METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

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EXECUTIVE SUMMARY

C.E. Jones and Associates Ltd. was requested by Gartner Lee Limited to design and implement a field-based study program in 2002 to determine if soils and plants in the vicinity of the Anvil Range Mine Complex have elevated elemental concentrations in comparison to background levels from the Faro area. The Anvil Range Mine Complex is located approximately 200 km north-northeast of Whitehorse and 10-15 km north and northeast of the town of Faro, and includes the Faro and Vangorda Plateau Mine sites. Active mining was conducted between 1969 and 1998 at the Anvil Range complex, which at the height of its production was one of the largest lead-zinc mining operations in the world.

This study was intended primarily as a preliminary investigation to determine whether any identifiable airborne contamination of soils and vegetation on otherwise undisturbed areas has occurred as a result of mine development and operation. The field program included reconnaissance-level sampling on areas adjacent to or within both the Faro and Vangorda Plateau Mine sites, as well as more intensive sampling centred on the Faro (Rose Creek) tailings impoundments, and background sampling. This program was intended to provide information in support of the environmental assessment process for the renewal of the mine's water license, as well as to provide information to guide subsequent risk assessment and mine decommissioning/ closure planning. Because of these multiple information requirements, this program had a number of specific objectives:

- to characterize background elemental concentrations in local soils and vegetation occurring outside any potential mine-affected areas;
- to characterize element levels in soils and vegetation in the vicinity of the Rose Creek tailings impoundments, and to determine the spatial distribution of any observed elevated levels;
- to provide reconnaissance-level information on element levels in soils and vegetation on areas adjacent to other potential mine-site contaminant sources, including the mill crusher, concentrate load-out facilities, open pits, haul roads, and waste rock dumps;
- to examine the potential effects of any elevated elemental concentrations on plant health; and

- to provide reconnaissance-level information on elemental concentrations in vegetation species potentially consumed by local wildlife and human populations, to support a quantitative (Tier 2) terrestrial and human health risk assessment for the mine site.

Field sampling consisted of collection of foliar or above-ground tissue samples of selected vegetation species (birch, willow, grass and lichen), which were included to represent different growth habits, and to be species utilized by local wildlife populations. Birch was added to the sampling program following initial site reconnaissance, as it was the most wide-spread and prevalent species in the study area, and thus provided the ability to compare elemental levels between all sites. Root samples of willow were collected to allow determination of airborne versus soil metals sources and to aid in determination of phytotoxicity, as some metals do not translocate easily within plants. Soil sampling included collection of surface and sub-surface samples, again to allow detection of airborne metals deposition versus native mineralization. Sample point layout was based on the premise that the probable primary mine-site sources for airborne contaminants were the Rose Creek tailings impoundments, with contaminant delivery to off-site areas through dusting. Thus sample points were established systematically on radial bearings from the tailings impoundments, to provide information on potential patterns of contaminant distribution. Additional sampling points were selected subjectively to represent particular areas (e.g. background areas or areas adjacent to particular mine disturbances).

Study results show soil and vegetation concentrations elevated above background levels for arsenic, silver, cadmium, chromium, copper, mercury, nickel, lead and zinc. Lead and zinc had the largest magnitudes of elevation (over two orders of magnitude greater than maximum background concentrations for soil and lichen) and had elevated levels furthest from the mine site, in comparison to other analyzed elements. Examination of collected data indicates that the probable origin of these elevated concentrations is airborne dust contamination from mine site sources. The spatial distribution of elevated elemental concentrations shows that metals transport and deposition has been concentrated from northwest to north of the mine complex and Rose Creek drainage. Elemental concentrations in surface soil and lichen samples on transects to the southeast to west-southwest of the tailings impoundments are substantially lower than those across the valley, and elevated concentrations are clustered closer to contaminant sources, indicating that there has been less airborne contamination in these directions. However, even on these transects, soil and lichen lead (and frequently zinc) levels on the furthest points from the mine site (approximately 2-3 km) remain well above the study background concentrations. In synthesis, the spatial distribution data indicate that elevated elemental levels (particularly lead and zinc) resulting from airborne contamination occur in a zone that extends at minimum 2-3 km in all directions from potential mine-site contaminant dust sources, and that is concentrated and extended to the northwest to north of the tailings impoundments and mill complex. This finding of elevated soils and vegetation metals levels is not unexpected, given that mining and milling operations were conducted on a large scale at the Anvil Range site for almost 30 years, and that other studies of airborne contamination from lead-zinc mining/milling activities have documented similar off-site impacts.

It should be emphasized that while this study clearly indicates that mine development and operations at the Anvil Range mine complex have resulted in metals contamination of mine-area soils and vegetation, further work would be required to refine study conclusions, such as definition of the full areal extent of contamination. Data collected in this study do not allow determination or speculation on the specific sources of documented contamination. Therefore, results should be generally interpreted as being indicative of the occurrence of mine-site contamination of off-site (non-mine or undisturbed) areas, but not of the specific source(s) of this contamination. Likewise, the temporal nature of contamination cannot be determined, and it is unknown whether all dust contamination has been historic (due to active mining operations), or whether there are remaining contaminant sources still contributing to off-site metals additions.

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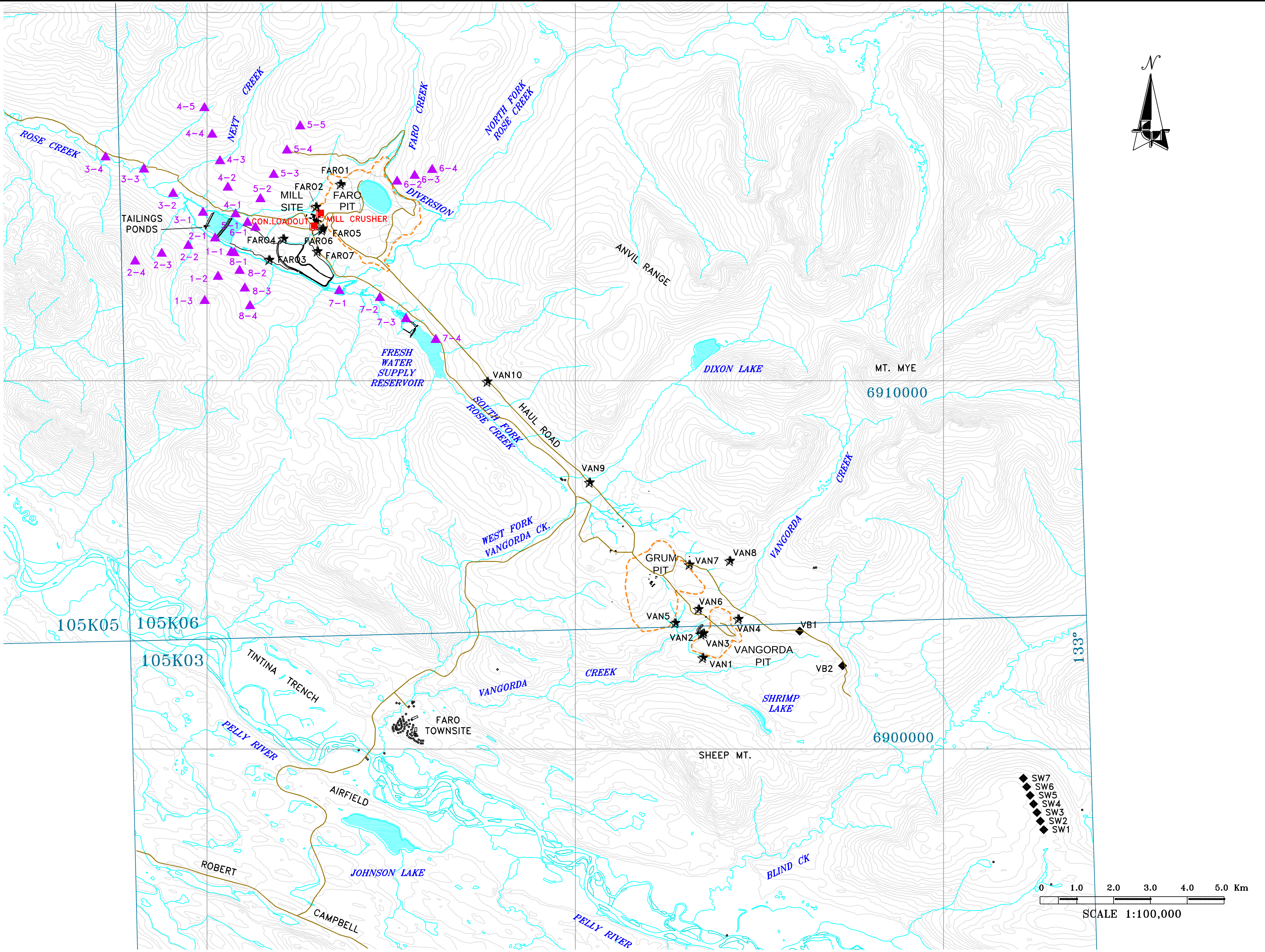

LEGEND:

- MAIN ROAD
- SURFACE DRAINAGE
- MINE AREA
- BACKGROUND SAMPLING POINT
- POTENTIAL MINE-AFFECTED SAMPLING POINTS
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- REFERENCE POINTS

SOURCES OF INFORMATION:

1. DIGITAL COPY OF 1:50,000 TOPOGRAPHIC MAP SUPPLIED BY SRK CONSULTING.
2. VEGETATION AND SOILS METALS MAPPING CONDUCTED IN SUMMER 2002 BY JUSTIN STRAKER OF C.E. JONES & ASSOCIATES
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CE JONES & Associates Ltd.

METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

REGIONAL STUDY AREA

Gartner Lee | Deloitte & Touche | FIGURE NO. 1

1.0 INTRODUCTION, OBJECTIVES AND ASSUMPTIONS

C.E. Jones and Associates Ltd. was requested by Gartner Lee Limited to design and implement a field program to determine if soils and plants in the vicinity of the Anvil Range (Faro) mine have elevated elemental concentrations in comparison to background levels from the Faro area. This program was intended to provide information in support of the environmental assessment process for the renewal of the mine's water license, as well as to provide information to guide subsequent risk assessment and mine decommissioning/ closure planning. Because of these multiple information requirements, this program had a number of specific objectives:

- to characterize background elemental concentrations in local soils and vegetation occurring outside any potential mine-affected areas;
- to characterize element levels in soils and vegetation in the vicinity of the Rose Creek tailings impoundments, and to determine the spatial distribution of any observed elevated levels, and the primary variables (distance from source, wind direction and speed, topographic controls on atmospheric conditions) that influence this distribution;
- to provide reconnaissance-level information on element levels in soils and vegetation on areas adjacent to other potential mine-site contaminant sources, including the mill crusher, concentrate load-out facilities, open pits, haul roads, and waste rock dumps;
- to examine the potential effects of any elevated elemental concentrations on plant health; and
- to provide information on elemental concentrations in vegetation species potentially consumed by local wildlife and human populations, to support a quantitative (Tier 2) terrestrial and human health risk assessment for the mine site.

The study was intended primarily as a preliminary investigation to determine whether any identifiable airborne contamination of soils and vegetation on otherwise undisturbed areas has occurred as a result of mine development and operation.

1.1 Study Assumptions

The sampling design of this study was based on the premise that the probable primary mine-site sources for airborne contaminants were the Rose Creek tailings impoundments, with contaminant delivery to off-site areas through dusting (E. Denholm, pers. comm.) However, it should be emphasized that there are multiple potential dust-borne contaminant sources, including the tailings impoundments, mill/crusher site, concentrate load-out facility and open pits. Data collected in this study do not allow determination or speculation on the specific sources of documented contamination. Therefore, results should be generally interpreted as being indicative of the occurrence of mine-site contamination of off-site (non-mine or undisturbed) areas, but not of the specific source of this contamination. Likewise, the temporal nature of contamination cannot be determined, and documented contamination could have occurred through cumulative long-term dusting or isolated substantial airborne sediment transport events. It is also difficult to speculate on whether all dust contamination has been historic (due to active mining operations), or whether there are remaining potential contaminant sources still contributing to off-site metals additions. Photo 1 shows the Rose Creek intermediate tailings impoundment in the centre of the photograph, with the mill/maintenance complex behind and to the left, and the Faro pit in the left background. This photo indicates the close proximity of some identified potential contaminant sources to each other.

PHOTO 1 Rose Creek Intermediate Tailings Impoundment and Mill Complex

2.0 STUDY AREA

The Anvil Range Mine Complex is located approximately 200 km north-northeast of Whitehorse, the capital of the Yukon Territory. The Faro Mine site (in production from 1969 to 1992), which includes a mill and tailings facilities, is located approximately 15 km north of the town of Faro. The Vangorda Plateau Mine site (in production from 1986 to 1998), which includes two open pits and associated mine facilities, is located approximately 9 km northeast of the town of Faro and can be reached by a heavy haul road (approximately 13 km in length) from the Faro Mine site. At the height of its production, the Anvil Range Mine Complex was one of the largest lead-zinc mining operations in the world.

This study included reconnaissance-level sampling on areas adjacent or within both the Faro and Vangorda Plateau Mine sites, as well as more intensive sampling centred on the Faro (Rose Creek) tailings impoundments, and background sampling. This study area is shown in Figure 1.

3.0 METHODS

General field and laboratory methods used in this study are discussed below. Methods specific to particular study objectives are discussed in the following subsections.

The field component of the study was conducted on August 11-17, 2002. All sampling points were located for specific project objectives, as discussed below. Sampling point location centres were recorded by handheld GPS, and are shown in Figure 1. Ecosystems represented in the sampling program were predominantly in the Upland Forest (Photos 2 and 3) and Subalpine Transition vegetation zones, with a minor component in the Alpine Tundra, as described in the Anvil Range Mine Complex environmental baseline report (Gartner Lee Limited, 2002). Soils at sampled locations were predominantly mineral soils (derived from morainal or glaciofluvial material) with thick (5-10 cm) organic (F) horizons, although organic horizons were thinner above treeline or on glaciofluvial landforms along Rose Creek.

The sampling program included four primary components:

1. Background sampling (shown as black diamonds in Figure 1). Included nine original sample points to the southeast of the mine complex, from which 45 vegetation samples and 18 soil samples were collected.
2. Rose Creek Tailings sampling (shown as purple triangles in Figure 1). Included thirty-three sample points centred on the Rose Creek intermediate tailings impoundment, from which 140 vegetation samples and 68 soil samples were collected.
3. Additional Mine Area sampling (shown as black stars in Figure 1). Included seventeen sample points on the Faro and Vangorda mine sites, from which 57 vegetation samples and 8 soil samples were collected.
4. Terrestrial/Human Health Risk Assessment sampling. Sample collection for this component were integrated in the above three components.

At each sampling point, the following samples were collected, where available:

- a composite foliar sample of scrub birch (*Betula glandulosa*);

- a composite foliar sample of grey-leaved willow (*Salix glauca*);
- a composite foliar sample of Altai fescue (*Festuca altaica*); and
- a composite sample of green reindeer lichen (*Cladina mitis*).

On tailings transect, background, and selected mine-affected sample points (see sections 3.1 – 3.3, below) the following additional samples were collected:

- a root sample of grey-leaved willow;
- a surface soil sample (0-2 cm depth from soil surface); and
- a sub-surface soil sample (5-10 cm depth from soil surface).

In addition, at selected locations, samples of blueberry (*Vaccinium uliginosum*) and crowberry (*Empetrum nigrum*) were collected to provide information for the terrestrial/human health risk assessment study component.

A chart showing samples collected by type at each point is presented in Appendix A.

Sampled vegetation species were originally selected to represent different growth habits, and to be species (willow, fescue, and lichen) utilized by local wildlife populations. Willow is an important food source for moose; fescue is utilized by Fannin sheep and is an important spring food for caribou; and lichen is the dominant winter food for caribou (S. Francis, pers. comm.). Following initial site reconnaissance, birch was added to the sampling program, as it was the most wide-spread and prevalent species in the study area, and thus provided the ability to compare elemental levels between all sites (although birch may be occasionally utilized as browse by local ungulate populations, it is not a primary food source). Root samples were collected to allow determination of airborne versus soil metals sources and to aid in determination of phytotoxicity, as some metals do not translocate easily within plants. Likewise, sampling of surface versus sub-surface depths for soils was done to allow detection of elevated soil metals concentrations resulting from airborne deposition. Due to the presence of thick organic horizons, the surface soil sample was predominantly composed of F horizon (with exceptions on disturbed or alpine sites), while the sub-surface sample was composed of either deeper F horizon or mineral A or B horizon material (see Appendix C for soil sample organic matter contents).

Vegetation samples were collected to yield approximately 10 g of oven-dry material for lab analyses (approximately 30-50 g wet weight). Composite samples were collected from a minimum 2-3 individuals of each species (for vascular plants) nearest the sample point centre. Lichen samples were generally collected from 1-3 areas on undisturbed ground nearest the sample point centre. All foliar samples contained live, above-ground plant material only. Foliar samples from the shrub species were composed of leaves and a minor component of succulent (current year's) shoots, in order to be representative of tissue consumed as browse. Root samples were excavated from one individual from which foliar samples were obtained. Soil samples were collected from a 30-cm excavation at the sample point centre. Vegetation samples were collected with stainless-steel bypass pruners, to avoid any potential metals contamination. Soil samples were collected using a stainless-steel shovel.

Vegetation samples were collected and stored in paper bags. Soil samples were collected and stored in plastic bags. At the end of each collection day, sample bags were opened in a clean, dry room to allow air-drying of samples (to retard decomposition), and were stored this way until shipping. Vegetation samples were sorted to remove dead material or material from other species. In total, 242 vegetation and 94 soil samples were collected.

All analyses were performed by Soilcon Labs of Richmond, B.C. All soils and vegetation samples were analyzed for: silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium, and zinc concentrations. Vegetation samples were prepared by oven-drying at 70°C for 48 hours and then grinding in a Wiley mill to pass a 2-mm stainless-steel screen. Digestion was by nitric acid – hydrogen peroxide. Soil samples were prepared by air-drying and crushing to pass a 2-mm sieve, with digestion by nitric – hydrochloric acid (*aqua regia*). All elements were analyzed using ICP-OES (Inductively-Coupled Plasma Optical Emission Spectrometry), with the exception of mercury, which was analyzed by cold-vapour atomic absorption spectroscopy. (For further details on analytical techniques, see Appendix B).

Above-ground vegetation samples were analyzed unwashed, in order to provide information on elemental concentrations likely to be consumed by wildlife utilizing these species as browse. However, in order to allow differentiation between metals levels in foliar tissue and those in airborne sediments, approximately 5 percent of samples were split and analyzed both washed (with deionized water) and unwashed. All root samples were washed prior to analysis. In order to allow determination of elemental concentrations in fresh browsed or consumed materials (as lab results are reported on an oven-dry weight basis), above-ground samples from every collected species were analyzed for gravimetric moisture content. Approximately 5 percent of soil samples (representative of overall sampled soils) were analyzed for organic matter content, as this information may be helpful in interpreting or predicting elemental mobility in soils. As a component of the program's quality control/quality assurance procedures, roughly 5 percent of both soils and vegetation samples were split in the field and sent to the lab as blind duplicates. Due to the heterogeneity of the sampled materials, particularly soils, similarity between field-split duplicates cannot be expected to be as great as in lab-generated duplicates. Nevertheless, these duplicates provide valuable information on intra-sample variation, and augment the lab quality control program. Data from these duplicates (provided in Appendices C and F) show that the majority of analytes meet the 20-percent relative percent difference standard used by Soilcon for lab-generated duplicates. In some cases this standard is substantially exceeded (e.g. the Faro5-Faro9 duplicate pair); however, these cases are consistent in terms of relative contamination reported (e.g. both the Faro5 and Faro9 results indicate a highly contaminated sample), and do not affect data interpretation.

3.1 Background Sampling

Background sampling was conducted as a component of the field program to establish "normal" local soils and vegetation metals concentrations, in order to identify effects of mining operations. On sites where pre-mine background elemental concentrations are not available, such as the Anvil Range mine complex, background samples need to be carefully located, so as to be outside the potential area of influence of the mine but within the natural mineralized zone that hosts the mined ore-bearing rock, and that would have existed on site prior to mining. To accomplish this goal, background samples were located with reference to local geological mapping and glacial till geochemistry information (Bond, 2001). Local geological studies have shown that the Anvil district lead-zinc-silver massive sulphide deposits occur within a 150-m interval at the contact between the Mount Mye and Vangorda formations, which lies in a southeast curvilinear pattern between the Faro deposit and the Swim Lake basin. Till geochemistry studies conducted in 1998 and 1999 determined the Swim Lake basin to be the most representative background area for the Anvil deposits, because of similar geology and glacial history (Bond, 2001). For the purpose of the 2002 soils and vegetation metals study, seven background samples (SW1-7) were located in the Swim basin in the same area as the till geochemistry study, and two samples (VB1 and 2) located southeast of the mine complex, between the Vangorda pit and the Swim basin. However, subsequent data analyses showed that the Vangorda-area background samples were likely influenced by airborne contamination, and thus were removed from the background data set. Background sample points are shown as black diamonds in Figure 1.

The background sampling study included the same soils and vegetation sampling components as the tailings transect study, with additional species (blueberry and crowberry) collected where available.

3.2 Rose Creek Tailings Transect Study

As the Rose Creek tailings impoundments had been identified as a potential primary source for off-site (non-mine or undisturbed) airborne metals/element contamination, this area was the primary focus of the 2002 soils and vegetation field study. Specific objectives of this study component were to identify if any elevated elemental concentrations exist off-site due to mine operations in the Rose Creek area, and to identify patterns and factors affecting the spatial distribution of these concentrations. In order to address this objective, eight transects were laid out radially from the approximate centre of the intermediate tailings impoundment, with sampling points generally located at equal intervals along these transects. The tailings transect sampling points are shown as purple triangles in Figure 1. Table 1, below, shows number of sample points and total length of each transect.

TABLE 1

Rose Creek Tailings Transect Sampling

Transect #	# of Sampling Points	Transect Length (m)
1	3	2070
2	4	2970
3	4	4220
4	5	3560
5	5	3330
6	4	5450
7	4	6000
8	4	1970
Total	**33**	**29570**

Previous studies on dust-borne metals contamination at other lead-zinc mines in northern Canada have shown affected areas extending up to 4500 m from contaminant sources. Based on this information, transects were planned to extend roughly 4-5 km from the transect centre, particularly along the northwest—southeast axis of the Rose Creek valley, which channels the seasonal prevailing winds. In practice, transect lengths were limited by access and time considerations, and were generally terminated at or near the height of land defining the Rose Creek Valley, where applicable. Transects 6 and 7 passed through large mine-affected areas adjacent to the tailings impoundments, and thus were extended beyond these areas. Total transect lengths varied from approximately 2 to 6 km from the intermediate impoundment centre.

Tailings transect sampling included foliar/above-ground samples of willow, birch, fescue, and lichen; root samples of willow; and soil samples. Samples of other species (blueberry) were occasionally collected to provide information for human-health risk assessment purposes (see section 3.4).

Photo 2 shows a typical sampling point (2-3) in Upland Forest on the tailings transects. Photo 3 shows the downstream Rose Creek transect location, looking west across the Rose Creek valley from the northern side.

PHOTO 2 Upland Forest Sampling Point (2-3)

PHOTO 3 Downstream Rose Creek Transect Area

3.3 Additional Mine-Area Sampling

To address the objective of obtaining reconnaissance-level information on potential contamination to off-site (undisturbed) areas resulting from mine operations, 17 sample points (shown as black stars in Figure 1) were established at various sites adjacent to the Faro/Grum/Vangorda mine areas. These sample points were intended to allow identification of any elevated elemental concentrations in soils and vegetation on these sites, but not to provide detailed information on spatial distribution of these concentrations. Sites were selected to represent a range of areas and potential contaminant sources on the mine site, and were located to be adjacent to areas of probable maximum effect, including:

- the Faro pit (Faro1);
- the Faro rock dumps (Faro2, 5 and 6);
- the mill site and crusher (Faro2);
- the concentrate load-out site (Faro5 and 6);
- the Rose Creek tailings impoundments (Faro3, 4 and 7);

- the Vangorda rock dumps (Van1, 2, 3 and 4, and VB1 and 2);
- the Grum rock dumps (Van5 and 8); and
- the Grum/Vangorda Haulroad (Van9 and 10).

In addition to these off-site sample points, two sample points (Van6 and 7) were located on reclaimed mine waste in the Grum/Vangorda area, to provide some information on likely post-reclamation vegetation elemental concentrations.

The additional mine area samples included foliar/above-ground samples for all species (willow, birch, fescue, lichen) collected in the tailings transect study component, where available. Vegetation species collected on reclaimed sites included creeping red fescue (*Festuca rubra*) and white clover (*Trifolium repens*), which were seeded on these sites during previous reclamation work. Where available, blueberry and crowberry were also collected, to provide information for terrestrial/human-health risk assessment purposes (see Section 3.4). Surface soil samples (0-10 cm) were collected at the Faro4, 5, and 7, and Van7 and 8 sites, to provide information on soil elemental concentrations adjacent to these mine-site areas and on elemental concentrations in the overburden (till) material used for capping of reclaimed sites.

3.4 Terrestrial/Human-Health Risk Assessment Sampling

The 2002 soils and vegetation sampling program included a component to provide support to an anticipated terrestrial and human health risk assessment for the Anvil Range mine complex. Requested information included elemental concentrations in vegetation species consumed by local human and/or wildlife populations, and in soils. This information was ideally to include sampling from areas known as important habitat for wildlife utilizing the general mine area. Consultation with the wildlife biologist working on the Anvil Range environmental assessment project indicated that the following vegetation types/species are of importance to local populations (S. Francis, pers. comm.):

- grasses – used by Fannin sheep, bear, and caribou;
- willow – predominant moose food;
- lichen (*Cladonia* and *Cladina spp.*) – predominant caribou winter food; and

- crowberry and blueberry – used by bear populations.

Information from one of the Ross River residents working at the mine indicated that both crowberry and blueberry are also used by local people for food. The first three types/species listed above were included in the original sample design, and thus represented in tailings transect samples, other mine-area samples, and background samples, where available. In order to provide specific information on elemental concentrations in berries used by humans and bears, both crowberry and blueberry were collected at eight sites to provide reconnaissance-level information for these species. Other species identified as important wildlife food sources included sage (*Artemesia spp.*), soapberry (*Shepherdia canadensis*), sedges (*Carex spp.*), and sweet-vetch (*Hedysarum spp.*). These species were not collected as they were either not found at sample points (sagebrush and sweet-vetch), were rarely located (soapberry), or represented similar food sources as species that were more prevalent and already being collected (sedge).

Information from the Anvil Range environmental baseline report (Gartner Lee Limited, 2002) identifies a major travel corridor for Fannin sheep located between the Grum and Vangorda pits, as the animals move north from Sheep Mountain to Mount Mye. Anecdotal observations from Anvil Range employees indicate that the sheep use bare and revegetated mine areas as part of this travel corridor. In order to provide information on soils and vegetation elemental concentrations on this route, samples Van5-8 were located to be within areas reported as within the route and/or being heavily used by sheep on site. The seasonal use areas on Mount Mye and Sheep Mountain were outside of the study area for the 2002 soils and vegetation program.

