundred thirty-two (132) soil samples were collected, and submitted for laboratory analyses of inorganic components (i.e. metals). The samples were collected throughout the townsite and located on a grid-based system. Each soil sample location was further surveyed utilizing a hand held GPS instrument. Thirteen (13) of the samples were from soil profiles taken from the surface to auger refusal. One hundred and nine (109) of the samples were collected from the upper 0.05 metres of the soil profile. Ten (10) samples were from soil profiles, from two background soil sample locations situated topographically upgradient and presumably up wind of the both the mine and townsite, were also established and sampled for comparison purposes. For the purposes of this investigation, legal sampling protocols were not implemented

A data report which summarized the results of the field investigation, including a site description, sampling protocols implemented, the analytical results and any conclusions which were obtained from the data was prepared. Geo-statistical contour plots, highlighting the distribution of four metal (zinc, lead, cadmium, and copper) parameters across the townsite were also prepared.

Additionally, the services of a toxicologist were retained to consider initial human health risk of the townsite, to assist in the identification and evaluation of the potential health effects that may result from the metal levels located at the town site.

2.1 Project Team

The team was comprised of members of EBA offices located in Yellowknife, NWT and Edmonton, Alberta. Mr. Brent Murphy, M.Sc., P.Geol., provided the overall project management and provided technical input into the project methodology including the design of the sampling program, analyses of the geochemical results, and assisted with the preparation and editing of the report. Mr. John Clark, P.Eng, a Senior Environmental Engineer provided technical expertise and the implementation and completion of the field soil sampling program. Ms. Laura Harbicht, an environmental technician, provided assistance in the field.

Outside expertise was solicited and secured by EBA to consider the potential human health risk of the metal levels contained within the soil samples collected from the Nanisivik Townsite. EnviroTest Laboratories of Edmonton, Alberta was subcontracted, with expertise in the metal toxicology field provided by Dr. Ian Johnson and Dr. Deib Birkhorwitz.

Mr. Joe Selann, Principal Environmental Consultant with EBA provided technical assistance and the final technical review of the document.

2.2 Liaison with Mine Owner's Agent

The mining company (CanZinco) retained the services of a geochemical consultant, Lorax Environmental Services of Vancouver, B.C. to observe the work of EBA and represent the interests of the owner by collecting their own soil samples. Both parties coordinated their soil sampling activities while on site. As a component of this project co-ordination, several duplicate samples were collected by both parties for later analyses at each firm's selected laboratory. Also, coordination was undertaken in ensuring that each firm understood the laboratory procedures that the other party had selected with regards to the sample preparation and digestion procedures.

However, the overriding concern was to maintain the independence of this study to ensure that the government's objectives were achieved and as a result there was no sharing nor discussion of each firm's analytical data prior to the preparation of this report.