Data collected for the terrestrial/human health risk assessment study component are presented in the Appendices to this document, but have not been interpreted as part of this report.

3.5 Statistical Interpretation of Data

Statistical analyses (t-tests and general-linear-model analyses of variance) were conducted on collected data sets to identify significant differences between sample groups ($\alpha = 0.05$). However, due to variation in the degree of mine influence on sample sites, depending on direction and distance from contaminant sources, these analyses are subject to interpretation in defining mine-affected samples for testing against background levels. For this reason, statistical analyses do not form a primary component of data interpretation in this study, and are not presented as such in the text or appendices. However, language in the text has been used carefully to identify statistically valid differences. Use of the term "significant" in describing identified differences in the following discussion indicates statistical significance; where large identified differences are not statistically significant or could not be tested, alternate terms such as "substantial" are used.

4.0 RESULTS AND DISCUSSION

Results are discussed by study component in the following subsections. In discussion of the tailings transect and additional mine area study component results, particular emphasis is placed on examination of lead and zinc concentrations in soil and vegetation, as these elements showed the greatest magnitude of elevations and had elevated levels furthest from potential contaminant sources. These attributes make these elements likely to be the most important contaminants on off-site (undisturbed) areas from mining activity, and also facilitate interpretation of spatial distribution of airborne contamination based on their measured levels. In general, other analyzed metals (including silver, arsenic, cadmium copper, mercury and nickel) show similar trends in distribution of elevated levels, but with less extreme or no significant elevation documented. Chromium showed isolated elevated levels that did not correspond to observed patterns in other elements, and are likely attributable to some mechanism other than airborne contamination from mine-site sources.

4.1 Background Elemental Concentrations

4.1.1 Soil

Analytical results for soil samples taken in the Swim Lake background sampling location are summarized in Table 2, and compared to Yukon Contaminated Sites Regulation (CSR) standards and reference background levels, Canadian Council of Ministers of the Environment (CCME) soil quality guidelines, and published levels for normal background elemental concentrations (complete data sets are presented in Appendix C – published background levels are from Kabata-Pendias, 2001, and are derived from extensive review of studies from around the world on elemental concentrations of non-anthropogenically contaminated soil). Note that the Yukon CSR standards used for comparison were for "park land use" for toxicity to soil invertebrates and plants, as this was the most appropriate comparison for undisturbed lands adjacent in the area of the mine complex. ***These comparisons are made solely for the purpose of identifying highly contaminated areas, and are not intended as an investigation of site contamination covered by the Regulation.*** Likewise, the CCME guidelines cited are for 'residential/parkland" use.

With the exception of selenium, all elements are within published normal ranges, and in general are at the lower end of these ranges and lower than the Yukon reference background concentration (see Table 2). Selenium concentrations at the Swim Lake background site appear to be marginally elevated in comparison to published levels from worldwide sources (Kabata-Pendias, 2001).

TABLE 2

Background Soil Elemental Concentrations (ppm)

		Surface (0-2 cm) n=7	**Sub-surface (5-10 cm) (n=7)**	**Yukon Contaminated Site Regulation Standards**	**Yukon Background Reference [a]**	**CCME Soil Quality Guidelines [b]**	**Published Normal Background Concentrations [c]**
pH	Mean	5.55	5.68				
	Std. Dev.	0.62	0.78				
Silver	Mean	0.46	0.38	20			0.2 - 3.2
	Std. Dev.	0.43	0.34				
Arsenic	Mean	10	10	50	14.9	12	4.8 - 13.6
	Std. Dev.	6	8				
Cadmium	Mean	0.99	1.08	70	1.3	10	0.1 - 1.1
	Std. Dev.	0.72	0.72				
Chromium	Mean	1.56	2.55	300	58.9	64	2.6 - 100
	Std. Dev.	1.07	3.71				
Copper	Mean	7.14	9.84	150	74	63	5 - 50
	Std. Dev.	6.05	10.96				
Mercury	Mean	0.13	0.11	100		6.6	0.06 - 0.41
	Std. Dev.	0.06	0.06				
Nickel	Mean	1.9	4.0	100		50	8 - 29
	Std. Dev.	2.1	4.2				
Lead	Mean	12.2	6.9	1000	108.6	140	1.5 - 50.1
	Std. Dev.	4.7	6.8				
Selenium	Mean	4	5	3		1	0.1 - 2.1
	Std. Dev.	3	2				
Zinc	Mean	72.2	38.7	450	138.1	200	10 - 200
	Std. Dev.	42.2	14.7				

[a] Yukon Contaminated Sites Regulation
[b] Canadian Council of Ministers of the Environment, 1999, updated 2002
[c] Kabata-Pendias, 2001.

It should be noted that a study of till geochemistry in the Swim Basin area (Bond, 2001) has indicated higher levels of lead and zinc in subsurface soil material in the Swim Lake background sampling area than the current study, with reported lead concentrations of 15-172 ppm (Bond, 2001) vs. 1-20 ppm (current study), and zinc concentrations of 80-622 ppm (Bond, 2001) vs. 15-54 (current study). This difference may be due to deeper sampling (to approximately 60 cm) in the till geochemistry study than in the current study, or to differing sampling locations. Excavated soil pits observed in the Swim Lake background area of the current study suggested overlap of the sampling area of the two studies, particularly at sample points SW7 and 6, which indicates that background sampling in the current study should be within this identified mineralized zone in the Swim Basin.

4.1.2 Vegetation

Analytical results for vegetation samples taken in the Swim Lake background sampling site are presented in Table 3, and compared to cited levels for normal background elemental concentrations. It should be noted that these cited background levels are generic (not species-specific), based on review of measured concentrations in forages, shrubs, and trees. (Data from Kabata Pendias, 2001 are based on extensive review of published studies on vegetation elemental concentrations, including Canadian sources. Jones *et al.*, unpublished, includes similar data from a review of Canadian studies conducted for the Canada Centre for Mineral and Energy Technology (CANMET), including unpublished work conducted in the vicinity of a number of Canadian mines. Ranges presented in Table 3 were selected to be representative of similar genera as species collected in the current study, from Canadian sources if possible, and from non-anthropogenically contaminated sites.) As elemental uptake may vary widely by species, the published background levels may not be applicable for all species in the current study, particularly for lichen. Nevertheless, the majority of reported results for elemental concentrations in vegetation at the Swim Lake background area are within published normal ranges. Cadmium levels in willow appear elevated in comparison to published "normal" levels, and zinc levels in birch appear marginally elevated. Despite marginally elevated soil selenium concentrations, there is no evidence of elevated selenium uptake by vegetation in the Swim Lake sampling area.

TABLE 3

Background Vegetation Elemental Concentrations (ppm)

		Lichen (n=6)	Willow Foliage (n=7)	Willow Root (n=7)	Birch (n=7)	Blueberry (n=2)	Crowberry (n=1)	Cited Normal Background Concentrations
Silver	Range	-	0.01 - 0.03	0.01 - 0.05	0.01 - 0.02			0.03 - 0.5[a]
	Mean	0.01	0.01	0.02	0.01	0.01	0.10	
Arsenic	Range	-	-	-	-			0.009 - 1.5[a]
	Mean	1	1	1	1	1	1	
Cadmium	Range	0.02 - 0.13	1.16 - 6.13	0.61 - 5.72	0.02 - 0.15			0.03 - 0.5[b]
	Mean	0.04	2.73	2.04	0.10	0.15	0.02	
Chromium	Range	0.14 - 0.27	0.05 - 0.22	0.05 - 0.99	0.06 - 0.18			0.02 - 0.2[a]
	Mean	0.21	0.12	0.35	0.12	0.07	0.07	
Copper	Range	0.60 - 1.04	2.56 - 6.00	3.39 - 8.79	3.92 - 6.13			2 – 30[b]
	Mean	0.89	3.38	5.39	4.76	3.67	3.43	
Mercury	Range	0.01 - 0.02	-	0.01 - 0.04	0.01 - 0.03			0.01 - 0.4[b]
	Mean	0.01	0.01	0.02	0.02	0.01	0.01	
Nickel	Range	0.1 - 0.4	0.2 - 2.9	0.1 - 1.5	0.1 - 1.8			0.1 – 4[b]
	Mean	0.2	1.1	0.7	0.6	0.5	0.3	
Lead	Range	0.7 - 1.6	0.2 - 0.5	0.3 - 2.2	0.3 - 0.8			0.1 – 10[a]
	Mean	1.2	0.3	1.2	0.4	0.3	0.3	
Selenium	Range	-	1 - 2	-	1 - 2			0.002 - 2.9[a]
	Mean	1	1	1	1	1	1	
Zinc	Range	15 - 24	27 - 243	76 - 167	115 - 390			15 – 150[b]
	Mean	19	154	122	242	22	8	

[a] Kabata-Pendias, 2001
[b] Jones *et al*., unpublished

4.2 Rose Creek Tailings Transect Study

For the purpose of interpretation of contaminant sources, it should be noted again that although this study component was based on the intermediate tailings impoundment, sample points in the transect study may be subject to multiple potential contaminant sources, including tailings impoundments and the mill complex.

4.2.1 Soils

Results of soil analyses from the Rose Creek tailings study area are summarized in Table 4 (complete data sets are presented in Appendix C). As samples from this study component may be affected to varying degrees by mine influence, concentration ranges are given as well as means, to identify observed extremes. Data are compared to background levels and standards from Table 2.

TABLE 4

Rose Creek Tailings Transect Soil Elemental Concentrations (ppm)
Surface Samples

		Transect Sample Concentrations (n=33)	Swim Lake Background Concentrations	Yukon Contaminated Site Regulation Standards	Yukon Background Reference [a]	CCME Soil Quality Guidelines [b]	Published Normal Background Concentrations [c]
pH	Range	2.95 - 6.94	4.65 - 6.32				
	Mean	5.28	5.55				
Silver	Range	0.10 - 3.56	0.15 - 1.35				
	Mean	0.72	0.46	20			0.2 - 3.2
Arsenic	Range	2 - 113	4 - 17				
	Mean	21	10	50	14.9	12	4.8 - 13.6
Cadmium	Range	0.14 - 7.45	0.31 - 2.38				
	Mean	1.9	0.99	70	1.3	10	0.1 - 1.1
Chromium	Range	0.05 - 302.04	0.79 - 3.80				
	Mean	21.50	1.56	300	58.9	64	2.6 - 100
Copper	Range	0.05 - 230.22	2.39 - 20.34				
	Mean	52.4	7.14	150	74	63	5 - 50
Mercury	Range	0.07 - 3.04	0.02 - 0.20				
	Mean	0.83	0.13	100		6.6	0.06 - 0.41
Nickel	Range	0.1 - 278.6	0.6 - 6.6				
	Mean	18.9	1.9	100		50	8 - 29
Lead	Range	0.3 - 3750.2	6.1 - 17.9				
	Mean	823.2	12.2	1000	108.6	140	1.5 - 50.1
Selenium	Range	1 - 23	1 - 9				
	Mean	8	4	3		1	0.1 - 2.1
Zinc	Range	0 - 3490	15 - 137				
	Mean	706	72.2	450	138.1	200	10 - 200

TABLE 4 (CONT'D.)
Sub-Surface Samples

		Transect Sample Concentrations (n=33)	Swim Lake Background Concentrations	Yukon Contaminated Site Regulation Standards	Yukon Background Reference [a]	CCME Soil Quality Guidelines [b]	Published Normal Background Concentrations [c]
pH	Range	4.20 - 7.39	4.71 - 6.80				
	Mean	5.40	5.68				
Silver	Range	0.01 - 0.79	0.13 - 1.11				
	Mean	0.11	0.38	20			0.2 - 3.2
Arsenic	Range	1 - 24	4 - 24				
	Mean	10	10	50	14.9	12	4.8 - 13.6
Cadmium	Range	0.02 - 3.92	0.50 - 2.64				
	Mean	0.95	1.08	70	1.3	10	0.1 - 1.1
Chromium	Range	0.52 - 99.84	0.52 - 10.87				
	Mean	20.38	2.55	300	58.9	64	2.6 - 100
Copper	Range	3.36 - 135.41	1.50 - 34.00				
	Mean	25.84	9.84	150	74	63	5 - 50
Mercury	Range	0.02 - 0.92	0.05 - 0.23				
	Mean	0.14	0.11	100		6.6	0.06 - 0.41
Nickel	Range	0.1 - 94.1	0.6 - 12.4				
	Mean	17.3	4.0	100		50	8 - 29
Lead	Range	3.6 - 968.7	1.8 - 21.8				
	Mean	89.7	6.9	1000	108.6	140	1.5 - 50.1
Selenium	Range	1 - 19	2 - 8				
	Mean	5	5	3		1	0.1 - 2.1
Zinc	Range	10 - 2370	15 - 54				
	Mean	255	38.7	450	138.1	200	10 - 200

[a] Yukon Contaminated Sites Regulation
[b] Canadian Council of Ministers of the Environment, 1999, updated 2002
[c] Kabata-Pendias, 2001.

Data from surface soil sampling show elevated elemental concentrations on the tailings transects in comparison to the Swim Lake background data. For all analyzed elements, mean concentrations and observed maxima are higher for the tailings transect area than for the background sampling area. This difference is substantial for arsenic, chromium, copper, mercury, nickel, lead and zinc, for which transect maxima also exceed Yukon and published normal background levels. With the exception of mercury, transect maxima for the above elements also exceed Yukon CSR standards and CCME soil quality guidelines. Exceedences for arsenic, chromium, copper, and nickel in surface samples are limited for the most part to the transect points closest to the tailings impoundment. Exceedences for lead and zinc are more widespread, and extend further from the intermediate tailings impoundment. Statistical testing of transect surface soil samples versus background samples indicates that copper, mercury, lead and zinc levels are significantly higher in the transect sampling area.

Elemental concentrations in sub-surface samples from the tailings transect area are generally more similar to the Swim Lake background concentrations, and with the exceptions of lead and zinc are within published normal ranges. Statistical comparison of sub-surface samples from the transect-area and background sample points shows no significant differences for the elements that have elevated concentrations in surface soil samples. Elevated elemental concentrations in the sub-surface samples are generally confined either to areas immediately adjacent to the tailings impoundment, or to sample points adjacent to the Rose Creek drainage system, which may be subject to some waterborne metals addition.

4.2.1.1 Mechanisms of Contamination

Figure 2 compares surface (0-2 cm) soil concentrations to sub-surface (5-10 cm) concentrations for lead and zinc, which are the elements found to be most elevated and most widespread at elevated concentrations on the tailings transect area. This information is presented with data points and with a 1:1 reference line. Data points clustered around the reference line indicate samples with similar surface and subsurface concentrations. Points lower than the line indicate samples with elevated concentrations at greater depths, and samples above the line indicate enrichment at the soil surface.

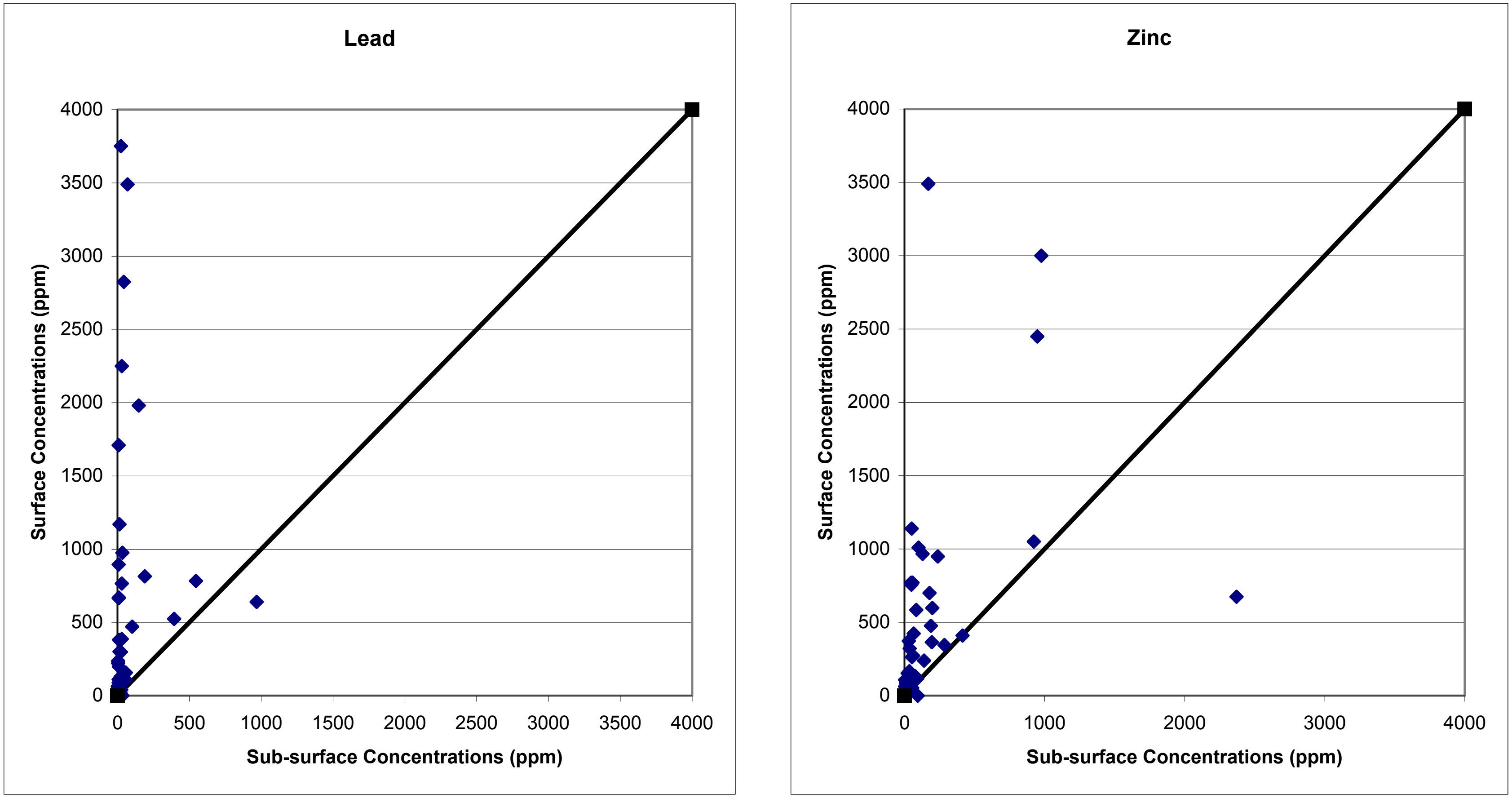


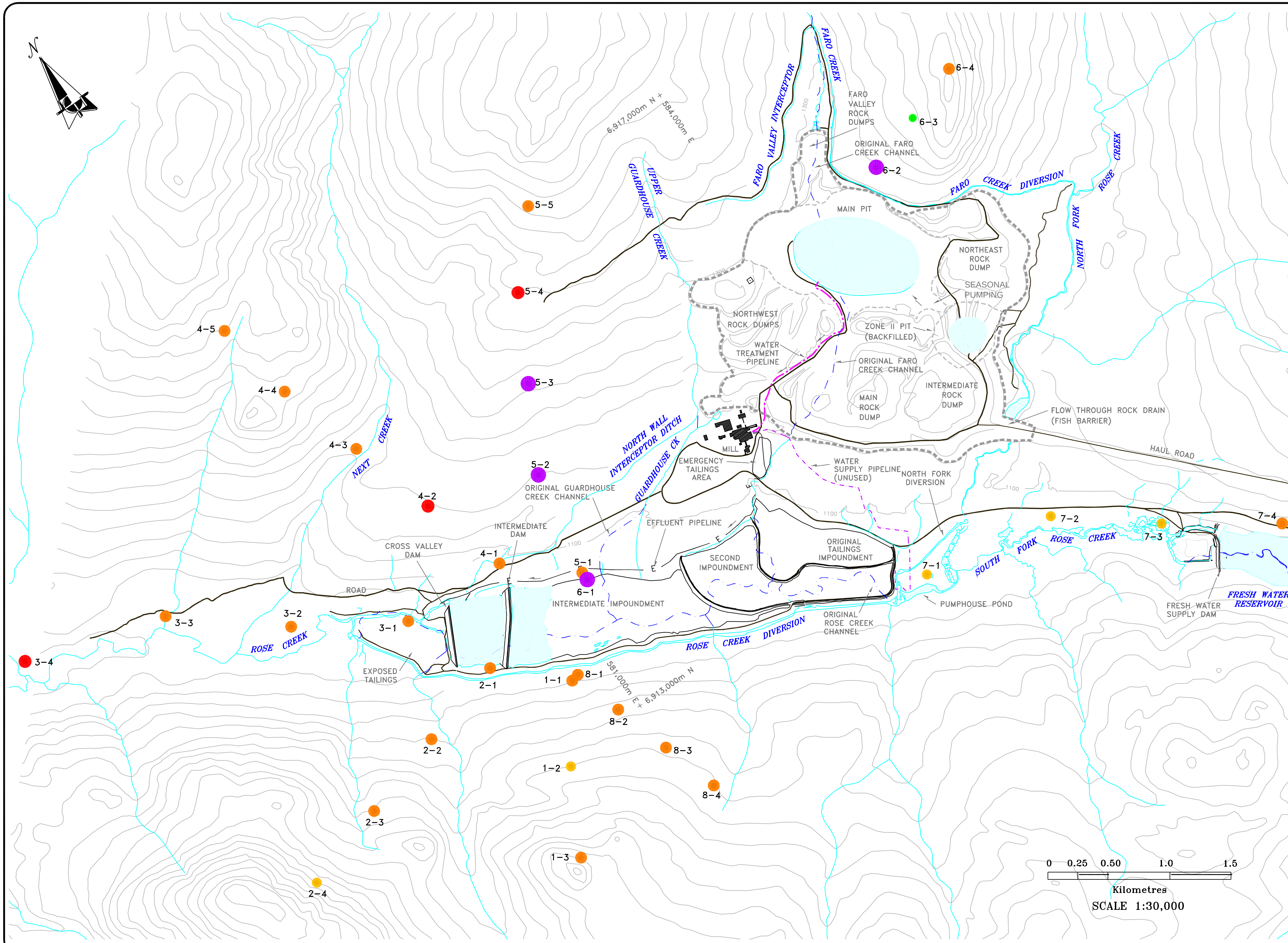
FIGURE 2 Surface Soil Lead and Zinc Levels versus Sub-surface Levels on Tailings Transect Sampling Points

The data presented in Figure 2 suggest substantial airborne (dust) contamination of lead and zinc on the tailings transect sampling area, at least at some locations. This conclusion is based on: 1) reported surface soil lead and zinc levels that are substantially higher than the Swim Lake background levels and published Yukon and worldwide normal levels, while sub-surface samples are closer to or within normal ranges; and 2) the clustering of data points for zinc and lead above the 1:1 reference line and close to the y axes, indicating high surface soil concentrations without correspondingly high sub-surface concentrations. If elevated levels were due to natural mineralization in the mine vicinity not represented by the Swim Lake background samples, one would expect even the more elevated concentrations to fall closer to the 1:1 reference line. It should also be noted that reported metals concentrations on some surface samples are substantially above the maxima (172 and 622 ppm for lead and zinc, respectively) reported in the Anvil district till geochemistry study (Bond, 2001).

4.2.1.2 Spatial Distribution

Figures 3 and 4 show ranges of surface soil lead (Figure 3) and zinc (Figure 4) concentrations on the tailings sampling transects. Defined ranges are based on the Swim Lake maxima recorded in this study, as well as Yukon background levels (defined by the Yukon CSR) and Yukon CSR standards. These figures indicate that extremely elevated levels of lead and zinc are generally located either adjacent to mine disturbances or on transects to the northeast to west of these disturbances, including the downstream Rose Creek drainage system. The consistent elevated levels along transect 3, 4 and 5 suggest that these have been the predominant directions of airborne deposition of dust from mine contaminant sources.

Wind rose diagrams from the Faro airport are presented in Appendix D. These diagrams indicate that prevailing wind directions in the Anvil Range area are from the east to southeast from October to April, and from the west and northwest from June to August, with September and May having roughly equal northwest and southeast influences. According to



LEGEND:
- ROADS
- FOOTPRINT OF OPEN PITS AND ROCK DUMPS
- EXISTING SURFACE DRAINAGE
- PRE-MINE DRAINAGE
- E EFFLUENT PIPELINE
- PIPELINE
- WATER TREATMENT PIPELINE
- SURFACE WATER
- • 1-2 TAILINGS TRANSECTS SAMPLING POINTS

ROSE CREEK TAILINGS TRANSECT SURFACE SOIL LEAD CONCENTRATIONS (ppm)

- < 17.9 (SWIM LAKE MAXIMUM)
- FROM 17.9 (SWIM LAKE MAXIMUM) TO 108.6 (YUKON BACKGROUND)
- FROM 108.6 (YUKON BACKGROUND) TO 1000 (YUKON CSR STANDARD)
- FROM 1000 (YUKON CSR STANDARD) TO 2000 (TWICE YUKON CSR STANDARD)
- >2000 (TWICE YUKON CSR STANDARD) MAX. 3750 ppm

SOURCES OF INFORMATION:

1. DIGITAL COPY OF 1:50,000 TOPOGRAPHIC MAP SUPPLIED BY SRK CONSULTING.
2. VEGETATION AND SOILS METALS MAPPING CONDUCTED IN SUMMER 2002 BY JUSTIN STRAKER OF C.E. JONES & ASSOCIATES
3. MAP COORDINATESA ARE UTM NAD83 ZONE 8; CONTOUR INTERVAL 100 FT.
4. FARO MINE DETAILS ADAPTED FROM DRAWINGS BY ROBERTSON GEOCONSULTANTS INC.

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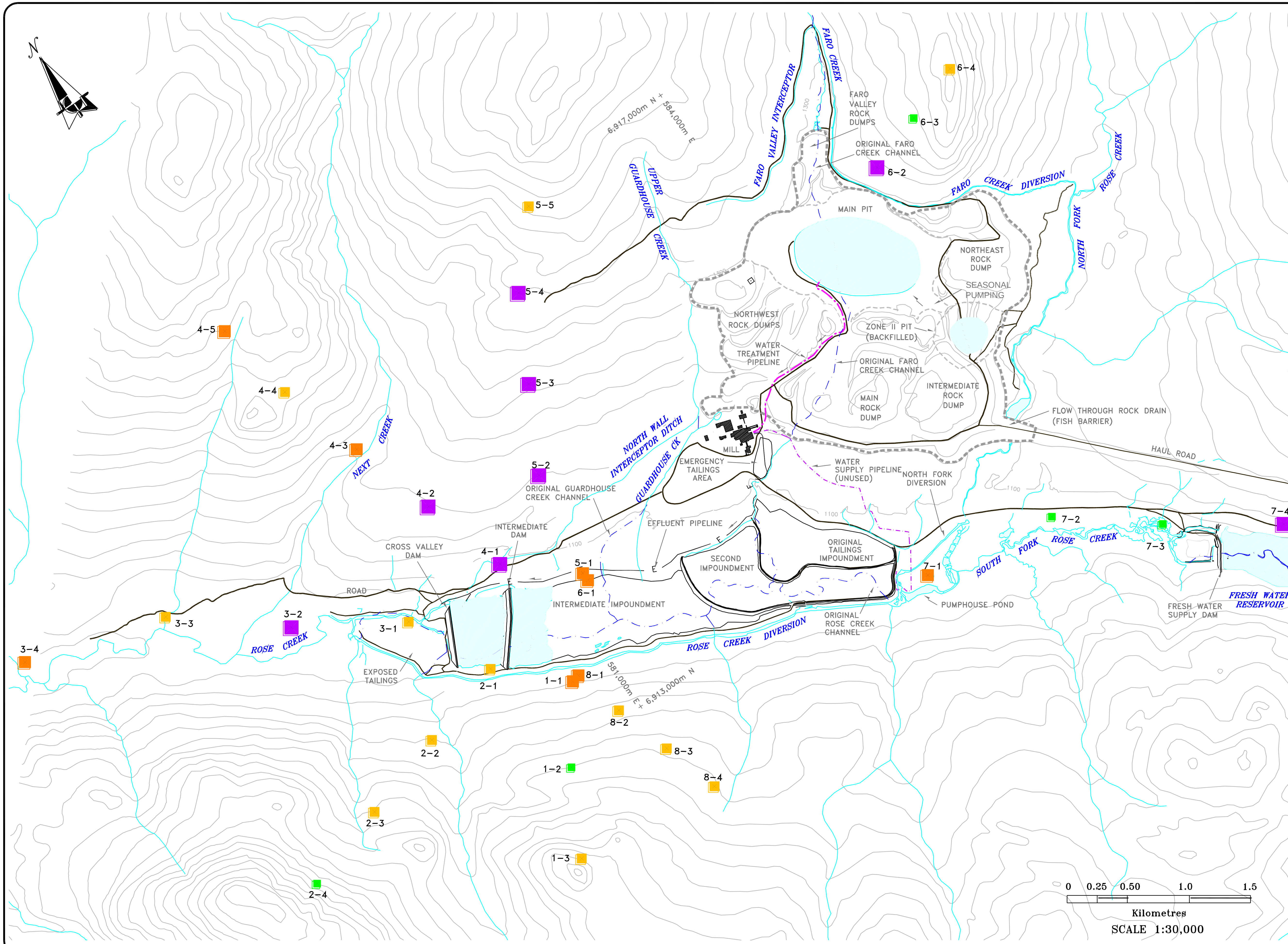
REVISION:	0

CE JONES & Associates Ltd.

METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

ROSE CREEK TAILINGS TRANSECT SURFACE SOIL LEAD CONCENTRATIONS

Gartner Lee | Deloitte & Touche | FIGURE NO. 3



LEGEND:

ROADS

FOOTPRINT OF OPEN PITS AND ROCK DUMPS

EXISTING SURFACE DRAINAGE

PRE-MINE DRAINAGE

E EFFLUENT PIPELINE

PIPELINE

WATER TREATMENT PIPELINE

SURFACE WATER

• 1-2 TAILINGS TRANSECTS SAMPLING POINTS

ROSE CREEK TAILINGS TRANSECT SURFACE SOIL ZINC CONCENTRATIONS (ppm)

< 136.6 (SWIM LAKE MAXIMUM)

FROM 136.6 (SWIM LAKE MAXIMUM) TO 450 (YUKON CSR STANDARD)

FROM 450 (YUKON CSR STANDARD) TO 900 (TWICE YUKON CSR STANDARD)

>900 (TWICE YUKON CSR STANDARD) MAX. 3490 ppm

SOURCES OF INFORMATION:

1. DIGITAL COPY OF 1:50,000 TOPOGRAPHIC MAP SUPPLIED BY SRK CONSULTING.
2. VEGETATION AND SOILS METALS MAPPING CONDUCTED IN SUMMER 2002 BY JUSTIN STRAKER OF C.E. JONES & ASSOCIATES
3. MAP COORDINATESA ARE UTM NAD83 ZONE 8; CONTOUR INTERVAL 100 FT.
4. FARO MINE DETAILS ADAPTED FROM DRAWINGS BY ROBERTSON GEOCONSULTANTS INC.

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METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

ROSE CREEK TAILINGS TRANSECT SURFACE SOIL ZINC CONCENTRATIONS

Gartner Lee | Deloitte & Touche | FIGURE NO. 4

a recent study of wind patterns at the Anvil Range mine site, the prevailing southeasterly winds in the valley bottom veer to southerly at higher elevations and to southwesterly above the mountaintops, with increasing velocities at increasing elevations (Pinard, 2002).

This combination of prevailing wind direction and rotation with increasing elevation is likely responsible for the observed higher soil metals concentrations along transects 4 and 5, which are to the west to northeast of the tailings impoundments and mill complex. This distribution pattern suggests substantial airborne dust contamination occurring between September and May.

Surface soil lead and zinc levels for each transect are presented by distance from the intermediate tailings impoundment centre in Appendix E (equations for best-fit curves are shown where appropriate). The relationship between soil elemental concentrations and distance from potential mine contaminant sources varies depending on the degree of influence of prevailing airborne deposition patterns and on other possible sources of enrichment such as surface water. Transects 1 and 2, which proceed on southwest bearings from the tailings centre, appear to be the least influenced by airborne metals deposition, but still show evidence of elevated metals levels based on the slope of the concentration—distance curve. Lead and zinc concentrations on these transects are 100-200 ppm at approximately 1.5 km from the tailings centre, and are 50-100 ppm at 3 km. At this distance, zinc levels are similar to the Swim Lake background data, but lead levels remain well above background. This finding suggests that the zone of mine influence extends further in these directions than the sampled distance (3 km); however, it may be that these elevated levels indicate a difference between Swim Lake background concentrations and those in the immediate vicinity of the mine site. Sampling at greater distances would be necessary to establish which of these scenarios is correct. The concentration—distance relationship is similar on transects 6 and 8 as on transects 1 and 2, but with slightly higher levels (200-400 ppm at 1 km), which may indicate the influence of the prevailing summer west/northwest winds.

Transects 3 and 7 are directly adjacent to the Rose Creek drainage system. There is no clear concentration—distance relationship on these valley-bottom transects. Lead and zinc levels on these transects are generally elevated in comparison to the Swim Lake background levels. Concentrations on transect 3 are also elevated in comparison to those on the sideslope transects 1, 2, 6 and 8, except for sample points on these transects closest to the intermediate tailings impoundment.

The concentration—distance plots for lead and zinc on transects 4 and 5 generally show decreasing concentrations with distance from mine disturbances, but show maxima not on the sample points closest to the tailings impoundment, but on points 1-2 km from the tailings centre, at higher elevations. These maxima at greater distances than on other transects may be due to the reported increase in wind velocity at higher elevations, which could result in increased deposition on higher-elevation sideslope points than in the valley bottom, or could be attributable to different primary contaminant sources than the tailings impoundment. These topographic differences may also be responsible for the anomalously high soil lead and zinc concentrations observed at sample point 4-5. Although this sample point appears adjacent to a mapped drainage channel in Figures 3 and 4, it was located in an open-slope position with no obvious drainage influence.

Statistical analysis of data from transect 4 and 5 sample points versus the Swim Lake background points indicates significantly higher surface soil concentrations on the transects for the following elements: arsenic, cadmium, copper, lead, mercury, selenium, and zinc. The mean lead concentration in transect 4 and 5 surface soil samples is 1384.4 ppm, versus 12.2 at Swim Lake, with mean zinc concentrations of 1244 ppm on the transects versus 72 at Swim Lake. Testing of sub-surface samples from these transects versus background levels indicates no significant differences for the above elements, which supports the conclusion that elevated levels are due to airborne deposition.

4.2.2 Vegetation

4.2.2.1 Vascular Plants

Results of vegetation sampling on the tailings transects are presented in Table 5 (complete data sets are presented in Appendix F). Statistical analysis of these data versus the Swim Lake background data for vascular plants (willow and birch) shows no significant differences between sites, with the exception of nickel in birch foliage. Comparison of transect elemental concentration means for vascular plants versus published normal levels (also means) indicates that the majority of elements in these samples are within normal ranges. Cadmium, chromium and zinc are marginally elevated in comparison to the published normal levels; however, for cadmium and zinc, the Swim Lake background means are also above these published levels.

TABLE 5

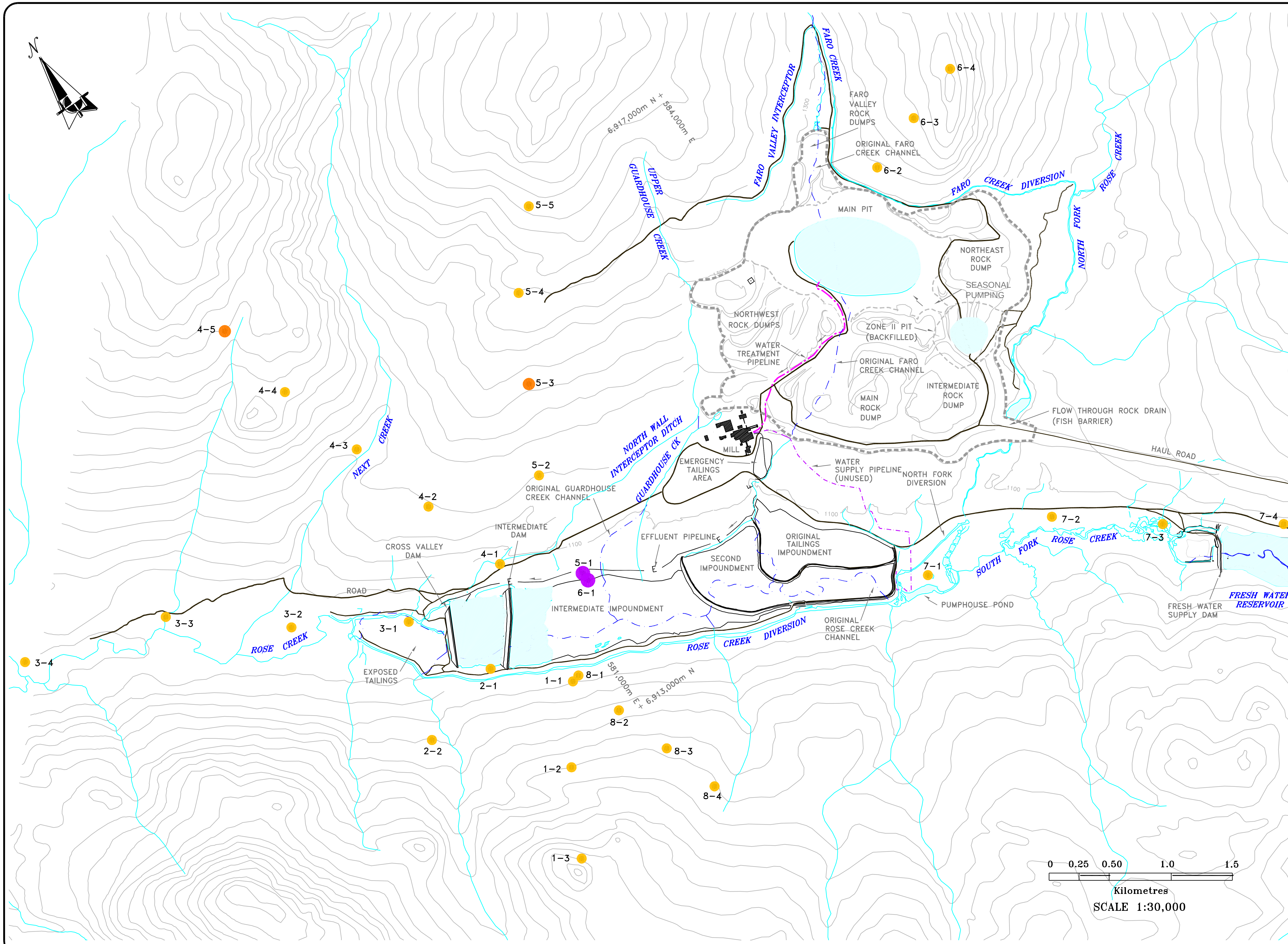
Transect Vegetation Elemental Concentrations (ppm)

		Lichen (n=24)	Willow Foliage (n=31)	Willow Root (n=29)	Birch (n=31)	Grass (n=13)	Blueberry (n=2)	Cited Normal Background Concentrations	Phytotoxicity
Silver	Range	0.01 - 1.83	0.01 - 0.20	0.01 - 1.24	0.01 - 0.08	0.01 - 0.34		0.03 - 0.5[a]	5.00[a]
	Mean	0.36	0.04	0.17	0.02	0.05	0.01		
Arsenic	Range	1 - 24	1 - 2	1 - 28	-	-		0.009 - 1.5[a]	2-100[a]
	Mean	3	1	2	1	1	1		
Cadmium	Range	0.02 - 1.39	0.31 - 15.73	0.12 - 8.86	0.02 - 0.69	0.02 - 0.43		0.03 - 0.5[b]	5 – 20[a]
	Mean	0.37	2.82	1.81	0.12	0.12	0.11		
Chromium	Range	0.29 - 4.60	0.05 - 3.69	0.19 - 20.48	0.06 - 3.56	0.01 - 2.11		0.02 - 0.2[a]	1 – 100[a]
	Mean	1.26	0.40	3.77	0.29	0.40	0.11		
Copper	Range	1.51 - 35.40	2.07 - 8.54	2.07 - 101.17	3.19 - 6.86	1.99 - 4.30		2 – 30[b]	10 – 30[a]
	Mean	8.37	4.56	14.45	5.05	2.61	4.59		
Mercury	Range	0.01 - 0.51	0.01 - 0.03	0.01 - 0.51	0.01 - 0.05	0.01 - 0.04		0.01 - 0.4[b]	1 – 8[a]
	Mean	0.09	0.02	0.06	0.02	0.03	0.01		
Nickel	Range	0.4 - 4.6	0.4 - 12.2	0.3 - 19.9	0.6 - 3.9	0.4 - 2.7		0.1 – 4[b]	20 – 300[a]
	Mean	1.2	2.9	3.9	1.8	1.4	0.7		
Lead	Range	16.7 - 747.7	0.5 - 34.6	1.3 - 566.4	0.9 - 61.7	0.8 - 30.0		0.1 – 10[a]	-
	Mean	168.5	4.7	72.6	10.4	6.8	2.3		
Selenium	Range	1 - 5	1 - 3	1 - 3	1 – 3	-		0.002 - 2.9[a]	-
	Mean	1	1	1	1	1	1		
Zinc	Range	35 - 1043	52 - 828	58 - 802	107 – 656	11 - 143		15 – 150[b]	100 – 500[a]
	Mean	232	231	252	301	78	27		

[a] Kabata-Pendias, 2001 [b] Jones *et al*., unpublished

Statistical analysis of foliar elemental data from transects 4 and 5 (shown by soils data to be most affected by dust contamination) for the vascular plants indicates that on these transects, lead and mercury levels are significantly higher than on the Swim Lake background sites, with mean concentrations of 22.2 (transect) and 0.03 (Swim Lake) ppm respectively for birch and 7.7 and 0.02 ppm for willow. (Note that statistical identification of differences in mercury levels may be unreliable due to assumed uniformity of concentrations at the laboratory detection limit; however, surface soil samples show significant differences for mercury on these transects and are not affected by uniform concentration limitations). Despite the fact that these levels are above the local background levels, they are either marginally elevated above published normal ranges (lead in birch), or within these ranges. This indicates that dust contamination has not affected shrubs growing on the transect sites to the degree that is has affected soils, likely for two reasons: 1) the majority of rooting by these species is below the upper organic surface soil horizons, and thus less impacted by dust contamination of these horizons; and 2) as foliar samples were taken from deciduous shrub species, these samples do not reflect cumulative dust loading on leaf surfaces, but only the current year's deposition and translocation from persistent tissues.

Due to the above factors that restrict dust influence on vascular plant foliar metals concentrations, the spatial distributions and concentration—distance relationships for the shrubs is less predictable than for soil. However, plots of sample points at which lead or zinc levels exceed published normal concentrations for willow and birch show that these points are generally confined to the transects to the north to east of the mine disturbances, and/or directly adjacent to mine disturbances, or along the downstream Rose Creek drainage transect (note that all transect data for shrub species exceed the appropriate Swim lake maxima). To demonstrate this finding, plots of concentration ranges of lead and zinc in willow foliage on the tailings transect area are shown in Figures 5 and 6.



LEGEND:

- ROADS
- FOOTPRINT OF OPEN PITS AND ROCK DUMPS
- EXISTING SURFACE DRAINAGE
- PRE-MINE DRAINAGE
- E EFFLUENT PIPELINE
- PIPELINE
- WATER TREATMENT PIPELINE
- SURFACE WATER
- • 1-2 TAILINGS TRANSECTS SAMPLING POINTS

ROSE CREEK TAILINGS TRANSECT FOLIAR LEAD CONCENTRATIONS IN WILLOW (ppm)

- FROM 0.5 (SWIM LAKE MAXIMUM) TO 10 (GENERIC UPPER NORMAL LIMIT)
- FROM 10 (GENERIC UPPER NORMAL LIMIT) TO 20 (TWICE GENERIC UPPER NORMAL LIMIT)
- >20 (TWICE THE GENERIC UPPER NORMAL LIMIT)

SOURCES OF INFORMATION:

1. DIGITAL COPY OF 1:50,000 TOPOGRAPHIC MAP SUPPLIED BY SRK CONSULTING.
2. VEGETATION AND SOILS METALS MAPPING CONDUCTED IN SUMMER 2002 BY JUSTIN STRAKER OF C.E. JONES & ASSOCIATES
3. MAP COORDINATESA ARE UTM NAD83 ZONE 8; CONTOUR INTERVAL 100 FT.
4. FARO MINE DETAILS ADAPTED FROM DRAWINGS BY ROBERTSON GEOCONSULTANTS INC.

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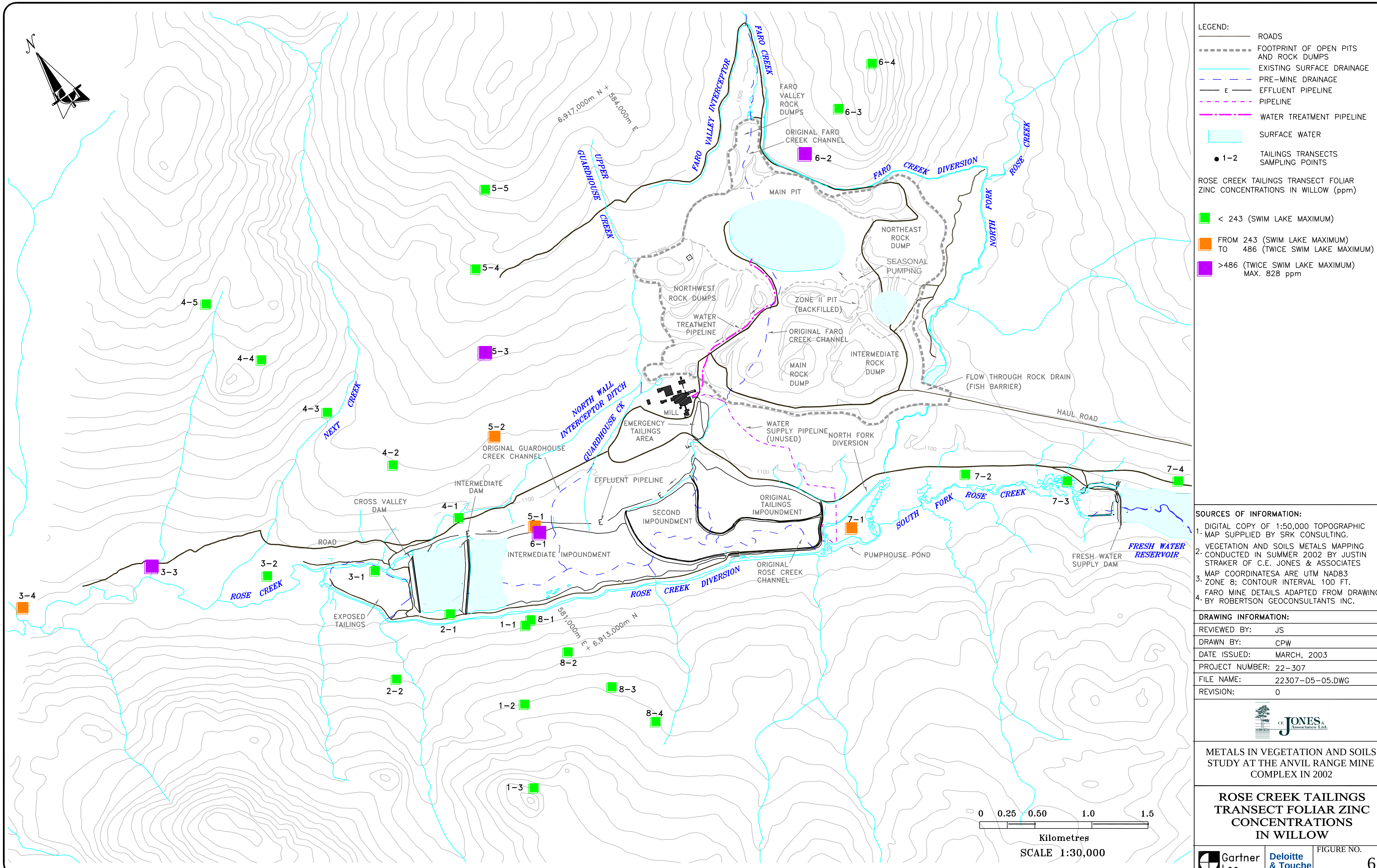
METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

ROSE CREEK TAILINGS TRANSECT FOLIAR LEAD CONCENTRATIONS IN WILLOW

Gartner Lee | Deloitte & Touche | FIGURE NO. 5


LEGEND:
ROADS
FOOTPRINT OF OPEN PITS AND ROCK DUMPS
EXISTING SURFACE DRAINAGE
PRE-MINE DRAINAGE
EFFLUENT PIPELINE
PIPELINE
WATER TREATMENT PIPELINE
SURFACE WATER
1-2 TAILINGS TRANSECTS SAMPLING POINTS
ROSE CREEK TAILINGS TRANSECT FOLIAR ZINC CONCENTRATIONS IN WILLOW (ppm)
< 243 (SWIM LAKE MAXIMUM)
FROM 243 (SWIM LAKE MAXIMUM) TO 486 (TWICE SWIM LAKE MAXIMUM)
>486 (TWICE SWIM LAKE MAXIMUM) MAX. 828 ppm
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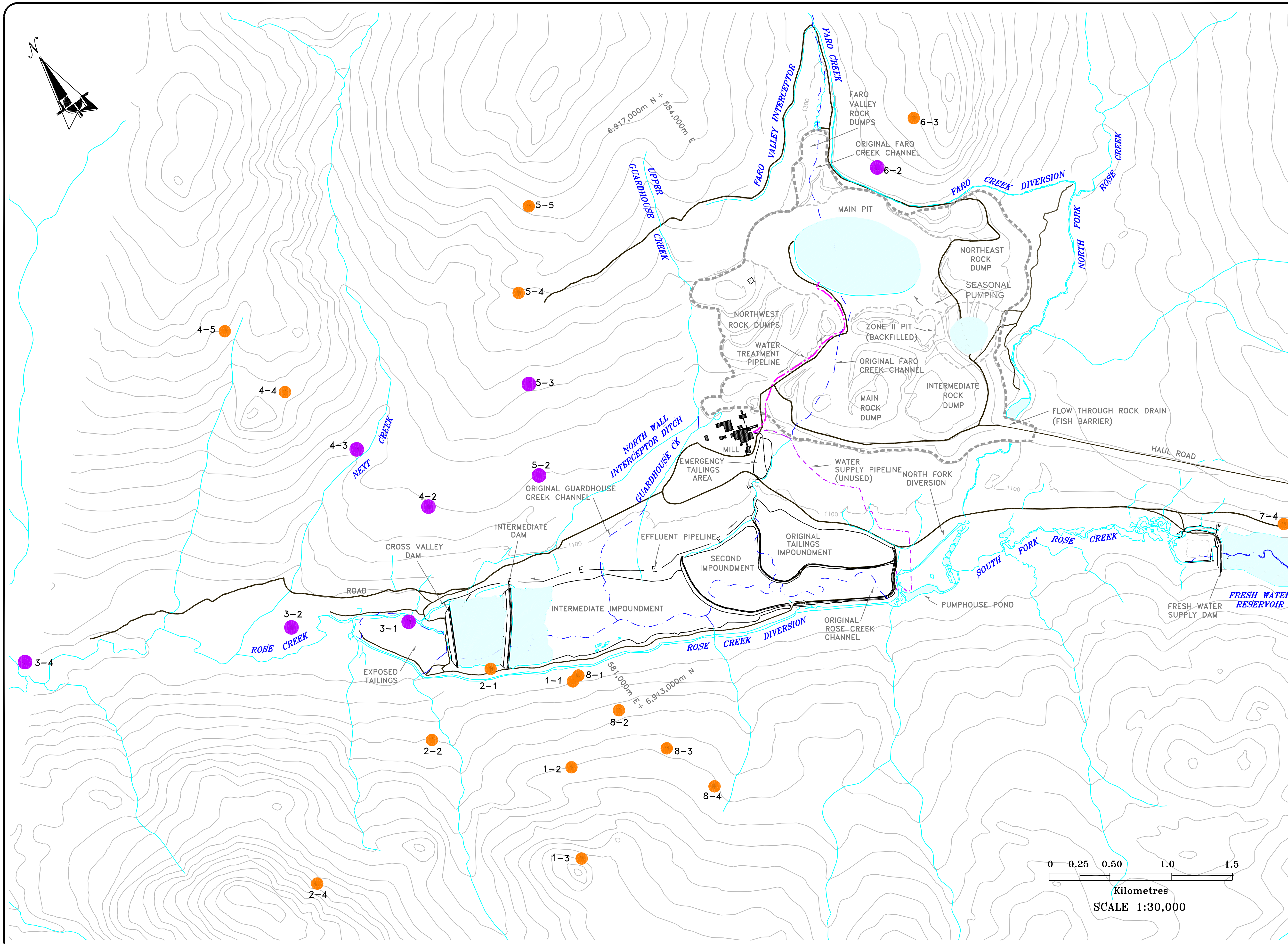
C.E. JONES & Associates Ltd.
METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002
ROSE CREEK TAILINGS TRANSECT FOLIAR ZINC CONCENTRATIONS IN WILLOW
Gartner Lee
Deloitte & Touche
FIGURE NO. 6
N
6,917,000m N + 584,000m E
581,000m E + 6,913,000m N
FARO CREEK
FARO VALLEY INTERCEPTOR
FARO VALLEY ROCK DUMPS
ORIGINAL FARO CREEK CHANNEL
FARO CREEK DIVERSION
ROSE CREEK
NORTH FORK
UPPER GUARDHOUSE CREEK
MAIN PIT
NORTHEAST ROCK DUMP
SEASONAL PUMPING
NORTHWEST ROCK DUMPS
ZONE II PIT (BACKFILLED)
WATER TREATMENT PIPELINE
ORIGINAL FARO CREEK CHANNEL
MAIN ROCK DUMP
INTERMEDIATE ROCK DUMP
FLOW THROUGH ROCK DRAIN (FISH BARRIER)
HAUL ROAD
NORTH WALL INTERCEPTOR DITCH
GUARDHOUSE CK
MILL
EMERGENCY TAILINGS AREA
WATER SUPPLY PIPELINE (UNUSED)
NORTH FORK DIVERSION
NEXT CREEK
ORIGINAL GUARDHOUSE CREEK CHANNEL
EFFLUENT PIPELINE
INTERMEDIATE DAM
CROSS VALLEY DAM
ROAD
SECOND IMPOUNDMENT
ORIGINAL TAILINGS IMPOUNDMENT
INTERMEDIATE IMPOUNDMENT
SOUTH FORK ROSE CREEK
PUMPHOUSE POND
FRESH WATER SUPPLY DAM
FRESH WATER RESERVOIR
ORIGINAL ROSE CREEK CHANNEL
ROSE CREEK DIVERSION
EXPOSED TAILINGS
ROSE CREEK
1-1
1-2
1-3
2-1
2-2
3-1
3-2
3-3
3-4
4-1
4-2
4-3
4-4
4-5
5-1
5-2
5-3
5-4
5-5
6-1
6-2
6-3
6-4
7-1
7-2
7-3
7-4
8-1
8-2
8-3
8-4
0 0.25 0.50 1.0 1.5
Kilometres
SCALE 1:30,000

4.2.2.2 Lichen

Unlike the foliage of deciduous shrubs, lichens are perennial and do not shed tissue as part of their growth cycle. As well, these organisms depend on airborne or precipitation sources for their nutrition, and lack cuticle or stoma, meaning that airborne elements are absorbed over their entire surface. This makes lichens susceptible to accumulation of airborne contaminants over time, and a valuable bioindicator of contamination (Conti and Cecchetti, 2001). Results presented in Table 5 for elemental concentrations in lichen samples on the tailings transect area show elevated concentrations for all elements, in comparison to the Swim Lake background samples. The majority of elements are approximately one order of magnitude higher on the tailings transect samples than background levels; for lead, levels on the tailings transects are approximately two orders of magnitude higher than background. Statistical comparison of tailings elemental concentrations in lichen versus the Swim Lake background data indicates that cadmium, chromium, nickel, lead, and zinc concentrations are significantly higher than background levels.