3.0 SITE DESCRIPTION

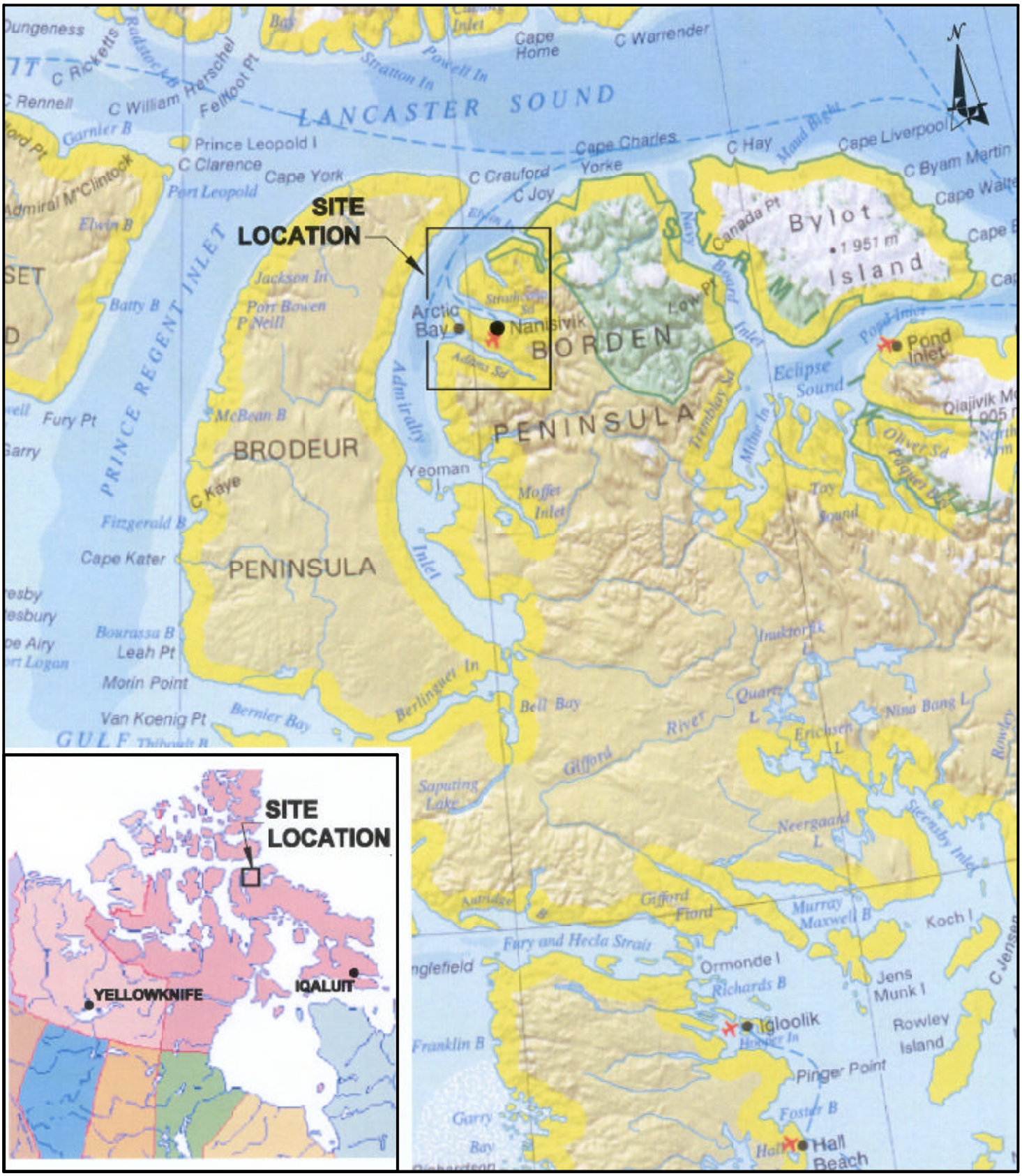
The following sections describing the mine site and it's associated facilities was extracted from the CanZinco Ltd.'s Abandonment and Restoration Plan for the Nanisivik Mine, Water License No: NWB1NAN9702, as prepared by Gartner Lee Limited in March 2002.

3.1 Overview

The Nanisivik Mine is located on the Borden Peninsula on northern Baffin Island in the Canadian Arctic at a latitude of approximately 73 degrees north (Figure 1). The mine site is situated on the south side of Strathcona Sound approximately 30 kilometres from the inlet of the Sound. The Inuit community of Arctic Bay is located approximately 25 kilometres to the west of Nanisivik, with the communities linked by a 33 kilometre all-weather road. A jet airport that is owned and operated by the Government of Nunavut is located approximately 9 kilometres south of Nanisivik. Commercial flight service is provided via Ottawa, Iqaluit and Resolute Bay.

Mineral exploration activities were carried out primarily between 1958 to 1968. Construction of the mine commenced in 1974 and operation/processing commenced in 1976, making the site the first operating metal mine in the Canadian Arctic. Historically, the Inuit have never inhabited the Nanisivik area. It is generally devoid of wildlife, and vegetation is unusually scarce for this region of the Arctic. In 1974, an agreement was signed which permitted a mine to open. The townsite was then developed as part of an industrial complex to mine the silver/lead/zinc deposit.

The mill and mine are located approximately three kilometres from Strathcona Sound, with the town situated approximately four kilometres from the Sound and the tailings



Adapted from "Nanisivik Mine Closure and Reclamation Plan" Figure 1-1 by Gartner Lee Limited, February 2002.

0 150

Approximate Scale (km)

Figure 1
Nanisivik Townsite
Location Map

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