As would be expected, the spatial distribution of elevated metals concentrations in lichen samples on the tailings transects is similar to that in surface soil samples, with the highest concentrations found either at sample points adjacent to potential contaminant sources or on transects to the north of the tailings impoundments (transects 4 and 5) and downstream on the Rose Creek drainage (transect 3). This is illustrated in Figures 7 and 8, which show ranges of lichen lead and zinc concentrations on the tailings transects. Statistical analysis of data from the most affected transects (3, 4 and 5) versus the Swim Lake data indicates that silver, cadmium, chromium, copper, nickel, lead, zinc and mercury concentrations are significantly higher in lichen on the transect sites than at background locations. Mean lead and zinc levels in lichen on these transects are 288.7 and 379 ppm respectively, versus 1.2 and 19 ppm at Swim Lake.



LEGEND:

ROADS

FOOTPRINT OF OPEN PITS AND ROCK DUMPS

EXISTING SURFACE DRAINAGE

PRE–MINE DRAINAGE

E EFFLUENT PIPELINE

PIPELINE

WATER TREATMENT PIPELINE

SURFACE WATER

• 1–2 TAILINGS TRANSECTS SAMPLING POINTS

ROSE CREEK TAILINGS TRANSECT LICHEN LEAD CONCENTRATIONS (ppm)

FROM 16 (10 X SWIM LAKE MAXIMUM) TO 160 (100 X SWIM LAKE MAXIMUM)

>160 (100 X SWIM LAKE MAXIMUM) MAX 747.7 ppm

SOURCES OF INFORMATION:

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4. FARO MINE DETAILS ADAPTED FROM DRAWINGS BY ROBERTSON GEOCONSULTANTS INC.

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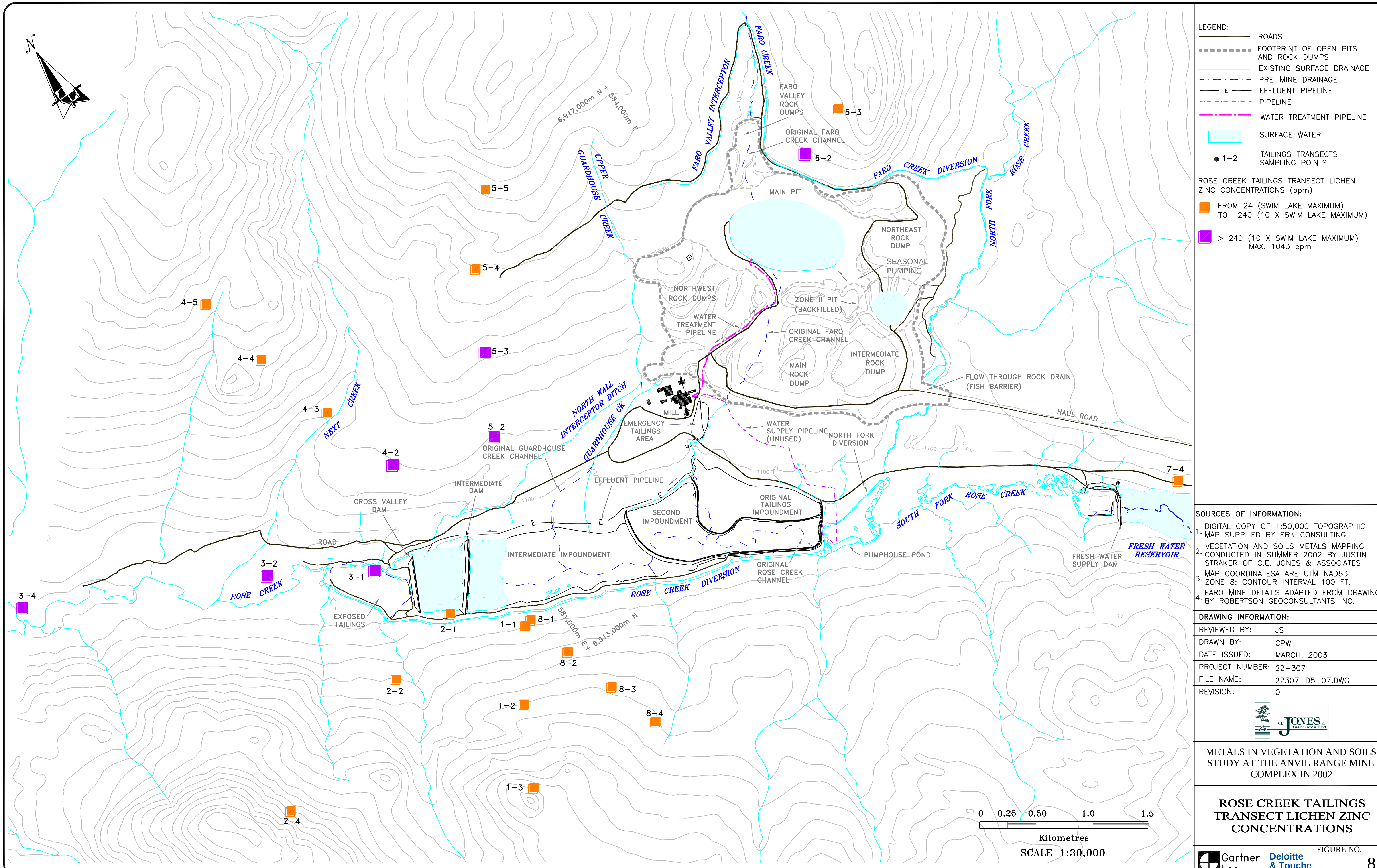
METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002

ROSE CREEK TAILINGS TRANSECT LICHEN LEAD CONCENTRATIONS

Gartner Lee | Deloitte & Touche | FIGURE NO. 7



N
6,917,000m N + 584,000m E
581,000m E + 6,913,000m N
FARO CREEK
FARO VALLEY INTERCEPTOR
FARO VALLEY ROCK DUMPS
ORIGINAL FARO CREEK CHANNEL
FARO CREEK DIVERSION
ROSE CREEK
NORTH FORK
MAIN PIT
NORTHEAST ROCK DUMP
SEASONAL PUMPING
ZONE II PIT (BACKFILLED)
NORTHWEST ROCK DUMPS
WATER TREATMENT PIPELINE
ORIGINAL FARO CREEK CHANNEL
INTERMEDIATE ROCK DUMP
MAIN ROCK DUMP
FLOW THROUGH ROCK DRAIN (FISH BARRIER)
HAUL ROAD
UPPER GUARDHOUSE CREEK
NORTH WALL INTERCEPTOR DITCH
GUARDHOUSE CK
MILL
EMERGENCY TAILINGS AREA
WATER SUPPLY PIPELINE (UNUSED)
NORTH FORK DIVERSION
ORIGINAL GUARDHOUSE CREEK CHANNEL
EFFLUENT PIPELINE
INTERMEDIATE DAM
CROSS VALLEY DAM
NEXT CREEK
ROAD
SECOND IMPOUNDMENT
ORIGINAL TAILINGS IMPOUNDMENT
INTERMEDIATE IMPOUNDMENT
SOUTH FORK ROSE CREEK
PUMPHOUSE POND
FRESH WATER SUPPLY DAM
FRESH WATER RESERVOIR
ROSE CREEK DIVERSION
ORIGINAL ROSE CREEK CHANNEL
EXPOSED TAILINGS
ROSE CREEK
6-3
6-2
5-5
5-4
5-3
5-2
4-5
4-4
4-3
4-2
3-1
3-2
3-4
2-1
2-2
2-4
1-1
1-2
1-3
8-1
8-2
8-3
8-4
7-4
0 0.25 0.50 1.0 1.5
Kilometres
SCALE 1:30,000
LEGEND:
ROADS
FOOTPRINT OF OPEN PITS AND ROCK DUMPS
EXISTING SURFACE DRAINAGE
PRE-MINE DRAINAGE
E EFFLUENT PIPELINE
PIPELINE
WATER TREATMENT PIPELINE
SURFACE WATER
1-2 TAILINGS TRANSECTS SAMPLING POINTS
ROSE CREEK TAILINGS TRANSECT LICHEN ZINC CONCENTRATIONS (ppm)
FROM 24 (SWIM LAKE MAXIMUM) TO 240 (10 X SWIM LAKE MAXIMUM)
> 240 (10 X SWIM LAKE MAXIMUM) MAX. 1043 ppm
SOURCES OF INFORMATION:
1. DIGITAL COPY OF 1:50,000 TOPOGRAPHIC MAP SUPPLIED BY SRK CONSULTING.
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METALS IN VEGETATION AND SOILS STUDY AT THE ANVIL RANGE MINE COMPLEX IN 2002
ROSE CREEK TAILINGS TRANSECT LICHEN ZINC CONCENTRATIONS
Gartner Lee
Deloitte & Touche
FIGURE NO. 8

Concentration—distance relationships for lead and zinc in lichen by transect are presented in Figure 9. These plots confirm spatial distribution patterns described above, with higher concentrations and more extensive zones of contamination found in transects 3, 4 and 5. (Note that there are no plots for transects 6 and 7, as transect 6 had only two sample points with lichen and transect 7 had none.) These plots indicate that, as with surface soils, the most extensive contaminant transport has occurred in a northwest direction, along transect 3 (which may also be influenced by surface water element transport) and transect 4. On these transects, despite declining levels with distance from potential mine contaminant sources, lead and zinc concentrations remain at approximately 100 ppm or greater 3.5-4 km from the tailings impoundment centre. However, data from all transects suggests that sampling in this study did not extend far enough from potential contaminant sources to reach background levels, and thus the zone of contamination from potential mine dust sources likely extends further than 3 km to the south of the tailings and 4.5 km to the north.

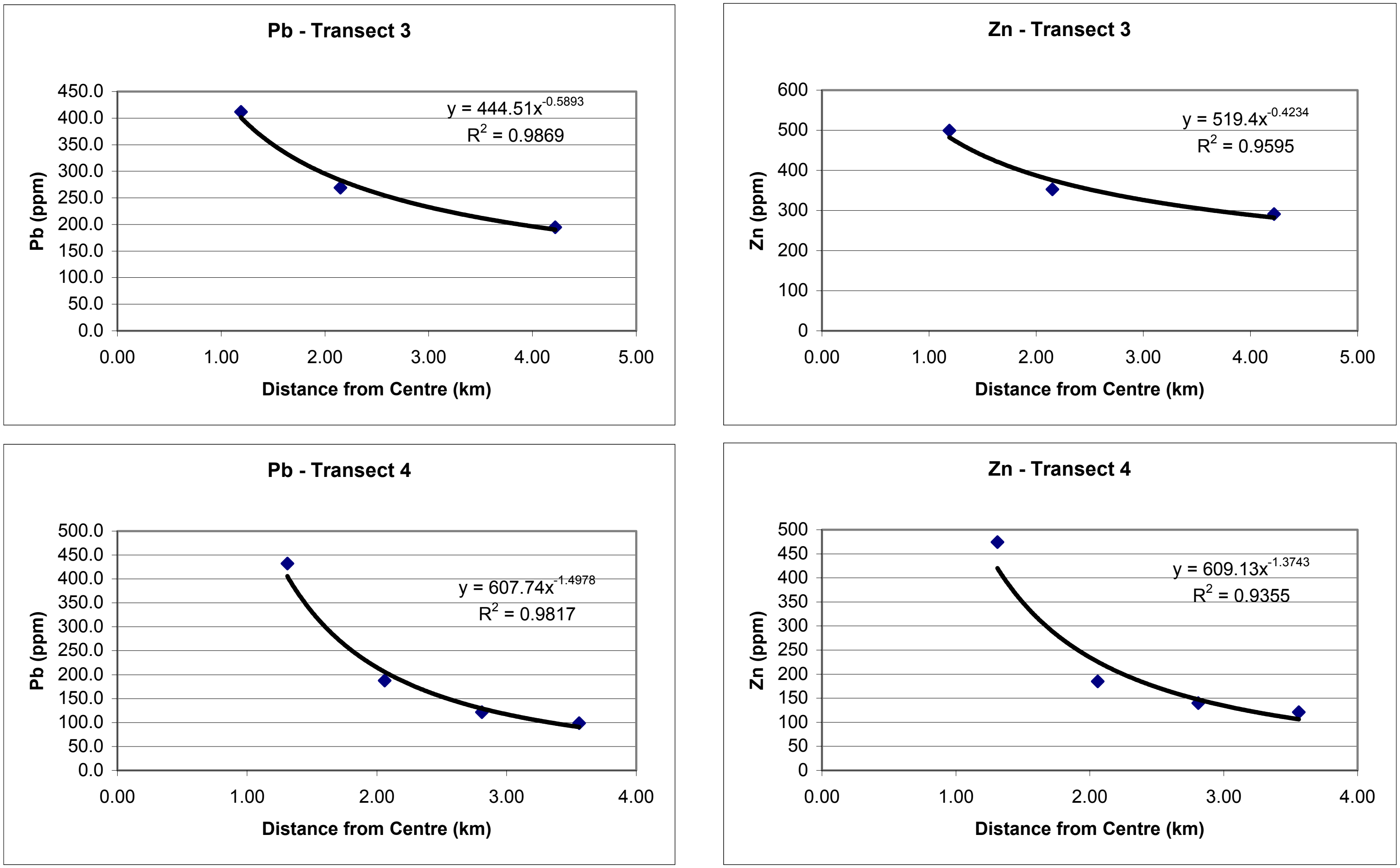

FIGURE 9 Lead and Zinc Concentrations in Lichen by Transect and Distance from Intermediate Tailings Impoundment

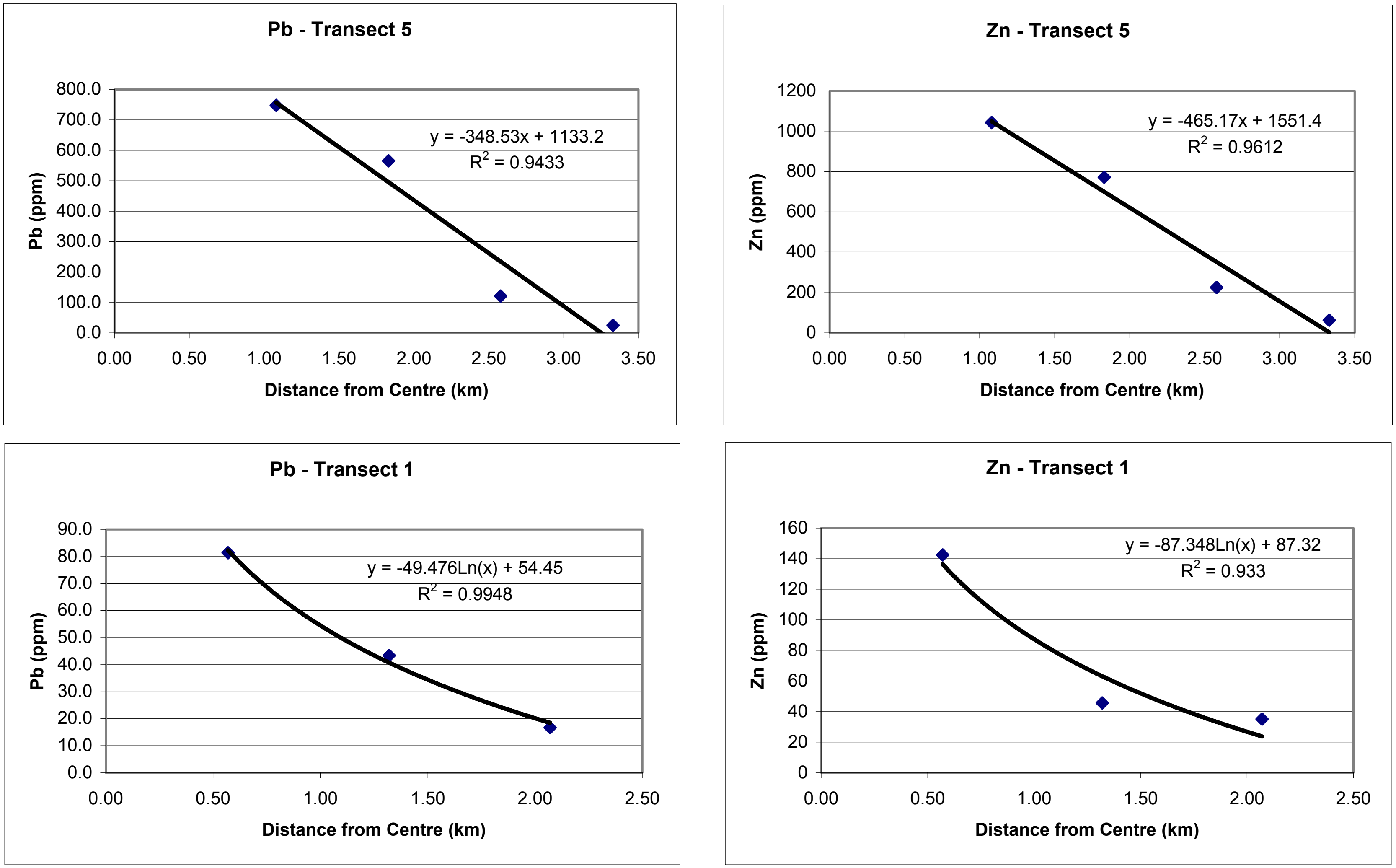

FIGURE 9 (Cont'd.) Lead and Zinc Concentrations in lichen by Transect and Distance from Intermediate Tailings Impoundment

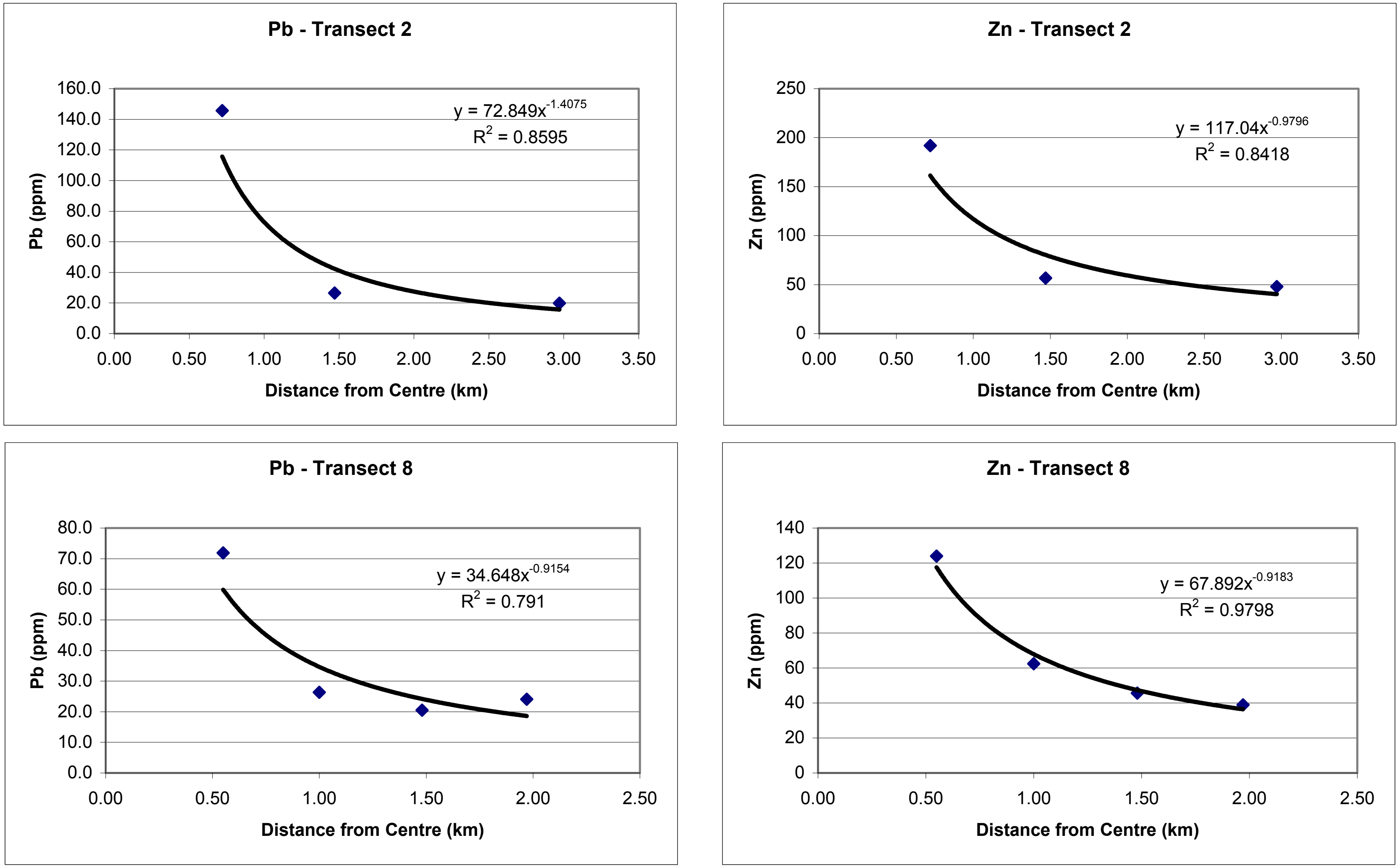

FIGURE 9 (Cont'd.) Lead and Zinc Concentrations in lichen by Transect and Distance from Intermediate Tailings Impoundment

4.2.2.3 Phytotoxicity

Phytotoxicity is the occurrence of harmful effects in plants due to elevated concentrations of elements or chemicals (in the case of this study, to metals) in soils and/or plant tissues.

Comparison of elemental concentrations on the tailings transects presented in Table 5 to published thresholds for observed phytotoxic effects suggests that for the majority of elements, despite elevated concentrations, phytotoxic effects on studied species within zones of contamination near the Anvil Range mine complex are unlikely to occur. (Note that the phyotoxicity thresholds referenced in Table 5 are generic, from a range of studies, and thus are only approximate for the species in the current study.) For copper and zinc, concentrations in the most highly affected samples (generally along transects 3 and 5) may be high enough to have phytotoxic effects. Zinc is not considered to be particularly phytotoxic, and symptoms of toxicity would likely be limited to reductions in growth. Copper is considered to be highly toxic, with common symptoms of toxicity including chlorosis and root malformation (Kabata-Pendias, 2001). Visual symptoms of toxicity in vascular plants were not observed on the tailings transect area of this study.

Despite the documented capacity for lead to inhibit vital plant processes, lead phytotoxicity has not been commonly observed in field conditions (Kabata-Pendias, 2001), and phytotoxic-effect thresholds have not been determined for this element. Thus it is not clear whether lead concentrations observed in plants in this study may be toxic to these plants. However, cell wall damage has been documented in lichen as a result of elevated lead concentrations (Conti and Cecchetti, 2001).

The absence of lichen from sample points showing signs of substantial contamination but which were otherwise undisturbed (points 5-1, 6-1, Van2 and 3, and Faro2, 4, 5 and 7; see Figure 1) suggests elemental concentrations on these sites are high enough to cause lichen mortality. These sites all had a blackened or “burned” look, with intact organic soil horizons, but no current live moss or lichen ground cover. On less affected sites where lichen was present, it is not possible to determine without further study if elevated elemental levels have had phytotoxic effects.

4.3 Additional Mine-Area Sampling

4.3.1 Soils

Bulk surface soils samples (0-10 cm) were collected at two sample points on the Vangorda mine area (Van7 and 8), and three points on the Faro mine area (Faro4, 5 and 7; see Figure 1).

Results from analyses of soil samples taken on the non-transect potentially mine-affected sampling points are presented in Table 6. Results from the Van7 sample (overburden capping near the Vangorda/Grum treatment plant) indicate that elemental levels in this material are generally comparable to Swim Lake background levels, with the exceptions of marginally elevated chromium, copper, nickel and lead levels. However, concentrations for all these elements are below the Yukon background reference level (where available), and within or close to published normal background ranges.

Results from the Van8 sample (undisturbed ground near the Vangorda/Grum treatment plant site) show no contamination of soils at this point, with all elemental concentrations remaining within or below the Swim Lake background ranges.

TABLE 6

Mine Area Soil Elemental Concentrations (ppm)

	VAN7	VAN8	FARO4	FARO5	FARO7	Swim Lake Background Concentrations	Yukon Contaminated Site Regulation Standards	Yukon Background Reference [a]	CCME Soil Quality Guidelines [b]	Published Normal Background Concentrations [c]
PH	6.32	5.29	3.07	4.13	3.98	4.65 - 6.32				
Silver	0.02	0.14	3.21	13.46	1.52	0.15 - 1.35	20			0.2 - 3.2
Arsenic	15	1	**109**	**53**	**28**	4 - 17	50	14.9	12	4.8 - 13.6
Cadmium	0.62	0.07	1.20	1.61	2.28	0.31 - 2.38	70	1.3	10	0.1 - 1.1
Chromium	36.56	1.73	11.77	27.89	23.03	0.79 - 3.80	300	58.9	64	2.6 - 100
Copper	31.80	1.85	**149.36**	**333.63**	**149.49**	2.39 - 20.34	150	74	63	5 - 50
Mercury	0.05	0.03	1.58	**7.34**	1.47	0.02 - 0.20	100		6.6	0.06 - 0.41
Nickel	32.0	0.4	2.4	13.2	20.1	0.6 - 6.6	100		50	8 - 29
Lead	27.9	1.2	**2310.0**	**12415.2**	**1475.2**	6.1 - 17.9	1000	108.6	140	1.5 - 50.1
Selenium	1	2	3	3	4	1 - 9	3		1	0.1 - 2.1
Zinc	88	4	**363**	**528**	**1235**	15 - 137	450	138.1	200	10 - 200

Values in bold exceed applicable Yukon CSR soil standards and/or CCME soil quality guidelines
[a] Yukon Contaminated Sites Regulation
[b] Canadian Council of Ministers of the Environment, 1999, updated 2002
[c] Kabata-Pendias, 2001

Results from the samples taken in the Faro mine area (adjacent to the older tailings impoundments [Faro4 and 7] or the concentrate load-out facility [Faro5]) show elevated concentrations in comparison to the Swim Lake background sampling for all elements except cadmium, nickel, and selenium. Arsenic, copper, mercury, lead, and zinc concentrations in these samples are particularly elevated, exceeding not only Swim Lake background data, but also Yukon background reference values (where available) and published normal ranges. For arsenic, copper, mercury, lead and zinc, at least one of the samples also exceeds the Yukon CSR standards and/or CCME soil quality guidelines. Concentrations of these elements on these sample points are similar to those in the most affected zone in the tailings transect study component (transects 3, 4, 5 and 6). It is important to note that due to prevailing wind patterns, the transect study points may also be subject to influence from the same contaminant sources as the Faro samples (i.e. the older tailings impoundments and the mill crusher and concentrate load-out complex). The reported lead concentration at sample point Faro5 of 12415 ppm (1.24 %) is the highest in this study, and indicates very high levels of contamination at this point, likely either from the original tailings impoundment or from the mill crusher/concentrate load-out. Elemental levels in the Faro soil samples in this study are generally similar to higher levels reported for mine-area surface samples in the 2002 baseline report, although the majority of zinc levels documented in the baseline report are substantially higher than those in this study's Faro samples (Gartner Lee Limited). Note that the Faro samples also have low pH values, which can compound metals contamination concerns because at lower pH values these elements are more mobile and thus available for plant uptake or leaching.

4.3.2 Vegetation

Results of laboratory analyses of vegetation samples taken from the potentially mine-affected sampling points are presented in Table 7. These results show that elemental concentrations in vegetation at these points are generally elevated, with silver, cadmium, chromium, copper, mercury, lead, nickel and zinc concentrations significantly above the Swim Lake background levels for at least one species. Lead and zinc are consistently elevated, with maximum concentrations approximately two orders of magnitude higher those at Swim Lake for lead and one order higher for zinc. Lead and zinc levels are also generally higher than published normal background levels. It should be noted that the generally lower elemental concentrations in lichen on the mine-area sampling points in comparison to the transect study component does not indicate lack of contamination, but that on the most affected mine-area sample points, lichen was not present, and thus these points are not represented in the data. As discussed in section 4.2.2.3, the absence of lichen from heavily dust-contaminated but otherwise undisturbed sample points in this study (including Van2 and 3 and Faro2, 4, 5, 6, and 7) suggests elemental concentrations on these sites high enough to cause lichen mortality.

TABLE 7

Mine-Area Vegetation Elemental Concentrations (ppm)

		Lichen (n=6)	Willow Foliage (n=12)	Birch (n=12)	Grass/Legume (n=12)	Blueberry (n=2)	Crowberry (n=3)	Published Normal Background Concentrations	Phytotoxicity
Silver	Range	0.01 - 0.61	0.01 - 0.22	0.01 - 0.12	0.01 - 0.09	-	0.01 – 0.03	0.03 - 0.5[a]	5.00[a]
	Mean	0.14	0.08	0.03	0.03	0.01	0.02		
Arsenic	Range	1 - 6	1 - 11	1 - 6	1 - 3	-	-	0.009 - 1.5[a]	2-100[a]
	Mean	2	2	1	1	1	1		
Cadmium	Range	0.02 - 0.53	1.13 - 12.66	0.02 - 0.73	0.02 - 0.32	0.21 – 0.23	-	0.03 - 0.5[b]	5 – 20[a]
	Mean	0.20	1.97	0.23	0.14	0.22	0.02		
Chromium	Range	0.97 - 3.07	0.18 - 1.27	0.16 - 0.71	0.18 - 0.80	0.20 – 0.21	0.05 – 0.28	0.02 - 0.2[a]	1 – 100[a]
	Mean	1.92	0.52	0.31	0.41	0.21	0.13		
Copper	Range	2.08 - 16.57	2.65 - 10.94	3.92 - 10.01	2.08 - 13.12	3.26 – 5.63	4.43 – 6.20	2 – 30[b]	10 – 30[a]
	Mean	5.82	6.23	5.76	5.12	4.44	5.12		
Mercury	Range	0.01 - 0.04	0.01 - 0.07	0.01 - 0.13	0.01 - 0.06	0.01 – 0.02	0.01 – 0.02	0.01 - 0.4[b]	1 – 8[a]
	Mean	0.02	0.02	0.03	0.02	0.01	0.01		
Nickel	Range	0.6 - 2.6	0.7 - 7.5	0.9 - 3.6	0.6 - 4.2	0.7 – 1.0	0.2 – 0.6	0.1 – 4[b]	20 – 300[a]
	Mean	1.5	3.4	2.0	1.9	0.9	0.3		
Lead	Range	12.2 - 411.3	1.1 - 115.0	1.0 - 126.5	0.4 - 85.5	0.1 – 4.0	0.7 – 2.7	0.1 – 10[a]	-
	Mean	96.5	25.8	28.2	19.2	2.1	1.3		
Selenium	Range	1 - 2	-	1 - 3	1 - 2	-	-	0.002 - 2.9[a]	-
	Mean	1	1	1	1	1	1		
Zinc	Range	38 - 414	43 - 2350	126 - 1120	10 - 1040	18 - 43	7 – 17	15 – 150[b]	100 – 500[a]
	Mean	120	607	478	173	31	11		

[a] Kabata-Pendias, 2001
[b] Jones *et al.*, unpublished

4.3.3 Areas of Contaminant Concentration

Soils and vegetation data from individual sample points in the additional mine-area study component indicate that the highest and most consistently elevated elemental concentrations occur at points Faro1, 2, 4, 5, 6 and 7 and at Van2 and 3. The Faro mine area sites are subject to influence from multiple potential contamination sources. In the Vangorda/Grum area, points Van2 and 3 are located on sites affected by overland flow from rock drain discharge from the Vangorda rock dumps. The Van 2 and 3 and Faro 2, 4, 5, 6 and 7 sites are visibly impacted, with no live moss or lichen layer, and visual symptoms of phytotoxicity (chlorosis). Note that only the Van2 and 3 and Faro6 sites are visibly impacted by drainage from mine waste materials. The Van2 and 3 sites also had organic surficial materials stained from overland flow, and substantial vascular plant mortality (Photo 4).

On the above Faro and Vangorda sampling points, lead and zinc concentrations in birch and willow are approximately 2-4 times higher than those on the most affected of the tailings transects. Because of these species' deciduous growth habit (see section 4.2.2.1), this observation may indicate that the current contaminant release from the sources affecting these points is of a greater magnitude than from those influencing the transect sampling points, or that uptake from soil on these mine-area sites is greater.

It is worth noting that analytical data from the vegetation samples collected on revegetated till-capped sites (Van6 and 7) show only marginal or no elevation in elemental concentrations in comparison to background data and published normals. This finding is supported by soils data showing concentrations similar to background on one of these sites.

PHOTO 4 Surface Flow-Affected Sample Point Below Vangorda Dumps (Van3)

4.4 Crowberry and Blueberry Samples

Because berry samples collected in this study were analyzed to provide information for an anticipated terrestrial/human health risk assessment outside the scope of this study, no interpretation of these analytical results has been undertaken in this document. However, because of the potential use of these species by local human populations, their potential contamination is of primary concern. Statistical comparison of berry samples collected on mine-affected areas versus background sample points indicates that only copper levels are significantly higher in mine-site samples. The maximum copper concentration recorded for a mine-site sample was 6.20 ppm, versus a 3.76-ppm background maximum. Maximum lead and zinc concentrations in mine-site berry samples were 4.0 and 43 ppm, respectively, versus 0.3 and 23 ppm background maxima. These results include sampling from the Faro4 point, which was a relatively heavily-affected additional mine area point. Overall, these preliminary results show little evidence of metals deposition or uptake in crowberry and blueberry fruits.

5.0 SUMMARY

The investigation of soils and vegetation elemental concentrations in the vicinity of the Anvil Range mine complex has documented concentrations elevated above background levels for arsenic, silver, cadmium, chromium, copper, mercury, nickel, lead and zinc. Lead and zinc had the largest magnitudes of elevation (over two orders of magnitude greater than maximum background concentrations for soil and lichen) and had elevated levels furthest from the mine site, in comparison to other analyzed elements. Examination of collected data indicates that the probable origin of these elevated concentrations is airborne dust contamination from mine site sources. This conclusion is based on the fact that surface (0-2 cm) soil samples in this study generally have substantially higher elemental concentrations than corresponding sub-surface (5-10 cm) samples, and that lichen, which depend on airborne sources for nutrition and thus are susceptible to airborne contamination, have extremely elevated elemental concentrations in affected areas, in comparison to background samples. This finding of elevated soils and vegetation metals levels is not unexpected, given that mining and milling operations were conducted on a large scale at the Anvil Range site for almost 30 years, and that other studies of airborne contamination from lead-zinc mining/milling activities have documented similar off-site impacts.

The spatial distribution of elevated elemental concentrations in soils and vegetation in this study in the Faro mine area shows that transport and deposition from the major mine disturbances has been concentrated from northwest to north of the mine complex and Rose Creek drainage, indicating the predominant influence of the October-April prevailing winds. These winds tend to rotate clockwise (from southeast to southwest) and gain velocity at higher elevations, which explains the concentration and greater distance from source of elevated metals levels on transects to the northwest and north of the tailings impoundments and mill complex. In addition, elevated metals levels to the east-northeast of the Faro pit suggest some dust transport by the western summer prevailing winds. Elemental concentrations in surface soil and lichen samples on transects to the southeast to west-southwest of the tailings impoundments are substantially lower than those across the valley, and elevated concentrations are clustered closer to contaminant sources, indicating that there has been less airborne contamination in these directions. However, even on these transects, soil and lichen lead (and frequently zinc) levels on the furthest points from the mine site (approximately 2-3 km) remain well above the Swim Lake background concentrations. It is worth noting that soil samples collected at the VB1 and 2 points (originally intended as additional background points to complement the Swim Lake data, due to their location approximately along the southeast-trending mineralized lithologic contact) show evidence of airborne metals contamination in substantially higher surface versus subsurface concentrations. These points are located approximately 1.7 and 3.1 km, respectively, from the Vangorda pit. In synthesis, the spatial distribution data indicate that elevated elemental levels (particularly lead and zinc) resulting from airborne contamination occur in a zone that extends at minimum 2-3 km in all directions from potential mine-site contaminant dust sources, and that is concentrated and extended to the northwest to north of the tailings impoundments and mill complex. It should be emphasized that this study was intended as a preliminary investigation to determine whether mine development and operations have resulted in metals contamination of mine-area soils and vegetation. The study results clearly indicate that such contamination has occurred. However, further work would be required to refine study conclusions, such as definition of the full areal extent of contamination.

For the majority of sampled area and analyzed elements, collected data suggest that phytotoxic effects are unlikely to occur for studied vegetation species, based on published effects thresholds. These data indicate that elevated zinc and copper levels on sites adjacent to contaminant sources could result in reduced growth, chlorosis, and growth malformation of vascular plants. Symptoms of phytotoxicity (mortality and chlorosis) were observed only on the most heavily affected sampling points in this study. The observed absence of lichen on the sites adjacent to contaminant sources may also be evidence of phytotoxic effects resulting from airborne contamination.

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Soil Scientist

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Principal

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APPENDIX A

Sample Collection Chart

Sample ID	Soil			Vegetation										
	Surface	Subsurface	0-10 cm	Willow Foliar	Willow Root	Birch Foliar	Grass Foliar	Lichen	Crowberry Fruit	Crowberry Fruit and Foliar	Blueberry Fruit	Fescue Foliar	Clover Foliar	Clover Flower
Van1				x										
Van2						x	x							
Van3						x	x							
Van4				x		x		x	x		x			
Van5				x		x	x	x						
Van6												x	x	x
Van7			x									x	x	
Van8			x			x	x	x						
Van9				x		x		x						
Van10				x		x	x	x	x	x				
Faro1				x		x		x	x					
Faro2				x		x								
Faro3				x										
Faro4			x	x		x	x				x			
Faro5			x			x	x							
Faro6				x										
Faro7			x	x		x	x							
SW-1	x	x		x	x	x		x						
SW-2	x	x		x	x	x		x						
SW-3	x	x		x	x	x		x						
SW-4	x	x		x	x	x		x						
SW-5	x	x		x	x	x		x			x			
SW-6	x	x		x	x	x								
SW-7	x	x		x	x	x		x	x		x			
VB-1	x	x		x	x	x	x	x						
VB-2	x	x		x	x	x	x	x	x		x			
1-1	x	x		x	x	x		x						
1-2	x			x	x	x		x						
1-3	x	x		x	x	x	x	x						
2-1	x	x		x		x		x						
2-2	x	x		x	x	x		x						
2-3	x	x				x								
2-4	x	x				x		x						
3-1	x	x		x	x			x						
3-2	x	x		x	x	x	x	x						
3-3	x	x		x	x	x	x							
3-4	x	x		x	x	x	x	x						
4-1	x	x		x										
4-2	x	x		x	x	x	x	x						
4-3	x	x		x	x	x		x						
4-4	x	x		x	x	x	x	x						
4-5	x	x		x	x	x		x						
5-1	x	x		x	x	x								
5-2	x	x		x	x	x	x	x						
5-3	x	x		x	x	x		x						
5-4	x	x		x	x	x		x						
5-5	x	x		x	x	x	x	x						
6-1	x	x		x	x	x	x				x			
6-2	x	x		x	x	x	x	x						
6-3	x	x		x	x	x	x	x						
6-4	x	x		x	x	x								
7-1	x	x		x	x	x	x							
7-2	x	x		x	x	x								
7-3	x	x		x		x								
7-4	x	x		x	x	x	x	x						
8-1	x	x		x	x	x		x						
8-2	x	x		x	x	x		x						
8-3	x	x		x	x	x		x						
8-4	x	x		x	x	x	x	x						

APPENDIX B

Laboratory Analytical Methods

Metals in Plant Tissue (Soilcon Method #C10.8)
Wet Ashing Method

Metals analysis was performed using the digestion procedures outlined in Kalra, Y.P., Handbook of Reference Methods for Plant Analysis, “Wet Ashing”, pp 44-46. CRC press, Florida, 1998

Five milliliters of nitric acid is added to 0.250 g (+/- 0.05g) of oven-dried foliar sample that has been ground to pass through a 2 mm stainless steel sieve, and allowed to predigest overnight. The digests are then placed on a 40-place block digestor at 125°C (+/-5°C) for 1 hour. 1-2 mililitres of 30% hydrogen peroxide is added at two half hour intervals. A small amount of nitric acid is added to dissolve any remaining ash. Digestates are removed from block digestor, allowed to cool to room temperature, brought up to 75 mL volume using distilled deionized (Type 1) water and centrifuged.

Spectral analysis of the digestates is performed using a Perkin Elmer Optima 2000DV, scanning CCD, ICP-OES, following the procedures outline in “Metals Analysis of Solids by ICP”, Version 1.0, BC Environmental Laboratory Manual., Supplement #1 to the 1994 Edition (British Columbia Ministry of Environment, March 1997). Additional guidelines for spectral analysis are given in Concepts, Instrumentation, and Techniques in Inductively Coupled Plasma Optical Emission Spectrometry, 2nd Edition, (Boss, Charles B., Fredeen, Ken J, 1997) published by the Perkin-Elmer Corporation, Norwalk, CT. Mercury is analyzed by cold vapour atomic absorption spectroscopy.

Metals in Soil and Sediment (Soilcon Method #C10.4)
Strong Acid Leachable Metals (SALM) Analytical Method

Metals analysis was performed using the digestion procedures outlined in “Strong Acid Leachable Metals (SALM) in Soil”, CSR – Analytical Method 8., Version 1.0, (Feb 2001), British Columbia Ministry of Environment, Lands and Parks.

Five milliliters of an *aqua regia* solution consisting of a 1:1 ratio of nitric acid to hydrochloric acid is added to a minimum of 1.00 g (+/- 0.05g) of air dried soil that has passed through a 2 mm stainless steel sieve. The mixture is allowed to digest at room temperature for 1 hour, then placed on a 40-place block digestor at 90°C (+/-5°C) for 2 hours. Digestates are removed from block digestor, allowed to cool to room temperature, brought up to 75 mL volume using distilled deionized (Type 1) water and centrifuged.

Spectral analysis of the digestates is performed using a Perkin Elmer Optima 2000DV, scanning CCD, ICP-OES, following the procedures outline in “Metals Analysis of Solids by ICP”, Version 1.0, BC Environmental Laboratory Manual., Supplement #1 to the 1994 Edition (British Columbia Ministry of Environment, March 1997). Additional guidelines for spectral analysis are given in Concepts, Instrumentation, and Techniques in Inductively Coupled Plasma Optical Emission Spectrometry, 2nd Edition, (Boss, Charles B., Fredeen, Ken J, 1997) published by the Perkin-Elmer Corporation, Norwalk, CT. Mercury is analyzed by cold vapour atomic absorption spectroscopy.

APPENDIX C

Soils Analytical Results

For interpretation of the following data, note that the following samples are field duplicates:

Faro-4 – Faro 8
Faro-5 – Faro-9
Faro-7 – Faro-10
1-2S2 – 1-4S2
6-1S1 – 6-5S1

These samples were split following collection but prior to submission to laboratory.

Surface samples are labeled “S1”; subsurface samples “S2”.

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	SM071002	
Date Run:		07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	
Sample ID		**VAN-7**	**VAN-8**	**FARO-4**	**FARO-5**	**FARO-7**	**FARO-8**	**FARO-9**	**FARO-10**	**SW-1S1**	**SW-1S2**	**SW2-S1**	**Detection**
Lab#		**02-375-1**	**02-375-2**	**02-375-3**	**02-375-4**	**02-375-5**	**02-375-6**	**02-375-7**	**02-375-8**	**02-375-9**	**02-375-10**	**02-375-11**	**Limit**
Analyte	**Units**												
pH	--	6.32	5.29	3.17	4.04	3.97	2.96	4.22	3.98	6.18	6.13	5.37	0.01
Ag	mg/kg	0.02	0.14	2.63	4.69	1.58	3.79	22.2	1.46	0.29	0.27	0.21	0.01
As	mg/kg	15	1	91	18	33	126	88	24	6	4	4	1
Cd	mg/kg	0.62	0.07	1.21	1.66	1.71	1.18	1.57	2.84	1.40	2.63	0.72	0.02
Cr	mg/kg	36.6	1.73	10.6	32.5	23.9	12.9	23.3	22.2	1.14	0.95	0.91	0.05
Cu	mg/kg	31.8	1.85	145	264	155	154	404	143	5.69	8.53	7.83	0.05
Ni	mg/kg	32.0	0.4	2.3	16.9	18.1	2.6	9.4	22.2	1.0	1.7	1.0	0.1
Pb	mg/kg	27.9	1.2	1870	4630	1440	2750	20200	1510	16.6	4.1	15.2	0.3
Se	mg/kg	<1	2	3	3	2	3	4	5	9	5	3	1
Zn	mg/kg	88.1	4.2	364	394	980	362	662	1490	52.3	54.4	137	0.1
Hg	mg/kg	0.05	0.03	1.49	2.52	1.44	1.67	12.2	1.50	0.13	0.11	0.20	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM071002	SM071002	SM071002	SM071002	SM071002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	
Date Run:		07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	
Sample ID		**SW2-S2**	**SW3-S1**	**SW3-S2**	**SW4-S1**	**SW4-S2**	**SW5-S1**	**SW5-S2**	**SW6-S1**	**SW6-S2**	**SW7-S1**	**SW7-S2**	**Detection**
Lab#		**02-375-12**	**02-375-13**	**02-375-14**	**02-375-15**	**02-375-16**	**02-375-17**	**02-375-18**	**02-375-19**	**02-375-20**	**02-375-21**	**02-375-22**	**Limit**
Analyte	**Units**												
pH	--	5.19	5.72	6.80	4.92	4.71	4.65	4.94	6.32	6.35	5.68	5.65	0.01
Ag	mg/kg	0.19	0.15	0.37	0.16	0.14	1.35	1.11	0.62	0.13	0.42	0.45	0.01
As	mg/kg	4	4	5	5	7	17	14	17	24	15	15	1
Cd	mg/kg	0.99	0.42	0.55	0.31	0.49	1.06	1.05	2.38	0.90	0.63	0.91	0.02
Cr	mg/kg	1.19	0.79	1.49	0.83	0.52	1.65	2.15	3.80	10.9	1.81	0.70	0.05
Cu	mg/kg	4.62	4.58	7.41	4.19	1.50	4.93	8.48	20.3	34.0	2.39	4.37	0.05
Ni	mg/kg	2.8	1.4	7.0	0.6	0.6	1.8	2.5	6.6	12.4	0.8	1.2	0.1
Pb	mg/kg	3.9	8.0	4.7	13.5	1.8	6.1	4.1	17.9	21.8	8.1	7.8	0.3
Se	mg/kg	4	4	6	7	5	<1	2	6	7	<1	8	1
Zn	mg/kg	43.2	67.7	24.5	107	53.7	15.0	14.8	91.1	43.6	36.0	37.0	0.1
Hg	mg/kg	0.23	0.11	0.05	0.20	0.13	0.16	0.06	0.02	0.07	0.11	0.10	0.01

Company:		**CE Jones & Associates**											
Project ID:		Anvil Range											
Soilcon Job#		02-375											
Media:		Soil											
Analysis:		ICP-Metals											
Batch #		SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	SM151002	
Date Run:		15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	15-Oct-02	
Sample ID		**VB1-S1**	**VB1-S2**	**VB2-S1**	**VB2-S2**	**1-1S1**	**1-1S2**	**1-2S1**	**1-3S1**	**1-3S2**	**2-1S1**	**2-1S2**	**Detection**
Lab#		**02-375-23**	**02-375-24**	**02-375-25**	**02-375-26**	**02-375-27**	**02-375-28**	**02-375-29**	**02-375-30**	**02-375-31**	**02-375-32**	**02-375-33**	**Limit**
Analyte	**Units**												
pH	--	5.81	5.67	4.46	4.97	5.62	4.44	4.72	6.46	6.48	6.35	6.43	0.01
Ag	mg/kg	1.16	0.08	1.96	0.16	0.77	0.36	0.35	0.57	0.52	<0.01	<0.01	0.01
As	mg/kg	20	7	17	5	18	15	14	13	16	31	24	1
Cd	mg/kg	1.58	0.11	2.19	0.11	1.43	0.92	0.90	0.71	0.46	0.82	0.69	0.02
Cr	mg/kg	7.13	3.18	5.15	1.48	5.21	1.18	1.94	2.22	2.50	302	99.8	0.05
Cu	mg/kg	15.8	5.02	14.9	<0.05	26.5	3.36	6.58	16.8	14.2	38.5	34.3	0.05
Ni	mg/kg	9.5	1.4	5.4	0.3	3.0	1.3	2.2	2.5	3.9	279	94.1	0.1
Pb	mg/kg	64.3	2.4	47.2	2.5	665	8.5	87.6	110	8.1	158	57.9	0.3
Se	mg/kg	2	2	5	2	7	<1	4	5	5	<1	19	1
Zn	mg/kg	61.9	3.9	108	4.0	771	57.9	102	153	22.9	239	139	0.1
Hg	mg/kg	0.19	0.03	0.15	0.01	0.47	0.10	0.14	0.22	0.14	0.17	0.10	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	SM161002	
Date Run:		16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	16-Oct-02	
Sample ID		**2-2S1**	**2-2S2**	**2-3S1**	**2-3S2**	**2-4S1**	**2-4S2**	**3-1S1**	**3-1S2**	**3-2S1**	**3-2S2**	**3-3S1**	**Detection**
Lab#		**02-375-34**	**02-375-35**	**02-375-36**	**02-375-37**	**02-375-38**	**02-375-39**	**02-375-40**	**02-375-41**	**02-375-42**	**02-375-43**	**02-375-44**	**Limit**
Analyte	**Units**												
pH	--	5.68	6.60	5.93	5.13	4.58	4.91	6.05	6.14	5.02	4.65	5.00	0.01
Ag	mg/kg	0.35	<0.01	0.22	0.18	0.48	<0.01	0.93	0.79	1.37	<0.01	1.00	0.01
As	mg/kg	6	5	6	4	4	1	9	9	15	14	35	1
Cd	mg/kg	0.98	0.54	0.52	1.23	0.57	0.04	1.67	2.68	2.79	0.66	1.62	0.02
Cr	mg/kg	2.57	17.9	1.33	2.13	6.03	4.40	6.92	3.80	4.35	46.3	56.0	0.05
Cu	mg/kg	15.3	26.9	9.44	13.8	12.3	5.66	39.1	41.6	42.5	26.2	96.1	0.05
Ni	mg/kg	1.6	18.7	1.4	3.9	4.2	1.4	10.1	17.2	4.3	32.2	43.6	0.1
Pb	mg/kg	199	10.1	130	21.6	52.7	4.2	525	394	975	33.8	784	0.3
Se	mg/kg	9	8	9	9	10	2	15	14	16	<1	<1	1
Zn	mg/kg	166	34.4	144	49.4	88.1	10.3	411	414	967	129	346	0.1
Hg	mg/kg	0.32	0.07	0.17	0.12	0.20	0.02	0.66	0.62	0.95	0.07	0.92	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM161002	SM161002	SM161002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	
Date Run:		16-Oct-02	16-Oct-02	16-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	
Sample ID		**3-3S2**	**3-4S1**	**3-4S2**	**4-1S1**	**4-1S2**	**4-2S1**	**4-2S2**	**4-3S1**	**4-3S2**	**4-4S1**	**4-4S2**	**Detection**
Lab#		**02-375-45**	**02-375-46**	**02-375-47**	**02-375-48**	**02-375-49**	**02-375-50**	**02-375-51**	**02-375-52**	**02-375-53**	**02-375-54**	**02-375-55**	**Limit**
Analyte	**Units**												
pH	--	5.02	5.08	4.87	6.87	7.39	5.19	5.21	5.16	5.19	5.34	5.49	0.01
Ag	mg/kg	0.24	3.56	<0.01	0.47	<0.01	1.72	<0.01	1.11	<0.01	0.75	<0.01	0.01
As	mg/kg	17	85	11	41	16	26	5	11	6	11	6	1
Cd	mg/kg	1.31	3.13	0.77	1.82	0.80	3.55	1.06	1.92	0.37	1.43	1.08	0.02
Cr	mg/kg	43.6	44.5	40.7	41.5	40.8	4.33	3.49	3.00	35.7	2.27	14.2	0.05
Cu	mg/kg	87.0	148	135	72.5	40.8	72.4	14.9	36.5	12.5	28.4	21.6	0.05
Ni	mg/kg	31.4	35.5	24.3	33.3	34.8	3.3	2.5	2.2	27.5	2.2	8.8	0.1
Pb	mg/kg	545	1980	147	815	190	1710	7.6	766	30.4	387	30.0	0.3
Se	mg/kg	<1	<1	<1	1	<1	19	4	13	<1	12	8	1
Zn	mg/kg	285	598	200	950	239	1010	101	585	83.2	424	64.8	0.1
Hg	mg/kg	0.46	2.10	0.14	0.71	0.14	1.43	0.05	0.85	0.02	0.62	0.12	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002	SM171002b	SM171002b	
Date Run:		17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	
Sample ID		**4-5S1**	**4-5S2**	**1-4S2**	**1-2S2**	**5-1S1**	**5-1S2**	**5-2S1**	**5-2S2**	**5-3S1**	**5-3S2**	**5-4S1**	**Detection**
Lab#		**02-375-56**	**02-375-57**	**02-375-58**	**02-375-59**	**02-375-60**	**02-375-61**	**02-375-62**	**02-375-63**	**02-375-64**	**02-375-65**	**02-375-66**	**Limit**
Analyte	**Units**												
pH	--	4.55	4.20	5.95	6.11	6.23	7.09	4.37	4.20	4.93	4.39	4.33	0.01
Ag	mg/kg	1.01	0.29	<0.01	<0.01	<0.01	<0.01	3.41	0.51	3.14	<0.01	0.28	0.01
As	mg/kg	11	10	7	11	53	16	31	14	20	5	14	1
Cd	mg/kg	1.54	0.38	0.27	0.29	1.70	0.89	5.33	0.77	6.66	0.74	2.43	0.02
Cr	mg/kg	2.29	3.03	22.1	23.3	44.1	43.3	6.11	2.09	5.95	38.4	5.22	0.05
Cu	mg/kg	31.6	6.54	20.4	21.4	73.4	37.4	139	5.23	136	16.3	52.7	0.05
Ni	mg/kg	1.8	1.5	19.5	20.4	37.9	37.0	4.0	1.4	4.5	24.8	4.2	0.1
Pb	mg/kg	895	7.3	7.9	8.3	472	102	3750	23.2	3490	70.5	1170	0.3
Se	mg/kg	14	5	2	2	<1	<1	22	9	23	<1	14	1
Zn	mg/kg	771	47.6	32.6	33.3	700	178	3000	977	3490	170	1140	0.1
Hg	mg/kg	0.75	0.16	0.03	0.03	0.68	0.12	2.89	0.20	3.04	0.05	1.41	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	SM171002b	
Date Run:		17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	
Sample ID		**5-4S2**	**5-5S1**	**5-5S2**	**6-1S1**	**6-1S2**	**6-2S1**	**6-2S2**	**6-3S1**	**6-3S2**	**6-4S1**	**Detection**
Lab#		**02-375-67**	**02-375-68**	**02-375-69**	**02-375-70**	**02-375-71**	**02-375-72**	**02-375-73**	**02-375-74**	**02-375-75**	**02-375-76**	**Limit**
Analyte	**Units**											
pH	--	4.45	5.21	5.72	2.96	4.65	4.87	4.44	5.16	5.15	4.73	0.01
Ag	mg/kg	<0.01	<0.01	<0.01	0.58	<0.01	0.80	<0.01	<0.01	<0.01	<0.01	0.01
As	mg/kg	8	10	4	104	15	28	9	2	4	6	1
Cd	mg/kg	0.02	1.77	0.44	1.42	3.92	7.45	2.92	0.13	1.52	1.24	0.02
Cr	mg/kg	27.3	3.68	10.4	15.7	6.85	18.1	1.96	<0.05	13.3	9.44	0.05
Cu	mg/kg	6.8	33.8	9.0	271	30.8	133	12.1	<0.05	23.2	23.2	0.05
Ni	mg/kg	15.7	2.1	4.3	7.1	7.9	15.4	4.8	<0.1	9.0	7.1	0.1
Pb	mg/kg	14.3	380	10.7	2860	43.3	2250	29.8	<0.3	34.0	301	0.3
Se	mg/kg	<1	10	4	8	19	12	9	4	5	7	1
Zn	mg/kg	51.4	373	31.6	700	2370	2450	949	<0.1	94.4	322	0.1
Hg	mg/kg	0.04	0.59	0.05	1.73	0.11	1.83	0.16	1.65	0.14	0.49	0.01

Company:		**CE Jones & Associates**										
Project ID:		Anvil Range										
Soilcon Job#		02-375										
Media:		Soil										
Analysis:		ICP-Metals										
Batch #		SM171002b	SM171002b	SM171002b	SM171002b	SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	
Date Run:		17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	
Sample ID		**6-4S2**	**6-5S1**	**7-1S1**	**7-1S2**	**7-2S1**	**7-2S2**	**7-3S1**	**7-3S2**	**7-4S1**	**7-4S2**	**Detection**
Lab#		**02-375-77**	**02-375-78**	**02-375-79**	**02-375-80**	**02-375-81**	**02-375-82**	**02-375-83**	**02-375-84**	**02-375-85**	**02-375-86**	**Limit**
Analyte	**Units**											
pH	--	4.29	2.93	5.51	6.48	5.30	5.19	6.94	6.69	6.05	6.34	0.01
Ag	mg/kg	<0.01	0.95	<0.01	<0.01	0.08	0.01	0.13	<0.01	0.35	0.63	0.01
As	mg/kg	5	121	20	12	11	6	14	17	14	18	1
Cd	mg/kg	0.53	1.28	2.05	0.50	0.50	0.39	0.30	0.17	2.01	1.86	0.02
Cr	mg/kg	18.1	16.0	26.7	28.3	17.7	17.3	36.2	32.8	25.8	24.3	0.05
Cu	mg/kg	15.6	190	24.1	22.2	19.0	16.9	39.9	28.1	52.6	74.7	0.05
Ni	mg/kg	13.1	5.2	25.5	26.9	13.7	13.3	44.3	35.5	25.5	29.3	0.1
Pb	mg/kg	14.4	2790	76.7	17.8	108	58.4	38.4	25.7	640	969	0.3
Se	mg/kg	<1	3	4	<1	<1	<1	<1	<1	6	7	1
Zn	mg/kg	37.2	650	476	189	115	90.1	134	76.4	1050	923	0.1
Hg	mg/kg	0.06	2.13	0.12	0.05	0.10	0.07	0.07	0.02	0.51	0.92	0.01

Company:		**CE Jones & Associates**							
Project ID:		Anvil Range							
Soilcon Job#		02-375							
Media:		Soil							
Analysis:		ICP-Metals							
Batch #		SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	SM171002c	
Date Run:		17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	17-Oct-02	
Sample ID		**8-1S1**	**8-1S2**	**8-2S1**	**8-2S2**	**8-3S1**	**8-3S2**	**8-4S1**	**8-4S2**	**Detection**
Lab#		**02-375-87**	**02-375-88**	**02-375-89**	**02-375-90**	**02-375-91**	**02-375-92**	**02-375-93**	**02-375-94**	**Limit**
Analyte	**Units**									
pH	--	5.36	6.16	5.05	4.81	4.81	5.49	4.95	4.48	0.01
Ag	mg/kg	0.15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
As	mg/kg	10	11	4	8	4	5	6	7	1
Cd	mg/kg	1.75	0.64	0.97	0.86	0.46	0.66	1.24	1.30	0.02
Cr	mg/kg	3.93	20.9	1.31	0.52	1.18	2.01	1.52	2.52	0.05
Cu	mg/kg	32.8	30.0	17.5	5.28	13.4	4.53	16.0	8.55	0.05
Ni	mg/kg	2.6	21.7	0.2	<0.1	0.1	<0.1	0.3	2.6	0.1
Pb	mg/kg	669	10.7	299	24.8	222	3.6	238	3.9	0.3
Se	mg/kg	8	5	8	5	6	5	8	6	1
Zn	mg/kg	758	48.6	365	195	272	62.2	263	53.5	0.1
Hg	mg/kg	0.50	0.05	0.30	0.08	0.25	0.10	0.25	0.12	0.01

LOSS ON IGNITION

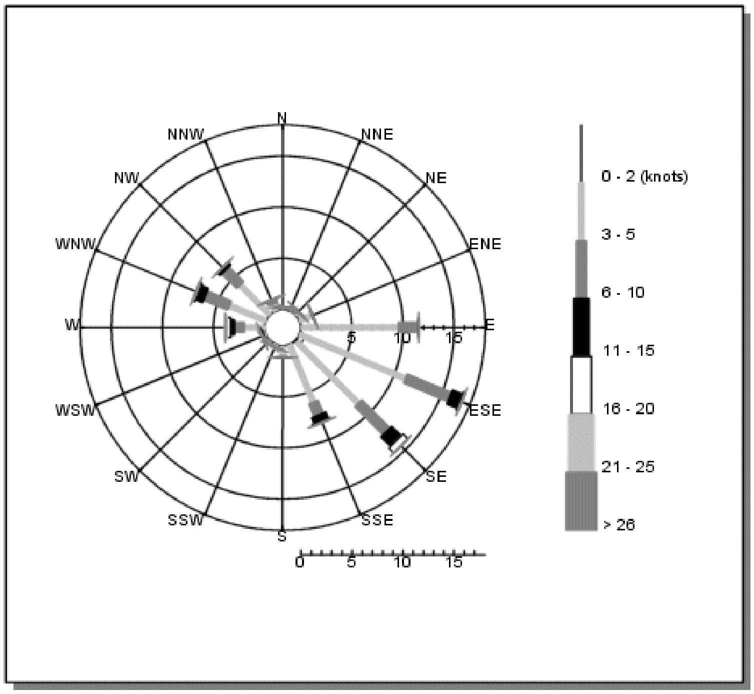
		Sample ID	Lab #	Organic Matter by Loss on Ignition (%)	Estimate of Total Org. C *assume 50% C in org. matter	% Ash
Company:	CE Jones & Associates	VAN-7	02-375-1	5.51	2.8	94.5
Contact:	Justin Straker	FARO-5	02-375-4	20.0	10.0	80.0
Project ID:	Anvil Range	VB2-S2	02-375-26	5.68	2.8	94.3
Soilcon Job#	02-375	3-2S1	02-375-42	90.8	45.4	9.2
Analysis:	LOI	3-2S2	02-375-43	11.65	5.8	88.3
Date Completed:	25-Oct-02					

APPENDIX D

Monthly Wind Rose Diagrams from the Faro Airport, 1971-1999

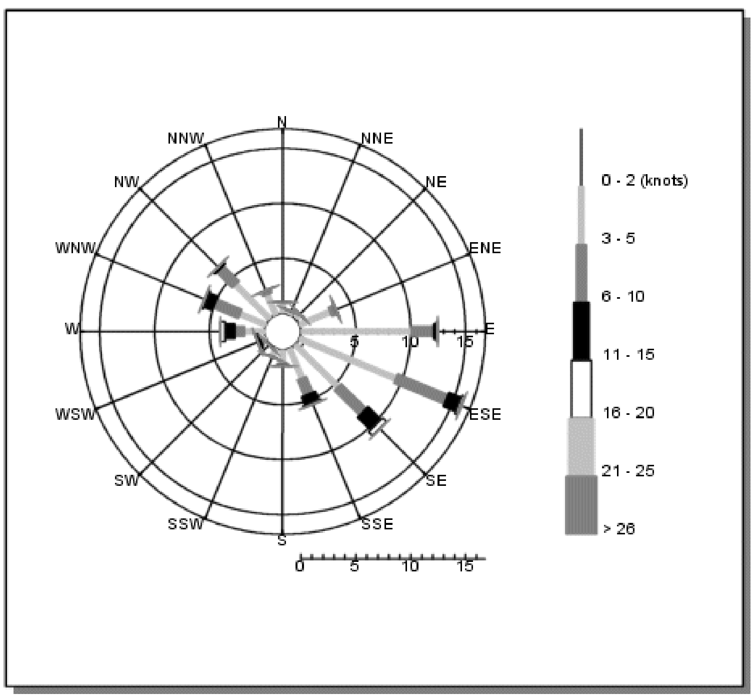
Windrose for Station ZFA (Faro A.)

J an (1971 - 1999)



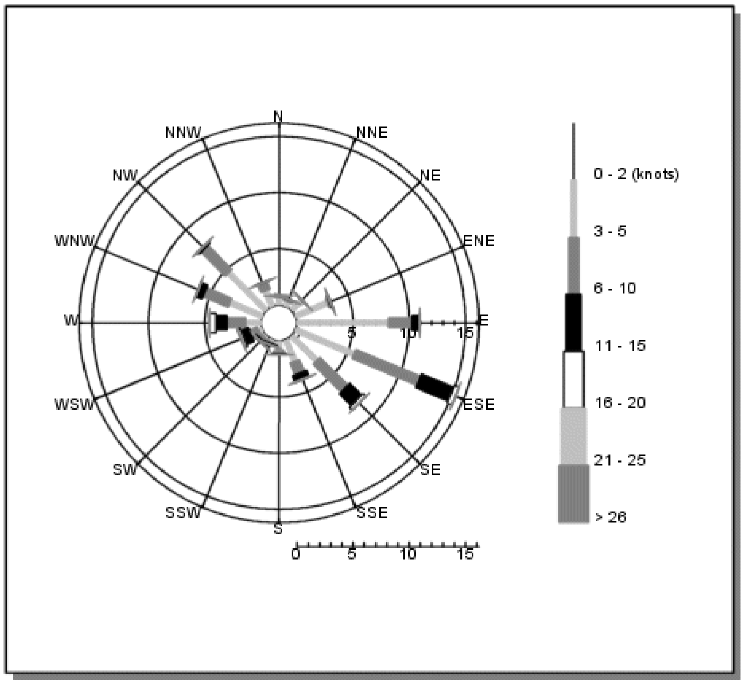
Windrose for Station ZFA (Faro A.)

Feb (1971 - 1999)



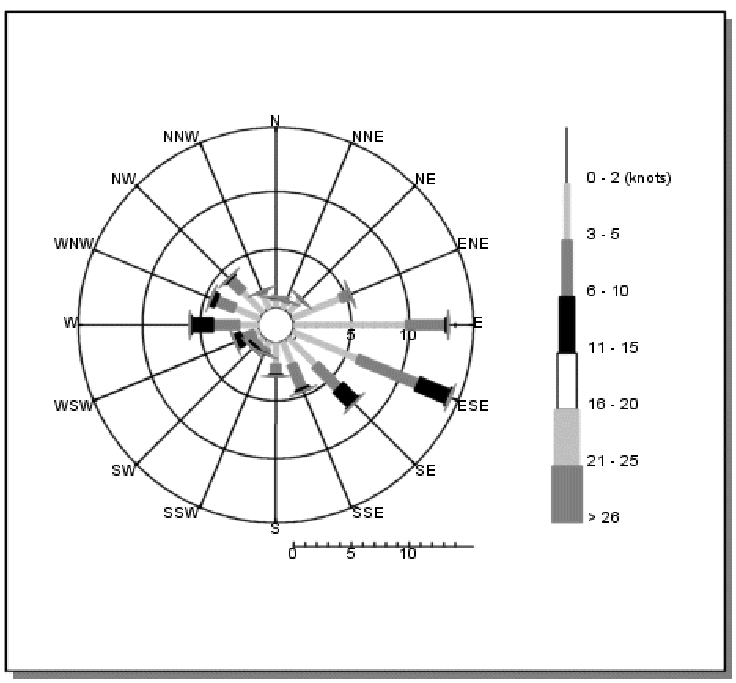
Windrose for Station ZFA (Faro A.)

Mar (1971 - 1999)



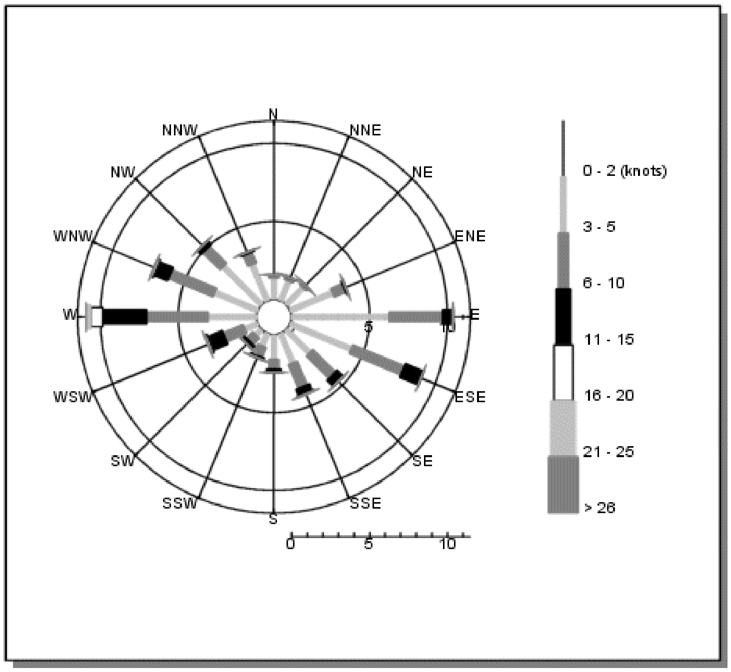
Windrose for Station ZFA (Faro A.)

Apr (1971 - 1999)



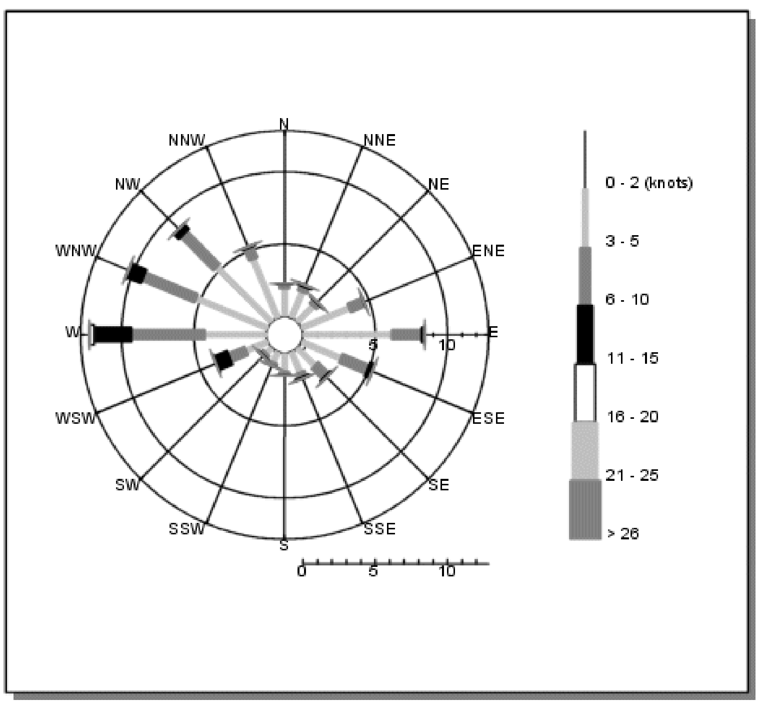
Windrose for Station ZFA (Faro A.)

May (1971 - 1999)



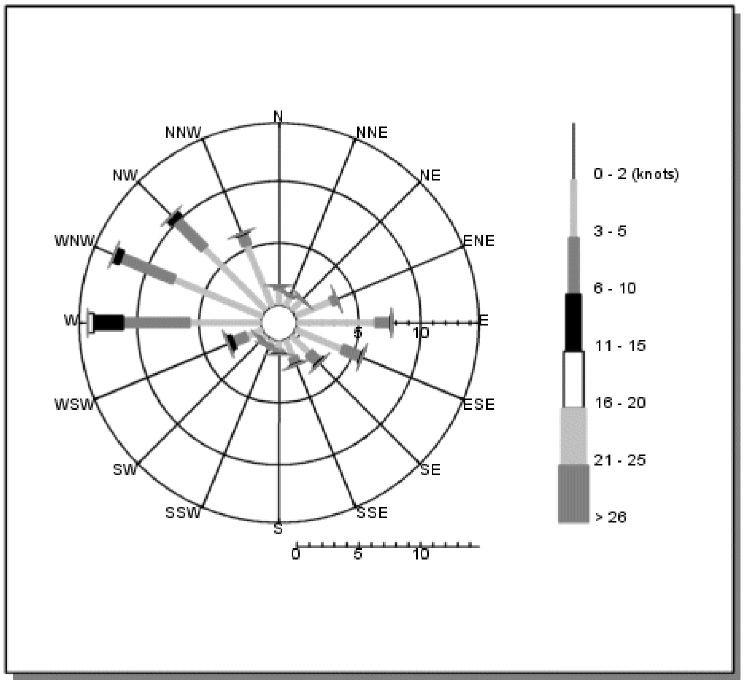
Windrose for Station ZFA (Faro A.)

Jun (1971 - 1999)



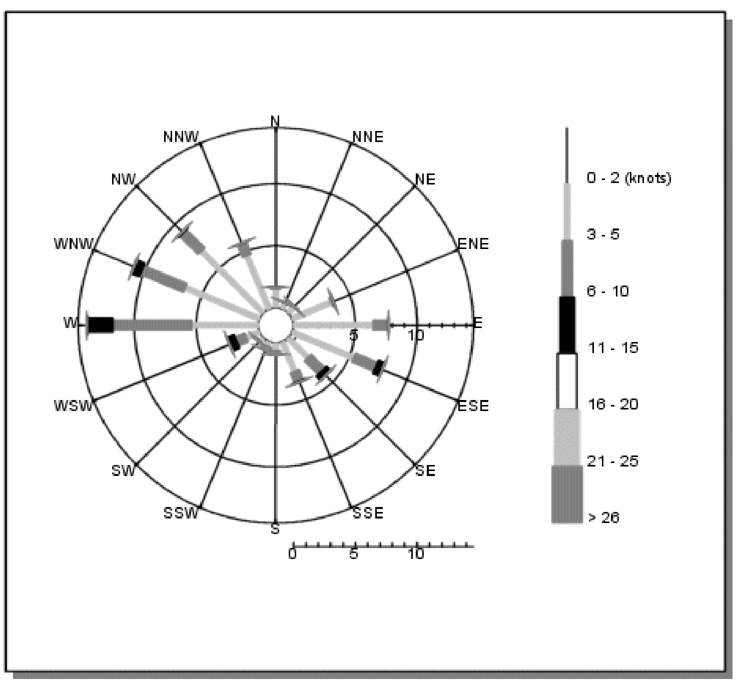
Windrose for Station ZFA (Faro A.)

Jul (1971 - 1999)

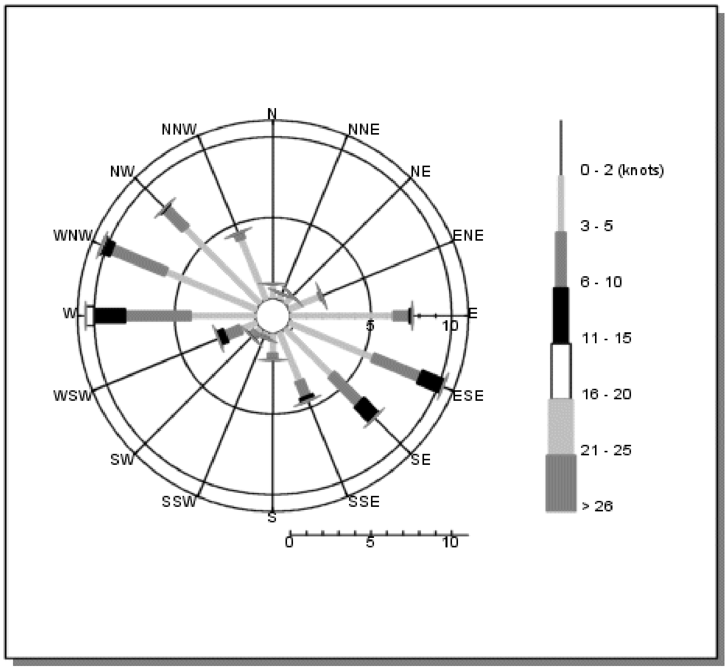


Windrose for Station ZFA (Faro A.)

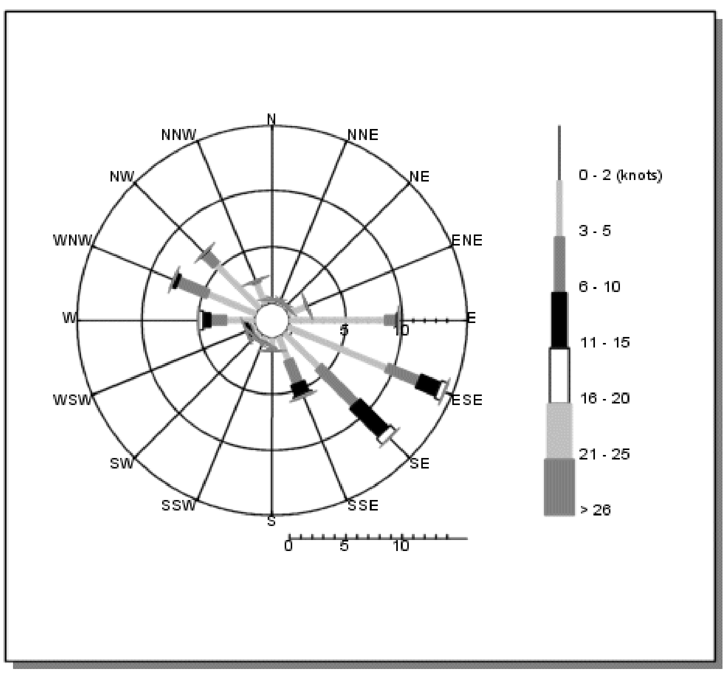
Aug (1971 - 1999)



Windrose for Station ZFA (Faro A.)
Sep (1971 - 1999)

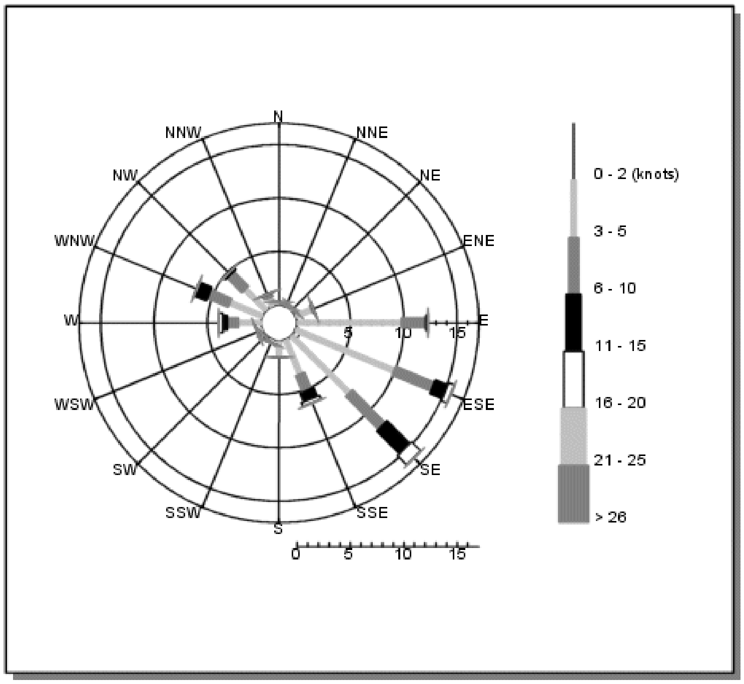


Windrose for Station ZFA (Faro A.)
Oct (1971 - 1999)



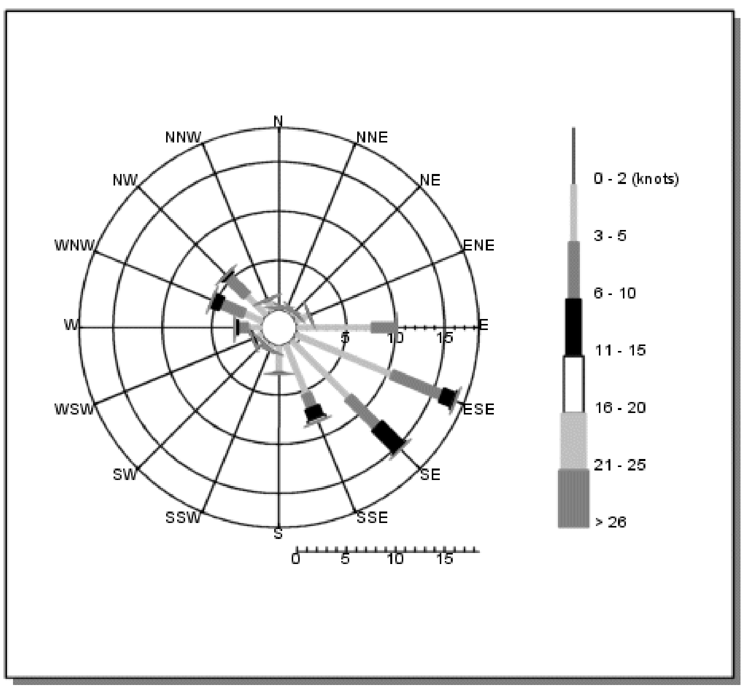
Windrose for Station ZFA (Faro A.)

Nov(1971 - 1999)



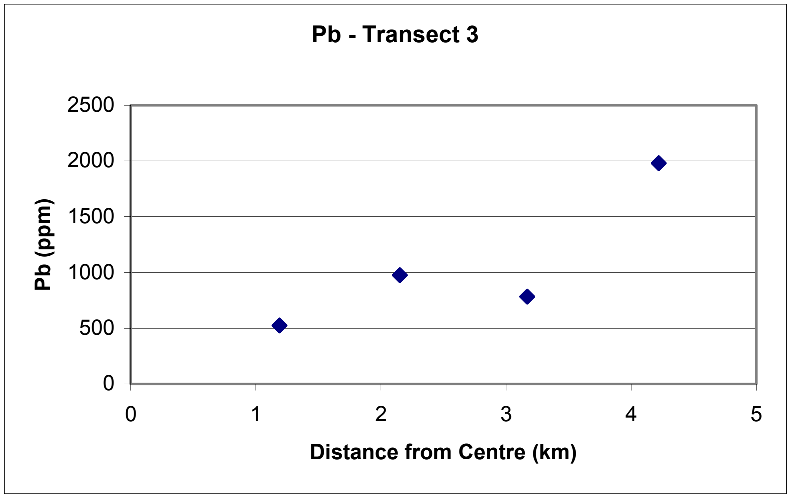
Windrose for Station ZFA (Faro A.)

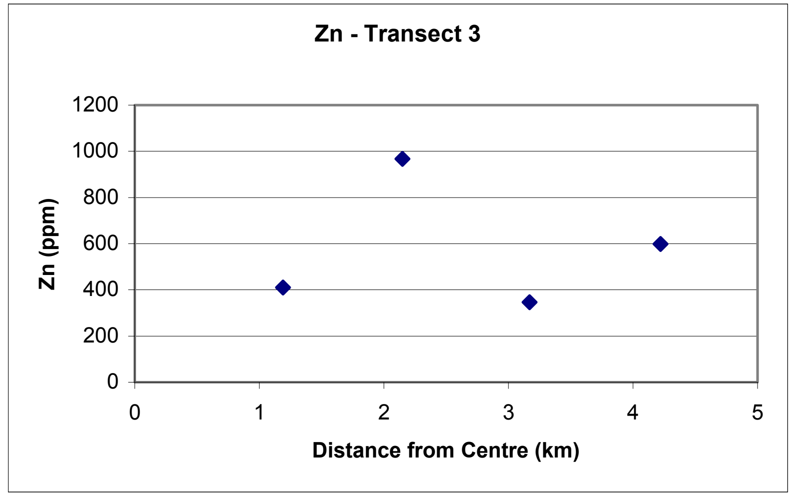
Dec (1971 - 1999)

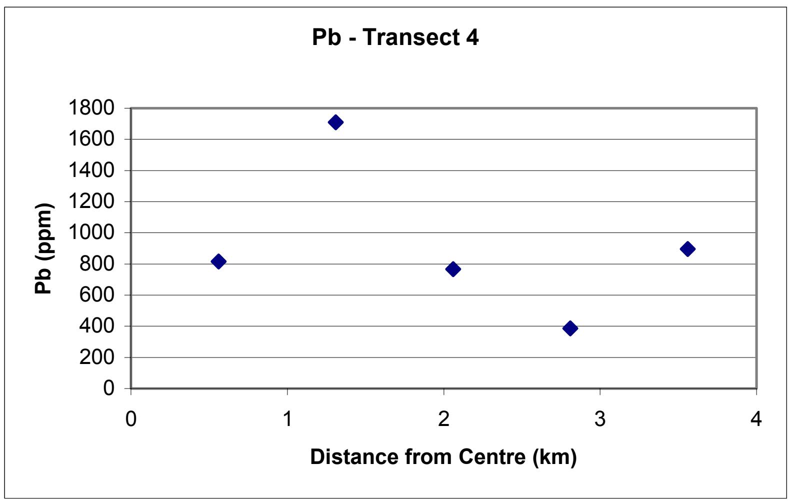


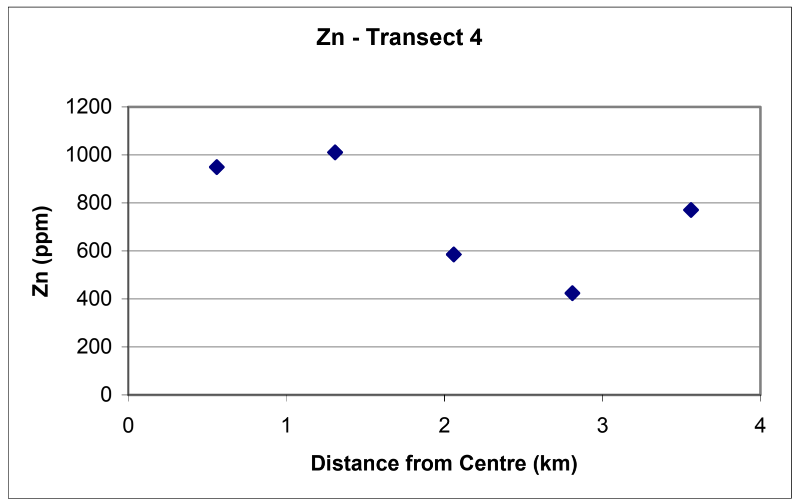
APPENDIX E

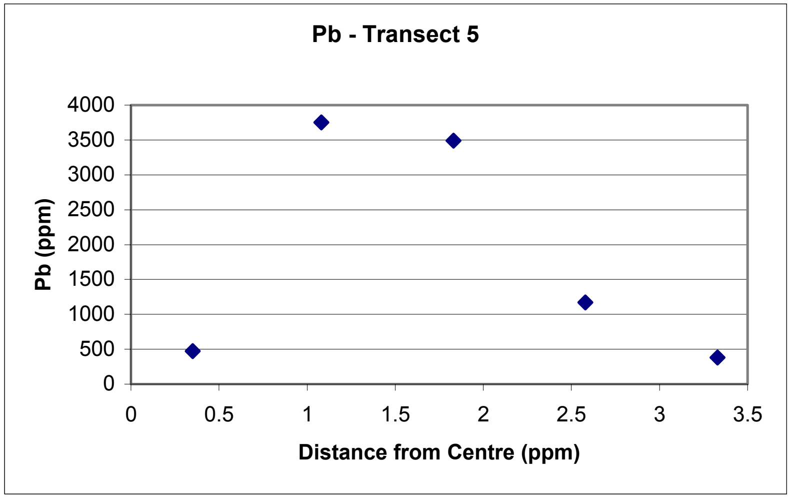
Surface Soil Lead and Zinc Concentrations by Transect and Distance from Intermediate Tailings Impoundment Centre

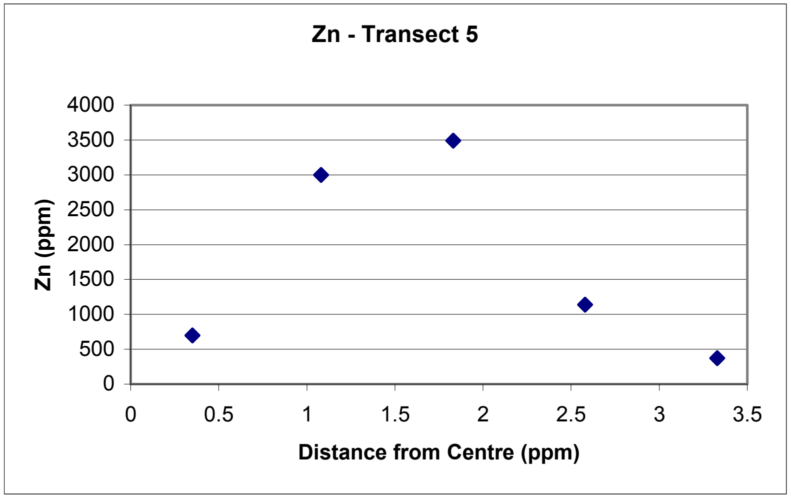

Pb - Transect 3
Pb (ppm)
Distance from Centre (km)
0
500
1000
1500
2000
2500
0
1
2
3
4
5

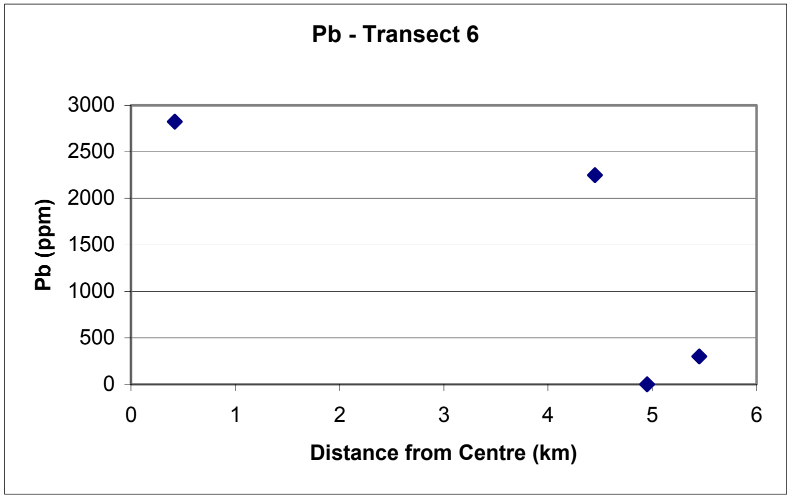

Zn - Transect 3
Zn (ppm)
Distance from Centre (km)
0
200
400
600
800
1000
1200
0
1
2
3
4
5

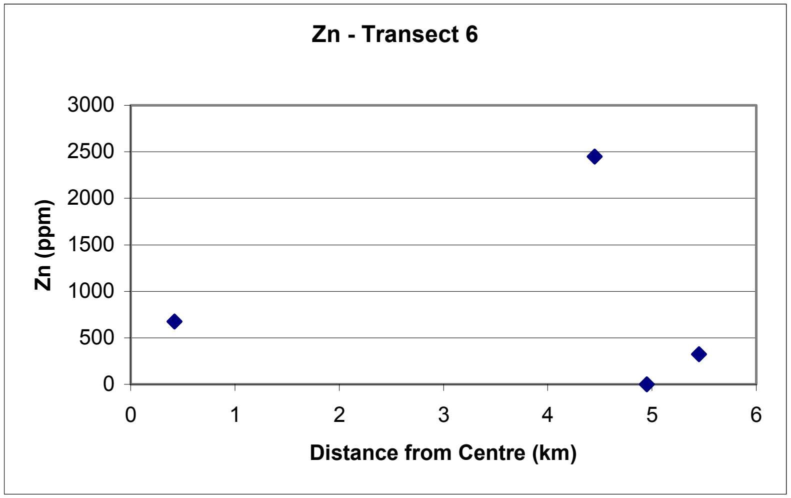

Pb - Transect 4
Pb (ppm)
Distance from Centre (km)
0
200
400
600
800
1000
1200
1400
1600
1800
0
1
2
3
4

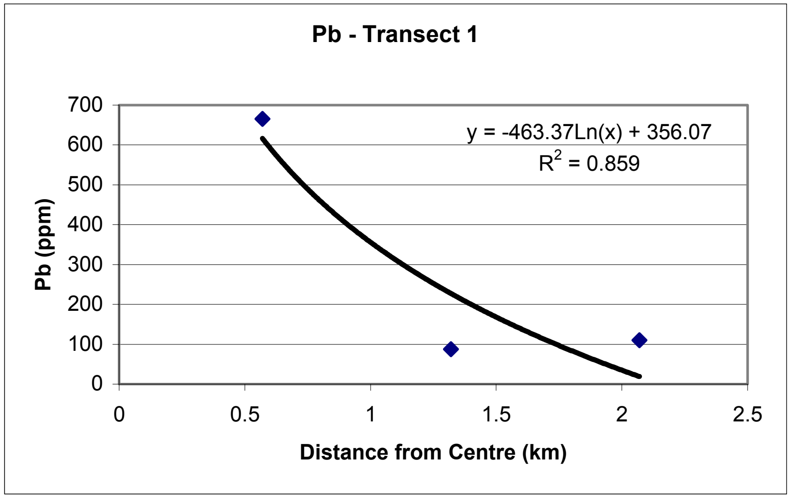

Zn - Transect 4
Zn (ppm)
Distance from Centre (km)
0
200
400
600
800
1000
1200
0
1
2
3
4

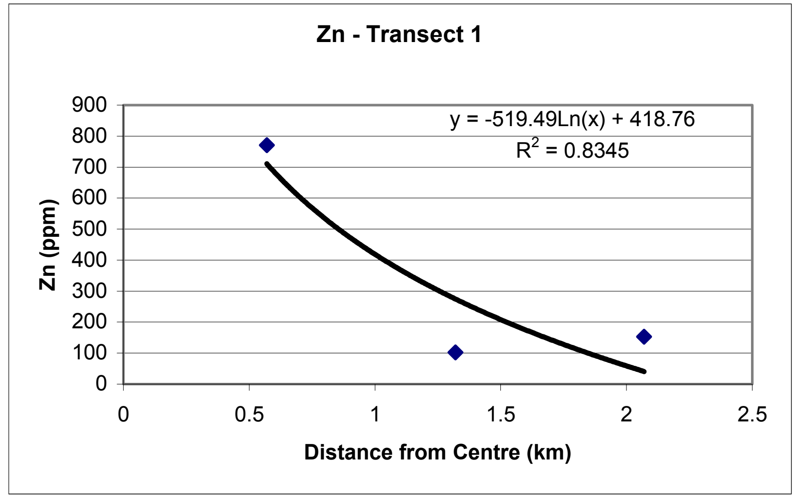

Pb - Transect 5
Pb (ppm)
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
Distance from Centre (ppm)

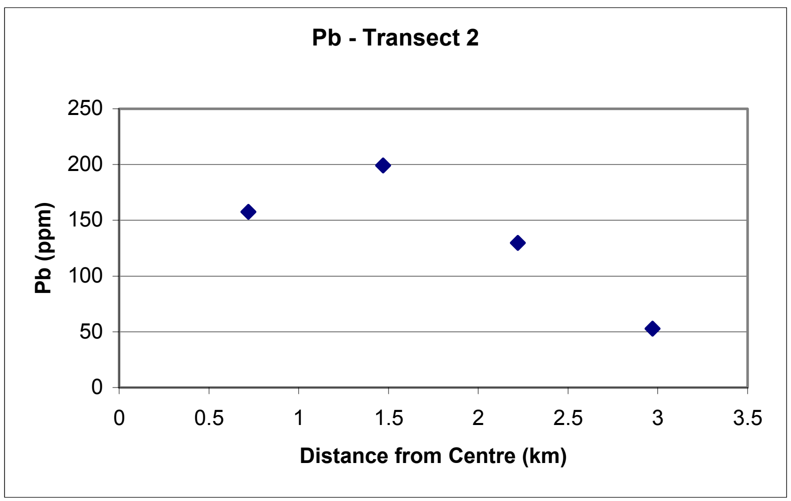

Zn - Transect 5
Zn (ppm)
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
Distance from Centre (ppm)

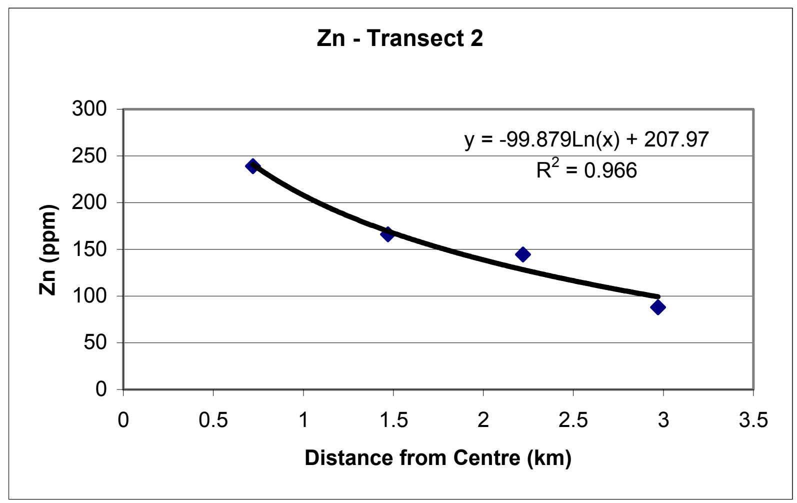

Pb - Transect 6
Pb (ppm)
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
Distance from Centre (km)

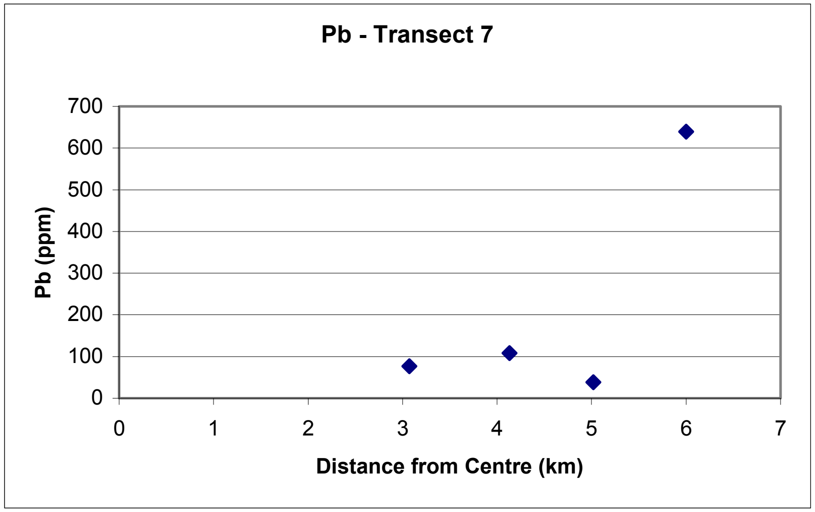

Zn - Transect 6
Zn (ppm)
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
Distance from Centre (km)


Pb - Transect 1
y = -463.37Ln(x) + 356.07
R2 = 0.859
Pb (ppm)
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
Distance from Centre (km)

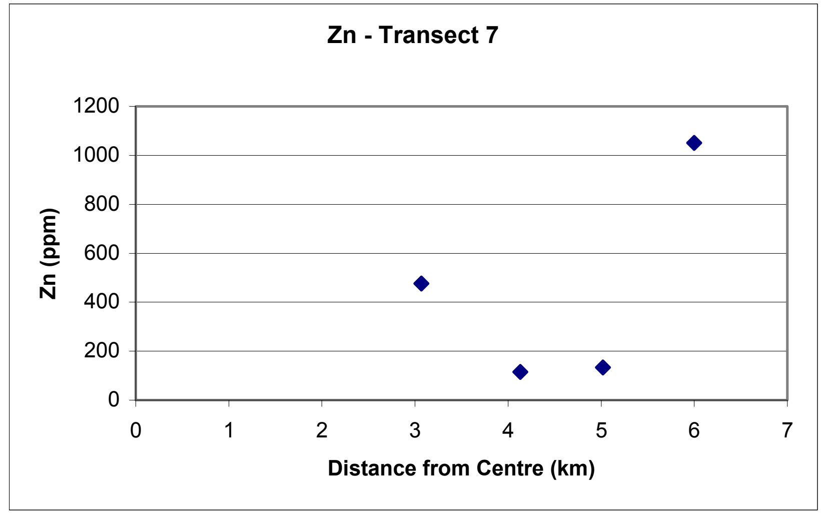

Zn - Transect 1
y = -519.49Ln(x) + 418.76
R2 = 0.8345
Zn (ppm)
900
800
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
Distance from Centre (km)


Pb - Transect 2
Pb (ppm)
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
3.5
Distance from Centre (km)

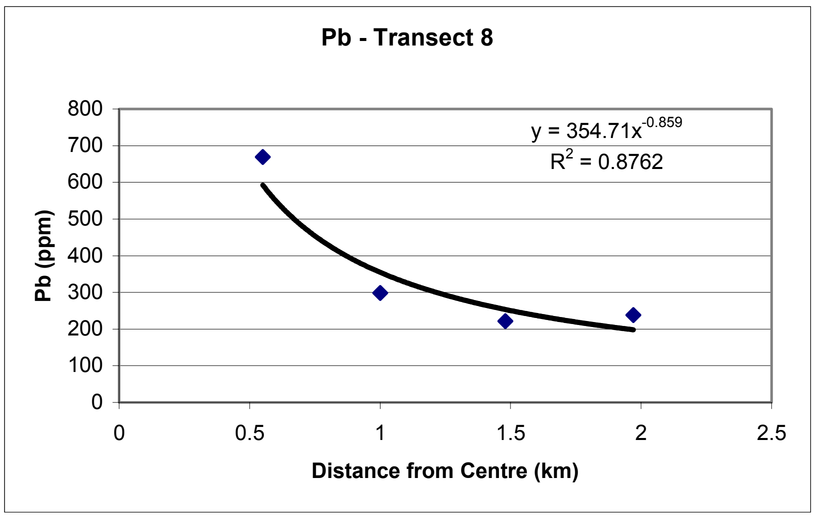

Zn - Transect 2
y = -99.879Ln(x) + 207.97
R2 = 0.966
Zn (ppm)
300
250
200
150
100
50
0
0
0.5
1
1.5
2
2.5
3
3.5
Distance from Centre (km)



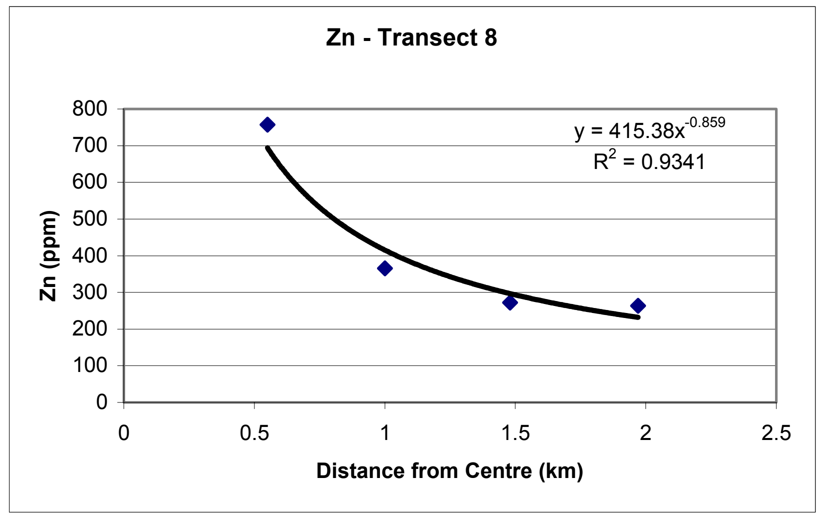
Pb - Transect 7
Pb (ppm)
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
Distance from Centre (km)



Zn - Transect 7
Zn (ppm)
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
7
Distance from Centre (km)



Pb - Transect 8
Pb (ppm)
y = 354.71x^-0.859
R^2 = 0.8762
800
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
Distance from Centre (km)



Zn - Transect 8
Zn (ppm)
y = 415.38x^-0.859
R^2 = 0.9341
800
700
600
500
400
300
200
100
0
0
0.5
1
1.5
2
2.5
Distance from Centre (km)

APPENDIX F

Vegetation Analytical Results

For interpretation of the following data, note that the following samples are field duplicates:

8-4 L – 8-5 L
4-3 L – 4-6 L
4-4 L – 4-7 L
SW-3 B – SW-8 B
VB-1 B – VB-3 B
VB-2 B – VB-4 B
VAN-9 W – VAN-11 W
4-2 W – 4-6 W
6-2 W – 6-5 W

These samples were split following collection but prior to submission to laboratory.

Uppercase letters following locations in sample labels refer to vegetation type: L=lichen, G=grass, W=willow, R=willow root, B=birch, BLUE=blueberry, CROW=crowberry, FLW=flower, CRF=creeping red fescue (grass).

On the VAN-10 location, two crowberry samples were taken. The first (labeled CROW), includes berries only. The second (labeled CROW 2 VEG) includes both berries and foliar tissue, to represent material potentially ingested by bears.

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM071002	FM071002	FM071002	FM071002	FM071002	FM071002	FM071002	FM071002	FM071002	FM200902	FM071002	FM071002	
Date Run:		07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	20-Sep-02	07-Oct-02	07-Oct-02	
Sample ID		**VAN-1W**	**VAN-2B**	**VAN-2G**	**VAN-3B**	**VAN-3G**	**VAN-4L**	**VAN-4BLUE**	**VAN-4B**	**VAN-4W**	**VAN-4 CROW**	**VAN-5L**	**VAN-5G**	**Detection**
Lab#		**02-376-1**	**02-376-2**	**02-376-3**	**02-376-4**	**02-376-5**	**02-376-6**	**02-376-7**	**02-376-8**	**02-376-9**	**02-376-10**	**02-376-11**	**02-376-12**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.06	0.05	0.05	<0.01	0.05	0.08	<0.01	0.02	0.08	0.03	0.11	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	12.3	0.73	0.17	0.50	0.32	0.19	0.23	0.13	1.53	<0.02	0.23	<0.02	0.02
Cr	mg/kg	0.68	0.35	0.75	0.37	0.66	1.29	0.21	0.24	0.37	0.28	2.41	0.30	0.05
Cu	mg/kg	7.73	5.93	3.52	3.92	4.89	3.51	3.26	4.49	3.38	4.43	4.61	2.47	0.05
Ni	mg/kg	4.3	3.6	2.1	2.9	3.6	1.1	1.0	2.0	2.8	0.6	1.8	2.0	0.1
Pb	mg/kg	1.3	1.8	2.3	6.0	1.7	29.0	0.1	1.7	1.8	0.7	37.9	1.8	0.3
Se	mg/kg	<1	3	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	1
Zn	mg/kg	402	1120	44.5	926	1040	42.1	18.3	136	42.8	7.4	59.3	10.3	0.1
Hg	mg/kg	0.02	0.01	0.03	0.01	0.02	<0.01	<0.01	0.02	<0.01	0.02	0.02	0.01	0.01

Company:		**CE Jones & Associates**										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM071002	FM071002	FM071002	FM071002	FM071002a	FM071002a	FM071002a	FM071002a	FM071002a	FM071002a	
Date Run:		07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	
Sample ID		**VAN-5W**	**VAN-5B**	**VAN-6 CRF**	**VAN-6 CLOVER FLW**	**VAN-6 CLOVER LEAVES**	**VAN-7 CLOVER**	**VAN-7 CRF**	**VAN-8 L**	**VAN-8 G**	**VAN-8 B**	**Detection**
Lab#		**02-376-13**	**02-376-14**	**02-376-15**	**02-376-16**	**02-376-17**	**02-376-18**	**02-376-19**	**02-376-20**	**02-376-21**	**02-376-22**	**Limit**
Analyte	**Units**											
Ag	mg/kg	0.05	<0.01	0.07	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	3.43	0.22	0.25	<0.02	<0.02	0.09	0.02	<0.02	<0.02	<0.02	0.02
Cr	mg/kg	0.18	0.18	0.26	0.19	0.18	0.28	0.19	0.97	0.20	0.16	0.05
Cu	mg/kg	2.65	4.79	3.06	10.7	13.1	12.1	3.15	2.08	2.08	4.76	0.05
Ni	mg/kg	3.0	2.0	0.7	7.5	3.7	4.2	0.9	0.6	0.9	1.4	0.1
Pb	mg/kg	1.1	1.3	7.9	1.7	3.0	1.7	0.4	12.2	0.4	1.0	0.3
Se	mg/kg	<1	<1	1	1	2	<1	<1	<1	1	<1	1
Zn	mg/kg	69.8	126	37.7	80.9	174	52.1	12.4	37.8	11.1	144	0.1
Hg	mg/kg	0.01	0.03	<0.01	<0.01	0.01	0.02	<0.01	<0.01	0.02	<0.01	0.01

Company:		**CE Jones & Associates**											
Project ID #		Anvil Range											
Soilcon Job#		02-376											
Media:		vegetation											
Analysis:		ICP-Metals											
Batch #		FM071002a	FM071002a	FM071002a	FM071002a	FM071002a	FM071002a	FM200902	FM200902	FM071002a	FM071002a	FM071002a	
Date Run:		07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	07-Oct-02	20-Sep-02	20-Sep-02	07-Oct-02	07-Oct-02	07-Oct-02	
Sample ID		**VAN-9 B**	**VAN- 9L**	**VAN- 9W**	**VAN-10 G**	**VAN-10 L**	**VAN-10 W**	**VAN-10 CROW**	**VAN-CROW 2 VEG**	**VAN-11 W**	**VAN-10 B**	**FARO-1 B**	**Detection**
Lab#		**02-376-23**	**02-376-24**	**02-376-25**	**02-376-26**	**02-376-27**	**02-376-28**	**02-376-29**	**02-376-30**	**02-376-31**	**02-376-32**	**02-376-33**	**Limit**
Analyte	**Units**												
Ag	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
As	mg/kg	<1	2	<1	<1	1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	<0.02	0.12	2.32	<0.02	0.09	1.13	<0.02	<0.02	2.17	0.04	0.08	0.02
Cr	mg/kg	0.24	3.07	0.42	0.38	2.07	0.57	<0.05	0.25	0.38	0.35	0.23	0.05
Cu	mg/kg	5.89	4.85	5.21	2.23	3.28	3.34	4.71	4.69	5.30	5.53	4.95	0.05
Ni	mg/kg	2.7	2.6	3.4	0.6	1.5	0.7	0.2	0.5	3.3	0.9	2.3	0.1
Pb	mg/kg	1.4	51.3	2.2	2.0	37.4	3.6	0.7	2.0	2.2	4.0	61.4	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	151	109	139	19.3	59.5	74.2	7.8	16.8	135	153	546	0.1
Hg	mg/kg	0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.01	0.13	<0.01	0.01

Company:		**CE Jones & Associates**									
Project ID #		Anvil Range									
Soilcon Job#		02-376									
Media:		vegetation									
Analysis:		ICP-Metals									
Batch #		FM071002a	FM071002a	FM200902	FM071002a	FM200902	FM200902	FM200902	FM200902	FM200902	FM200902	
Date Run:		07-Oct-02	07-Oct-02	20-Sep-02	07-Oct-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	
Sample ID		**FARO-1 L**	**FARO-1 W**	**FARO-1 CROW**	**FARO-2 B**	**FARO-2 W**	**FARO-3 W unwashed**	**FARO-3 W washed**	**FARO-4B**	**FARO-4G**	**FARO-4W**	**Detection**
Lab#		**02-376-34**	**02-376-35**	**02-376-36**	**02-376-37**	**02-376-38**	**02-376-39A**	**02-376-39B**	**02-376-40**	**02-376-41**	**02-376-42**	**Limit**
Analyte	**Units**											
Ag	mg/kg	0.61	<0.01	<0.01	<0.01	0.07	0.12	0.14	0.12	0.09	0.22	0.01
As	mg/kg	6	<1	<1	<1	<1	2	2	6	3	11	1
Cd	mg/kg	0.53	1.31	<0.02	<0.02	2.42	5.65	5.71	0.45	0.18	3.62	0.02
Cr	mg/kg	1.68	0.35	0.06	0.16	0.35	0.41	0.46	0.71	0.64	1.27	0.05
Cu	mg/kg	16.6	4.04	6.20	5.78	7.08	6.61	6.39	10.0	4.96	10.9	0.05
Ni	mg/kg	1.5	2.4	0.2	1.5	2.2	7.5	7.3	1.6	1.1	1.9	0.1
Pb	mg/kg	411	6.0	2.7	13.1	28.1	14.6	17.9	93.9	69.7	115	0.3
Se	mg/kg	2	<1	<1	1	<1	<1	<1	1	<1	<1	1
Zn	mg/kg	414	84.7	17.2	523	1340	270	252	503	139	623	0.1
Hg	mg/kg	0.02	0.01	0.01	0.02	0.01	0.02	<0.01	0.01	0.05	0.07	0.01

Company:		**CE Jones & Associates**										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM200902	FM200902	FM200902	FM200902	FM200902	FM200902	FM200902	FM200902a	FM200902a	FM200902a	FM200902a	
Date Run:		20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	
Sample ID		**FARO-4 BLUE**	**FARO-5 B**	**FARO-5 G**	**FARO-5 W**	**FARO-6 W unwashed**	**FARO-6 W washed**	**FARO-7B**	**FARO-7G**	**FARO-7W**	**SW-1 B**	**SW-1 L**	**Detection**
Lab#		**02-376-43**	**02-376-44**	**02-376-45**	**02-376-46**	**02-376-47A**	**02-376-47B**	**02-376-48**	**02-376-49**	**02-376-50**	**02-376-51**	**02-376-52**	**Limit**
Analyte	**Units**												
Ag	mg/kg	0.01	0.05	0.04	0.12	0.09	0.09	0.08	0.03	0.10	0.02	<0.01	0.01
As	mg/kg	<1	<1	<1	1	2	1	<1	<1	1	<1	<1	1
Cd	mg/kg	0.21	0.29	0.24	2.96	12.7	13.3	0.30	0.30	10.44	0.15	0.13	0.02
Cr	mg/kg	0.20	0.30	0.34	0.45	0.46	0.43	0.46	0.80	0.71	0.17	0.22	0.05
Cu	mg/kg	5.63	5.73	5.17	6.24	10.3	10.9	7.38	4.74	7.19	4.85	1.04	0.05
Ni	mg/kg	0.7	1.6	1.3	2.7	5.3	5.4	2.1	1.2	4.3	<0.1	<0.1	0.1
Pb	mg/kg	4.0	126	85.5	63.6	43.8	33.4	26.7	53.5	28.6	0.3	1.6	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	43.3	778	317	1290	2350	2440	630	214	601	390	20.9	0.1
Hg	mg/kg	0.02	0.03	0.06	0.04	0.03	0.01	0.02	0.04	0.03	0.01	<0.01	0.01

Company:		**CE Jones & Associates**													
Project ID #		Anvil Range													
Soilcon Job#		02-376													
Media:		vegetation													
Analysis:		ICP-Metals													
Batch #		FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM200902a	FM230902	
Date Run:		20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	20-Sep-02	23-Sep-02	
Sample ID		**SW-1 W**	**SW-1 R**	**SW-2 B**	**SW-2 L**	**SW-2 W**	**SW- 2 R**	**SW-3 B**	**SW- 3 L**	**SW-3 W**	**SW-3 R**	**SW-4 B**	**SW-4 L**	**SW-4 W**	**Detection**
Lab#		**02-376-53**	**02-376-54**	**02-376-55**	**02-376-56**	**02-376-57**	**02-376-58**	**02-376-59**	**02-376-60**	**02-376-61**	**02-376-62**	**02-376-63**	**02-376-64**	**02-376-65**	**Limit**
Analyte	**Units**														
Ag	mg/kg	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.04	0.01	<0.01	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	5.20	5.72	0.14	0.02	1.78	3.47	0.13	<0.02	1.33	1.95	0.10	0.04	1.47	0.02
Cr	mg/kg	0.18	0.39	0.15	0.27	0.18	0.37	0.19	0.24	0.22	0.36	0.18	0.18	0.07	0.05
Cu	mg/kg	3.14	5.31	3.92	0.95	3.04	7.34	4.20	0.88	3.09	4.19	4.25	0.86	2.85	0.05
Ni	mg/kg	0.6	0.6	0.2	<0.1	1.1	0.9	0.1	<0.1	0.2	0.5	0.2	<0.1	0.5	0.1
Pb	mg/kg	0.2	1.9	0.4	0.7	<0.3	1.4	<0.3	1.5	<0.3	0.5	0.8	1.0	0.3	0.3
Se	mg/kg	<1	<1	<1	<1	1	<1	1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	133	121	299	18.6	122	114	315	15.3	159	167	309	24.0	243	0.1
Hg	mg/kg	<0.01	<0.01	0.03	<0.01	<0.01	0.04	0.01	0.02	0.01	<0.01	0.02	<0.01	<0.01	0.01

Company:		**CE Jones & Associates**											
Project ID #		Anvil Range											
Soilcon Job#		02-376											
Media:		vegetation											
Analysis:		ICP-Metals											
Batch #		FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	FM230902	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**SW- 4 R**	**SW- 5 B**	**SW-5 L**	**SW-5 W**	**SW-5 R**	**SW-5 BLUE**	**SW-6 B**	**SW-6 W**	**SW-6 R**	**SW-6 B**	**SW-7 L**	**SW-7 W unwashed**	**Detection**
Lab#		**02-376-66**	**02-376-67**	**02-376-68**	**02-376-69**	**02-376-70**	**02-376-71**	**02-376-72**	**02-376-73**	**02-376-74**	**02-376-75**	**02-376-76**	**02-376-77A**	**Limit**
Analyte	**Units**													
Ag	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.04	<0.01	<0.01	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	1.01	0.13	0.03	1.16	0.61	0.19	0.05	6.13	0.88	<0.02	<0.02	2.02	0.02
Cr	mg/kg	<0.05	0.06	0.21	<0.05	0.08	<0.05	0.08	0.06	0.99	0.07	0.14	<0.05	0.05
Cu	mg/kg	3.39	4.81	0.98	2.56	3.73	3.76	6.13	6.00	8.79	4.97	0.60	2.97	0.05
Ni	mg/kg	0.8	0.8	0.4	2.9	0.4	0.6	1.8	2.4	1.5	0.6	0.3	0.2	0.1
Pb	mg/kg	0.5	<0.3	1.3	<0.3	<0.3	<0.3	0.4	0.4	1.3	<0.3	1.2	0.5	0.3
Se	mg/kg	<1	1	<1	<1	<1	<1	2	2	<1	1	<1	<1	1
Zn	mg/kg	139	115	17.9	26.7	117	22.7	126	170	76.3	171	16.5	225	0.1
Hg	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01

Company:		**CE Jones & Associates**											
Project ID #		Anvil Range											
Soilcon Job#		02-376											
Media:		vegetation											
Analysis:		ICP-Metals											
Batch #		FM230902	FM230902	FM230902	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**SW- 7 W washed**	**SW-7 R**	**SW-7 CROW**	**SW-7 BLUE**	**SW-8 B**	**VB-1 B**	**VB-1 G**	**VB-1 L**	**VB-1 W**	**VB-1 R**	**VB-2 B**	**VB-2 G**	**Detection**
Lab#		**02-376-77B**	**02-376-78**	**02-376-79**	**02-376-80**	**02-376-81**	**02-376-82**	**02-376-83**	**02-376-84**	**02-376-85**	**02-376-86**	**02-376-87**	**02-376-88**	**Limit**
Analyte	**Units**													
Ag	mg/kg	<0.01	<0.01	0.10	<0.01	0.01	0.02	<0.01	<0.01	0.05	0.08	0.01	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	2.10	0.62	<0.02	0.12	0.10	0.07	<0.02	0.11	1.31	0.97	0.24	<0.02	0.02
Cr	mg/kg	0.22	0.19	0.07	0.10	<0.05	0.10	0.15	0.65	0.16	0.85	0.16	0.23	0.05
Cu	mg/kg	3.18	5.00	3.43	3.57	4.52	4.62	2.39	2.07	3.38	8.52	4.94	1.99	0.05
Ni	mg/kg	<0.1	0.1	0.3	0.4	0.7	1.2	0.5	0.6	1.6	2.0	1.5	1.2	0.1
Pb	mg/kg	0.6	2.2	<0.3	<0.3	0.4	1.0	<0.3	10.6	0.6	19.2	0.6	<0.3	0.3
Se	mg/kg	<1	<1	1	<1	<1	1	<1	<1	1	1	<1	<1	1
Zn	mg/kg	311	121	7.8	22.7	252	174	13.8	38.9	75.5	99.8	143	26.6	0.1
Hg	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01

Company:		**CE Jones & Associates**										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902b	FM230902c	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**VB-2 L**	**VB-2 W**	**VB-2 R**	**VB-2 BLUE**	**VB-2 CROW**	**VB-3 B**	**VB-4 B**	**1-1 B unwashed**	**1-1 B washed**	**1-1 L**	**Detection**
Lab#		**02-376-89**	**02-376-90**	**02-376-91**	**02-376-92**	**02-376-93**	**02-376-94**	**02-376-95**	**02-376-96A**	**02-376-96B**	**02-376-97**	**Limit**
Analyte	**Units**											
Ag	mg/kg	0.03	0.06	0.41	<0.01	<0.01	<0.01	<0.01	0.01	0.04	0.16	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	1
Cd	mg/kg	0.06	1.74	0.42	0.37	<0.02	0.10	0.17	0.03	0.05	0.21	0.02
Cr	mg/kg	0.35	0.09	1.46	0.11	<0.05	0.21	0.11	0.18	0.21	0.81	0.05
Cu	mg/kg	1.73	4.09	5.00	3.63	3.29	3.76	4.84	5.07	5.35	5.38	0.05
Ni	mg/kg	0.5	4.7	1.9	1.0	0.3	1.4	1.6	2.5	2.1	0.7	0.1
Pb	mg/kg	8.1	0.7	1.4	<0.3	<0.3	1.2	0.5	15.9	16.3	81.3	0.3
Se	mg/kg	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	28.2	68.4	26.1	18.2	5.5	160	108	402	475	142	0.1
Hg	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01

Company:		**CE Jones & Associates**									
Project ID #		Anvil Range									
Soilcon Job#		02-376									
Media:		vegetation									
Analysis:		ICP-Metals									
Batch #		FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**1-1 W unwashed**	**1-1 W washed**	**1-1 R**	**1-2 B unwashed**	**1-2 B washed**	**1-2 L**	**1-2 W unwashed**	**1-2 W washed**	**1-2 R**	**Detection**
Lab#		**02-376-98A**	**02-376-98B**	**02-376-99**	**02-376-100A**	**02-376-100B**	**02-376-101**	**02-376-102A**	**02-376-102B**	**02-376-103**	**Limit**
Analyte	**Units**										
Ag	mg/kg	0.05	0.03	0.03	0.04	0.03	0.07	0.03	0.05	<0.01	0.01
As	mg/kg	<1	<1	1	<1	1	<1	<1	<1	<1	1
Cd	mg/kg	0.91	0.85	1.15	0.12	0.14	0.05	0.94	1.20	0.34	0.02
Cr	mg/kg	0.25	0.26	5.16	0.26	0.24	0.59	0.17	0.27	0.30	0.05
Cu	mg/kg	4.31	5.01	9.94	4.81	5.50	2.03	5.08	4.81	4.23	0.05
Ni	mg/kg	2.0	1.6	7.2	1.1	0.8	0.6	1.7	0.7	0.7	0.1
Pb	mg/kg	0.8	0.8	3.8	9.8	12.2	43.4	0.6	0.8	12.1	0.3
Se	mg/kg	<1	<1	1	<1	2	3	3	<1	<1	1
Zn	mg/kg	97.1	116	125	323	350	45.6	116	99.1	58.0	0.1
Hg	mg/kg	0.01	0.04	0.03	0.02	0.02	0.01	<0.01	<0.01	0.02	0.01

Company:		**CE Jones & Associates**										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902c	FM230902d	FM230902d	FM230902d	FM230902d	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**1-3 B unwashed**	**1-3 B washed**	**1-3 G**	**1-3 L**	**1-3 W unwashed**	**1-3 W washed**	**1-3 R**	**2-2 B**	**2-2 L**	**2-2 W**	**Detection**
Lab#		**02-376-104A**	**02-376-104B**	**02-376-105**	**02-376-106**	**02-376-107A**	**02-376-107B**	**02-376-108**	**02-376-109**	**02-376-110**	**02-376-111**	**Limit**
Analyte	**Units**											
Ag	mg/kg	<0.01	<0.01	<0.01	0.01	0.05	0.05	0.04	0.02	0.07	0.02	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	1
Cd	mg/kg	<0.02	0.03	<0.02	0.04	0.31	0.19	0.19	0.06	0.09	1.19	0.02
Cr	mg/kg	0.21	0.27	0.23	0.49	0.17	0.14	0.33	0.14	0.32	0.15	0.05
Cu	mg/kg	4.36	5.17	2.26	2.26	2.92	3.61	2.07	3.91	1.73	2.07	0.05
Ni	mg/kg	0.6	0.9	0.4	0.6	0.6	0.8	0.7	0.6	0.5	0.7	0.1
Pb	mg/kg	1.2	1.4	0.8	16.7	0.5	0.3	1.3	6.5	26.6	0.5	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	151	142	11.2	35.1	89.7	62.5	114	313	56.7	116	0.1
Hg	mg/kg	0.04	0.05	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	FM230902d	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**2-2 R**	**2-1 B**	**2-1 L**	**2-1 W**	**2-3 B**	**2-4 B**	**2-4 L (1)**	**2-4 L (2)**	**3-1B**	**3-1L**	**3-1W**	**3-1R**	**Detection**
Lab#		**02-376-112**	**02-376-113**	**02-376-114**	**02-376-115**	**02-376-116**	**02-376-117**	**02-376-118**	**02-376-119**	**02-376-120**	**02-376-121**	**02-376-122**	**02-376-123**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.02	0.01	0.27	0.04	0.01	<0.01	0.03	0.06	0.02	0.87	0.04	0.07	0.01
As	mg/kg	<1	<1	3	<1	<1	1	<1	<1	<1	24	2	2	1
Cd	mg/kg	0.36	<0.02	0.45	1.95	0.04	0.12	0.03	0.06	0.12	1.39	2.82	5.67	0.02
Cr	mg/kg	0.22	0.22	1.81	0.19	0.18	0.13	0.51	0.66	0.22	3.27	0.26	0.49	0.05
Cu	mg/kg	3.57	4.98	8.48	4.34	4.82	5.41	1.95	2.73	5.01	28.6	6.08	11.2	0.05
Ni	mg/kg	0.6	3.1	1.7	4.0	1.2	3.1	0.8	0.7	2.3	2.1	1.3	3.0	0.1
Pb	mg/kg	5.0	5.2	146	3.9	1.2	1.3	12.7	27.0	6.9	412	2.2	61.1	0.3
Se	mg/kg	<1	1	<1	<1	<1	1	2	1	<1	1	<1	1	1
Zn	mg/kg	108	154	192	219	247	138	36.9	58.6	289	499	216	403	0.1
Hg	mg/kg	<0.01	0.02	0.09	<0.01	<0.01	0.01	<0.01	0.03	0.02	0.35	<0.01	0.02	0.01

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM230902d	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	
Sample ID		**3-2B**	**3-2G**	**3-2L**	**3-2W**	**3-2R**	**3-3B**	**3-3G**	**3-3W**	**3-3R**	**3-4B**	**3-4L**	**3-4W**	**Detection**
Lab#		**02-376-124**	**02-376-125**	**02-376-126**	**02-376-127**	**02-376-128**	**02-376-129**	**02-376-130**	**02-376-131**	**02-376-132**	**02-376-133**	**02-376-134**	**02-376-135**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.03	0.12	0.51	0.03	0.16	0.01	0.02	0.05	1.24	0.01	0.53	0.03	0.01
As	mg/kg	1	<1	8	<1	1	<1	<1	<1	28	<1	5	<1	1
Cd	mg/kg	0.18	0.17	0.78	3.80	7.11	0.25	0.11	4.72	1.58	0.18	0.51	4.81	0.02
Cr	mg/kg	0.27	0.46	1.56	0.20	2.37	0.16	0.25	0.22	19.6	0.29	1.22	0.20	0.05
Cu	mg/kg	5.12	2.20	14.6	2.90	9.71	5.84	2.69	6.64	101	6.26	9.43	4.63	0.05
Ni	mg/kg	3.6	2.5	2.0	7.5	4.6	3.9	2.2	5.5	19.9	3.8	1.7	4.9	0.1
Pb	mg/kg	2.0	9.1	269	2.1	28.8	2.4	3.6	3.3	566	2.3	195	0.7	0.3
Se	mg/kg	1	<1	1	<1	<1	<1	<1	1	<1	<1	1	<1	1
Zn	mg/kg	257	45.8	352	113	265	291	139	828	407	315	291	397	0.1
Hg	mg/kg	0.03	0.02	0.24	0.01	0.04	0.05	0.03	0.01	0.51	0.03	0.11	0.02	0.01

Company:		CE Jones & Associates												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM230902e	FM230902e	FM230902e	FM230902e	FM230902e	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	
Date Run:		23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	23-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**3-4G**	**3-4R**	**4-1 W**	**4-2 B**	**4-2 G**	**4-2 L**	**4-2 W**	**4-2 R**	**4-3 B**	**4-3 L**	**4-3 W**	**4-3 R**	**Detection**
Lab#		**02-376-136**	**02-376-137**	**02-376-138**	**02-376-139**	**02-376-140**	**02-376-141**	**02-376-142**	**02-376-143**	**02-376-144**	**02-376-145**	**02-376-146**	**02-376-147**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.34	0.95	0.20	0.04	0.07	0.77	0.02	0.11	0.00	0.36	<0.01	0.05	0.01
As	mg/kg	<1	12	2	<1	<1	9	1	1	<1	4	<1	<1	1
Cd	mg/kg	0.43	8.86	9.92	0.25	0.33	1.20	3.01	1.58	0.39	0.51	1.39	1.49	0.02
Cr	mg/kg	0.34	9.32	0.51	0.15	0.25	1.47	0.13	0.44	0.06	0.68	<0.05	0.19	0.05
Cu	mg/kg	3.10	91.3	8.54	4.33	2.46	15.1	4.93	10.2	4.50	7.93	3.93	6.82	0.05
Ni	mg/kg	2.7	13.9	8.6	0.8	0.9	1.2	2.4	1.0	0.7	0.9	1.2	1.1	0.1
Pb	mg/kg	4.1	282	8.4	12.1	8.9	432	4.5	133	31.1	189	2.2	73.4	0.3
Se	mg/kg	<1	1	1	<1	1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	143	774	165	362	107	474	201	285	338	211	161	252	0.1
Hg	mg/kg	0.03	0.39	0.02	0.04	0.02	0.17	0.02	0.10	0.04	0.13	0.03	0.02	0.01

Company:	CE Jones & Associates												
Project ID #	Anvil Range												
Soilcon Job#	02-376												
Media:	vegetation												
Analysis:	ICP-Metals												
Batch #		FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902	FM240902a	FM240902a	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**4-4 B**	**4-4 G**	**4-4 L**	**4-4 W**	**4-4 R**	**4-5 B**	**4-5 L**	**4-5 W**	**4-5 R**	**4-6 L**	**4-6 W**	**5-1 B**	**Detection**
Lab#		**02-376-148**	**02-376-149**	**02-376-150**	**02-376-151**	**02-376-152**	**02-376-153**	**02-376-154**	**02-376-155**	**02-376-156**	**02-376-157**	**02-376-158**	**02-376-159**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.08	<0.01	0.25	0.03	0.08	<0.01	0.15	0.01	0.02	0.30	0.02	<0.01	0.01
As	mg/kg	<1	<1	2	<1	1	<1	<1	<1	<1	3	<1	<1	1
Cd	mg/kg	0.05	0.06	0.36	1.33	1.38	0.11	0.17	0.72	0.68	0.43	1.47	0.07	0.02
Cr	mg/kg	0.10	0.01	0.69	0.06	0.41	0.11	0.53	0.11	0.21	0.71	0.11	0.19	0.05
Cu	mg/kg	5.27	2.43	5.82	4.27	12.0	5.37	3.29	4.53	6.77	6.19	4.06	5.42	0.05
Ni	mg/kg	1.4	1.5	0.7	1.3	1.9	0.8	0.7	0.6	0.7	1.0	1.4	2.3	0.1
Pb	mg/kg	11.6	0.9	147	1.1	139	7.1	99.0	14.2	26.0	187	4.7	14.3	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	1	1
Zn	mg/kg	338	53.5	178	84.1	284	382	121	189	181	160	174	141	0.1
Hg	mg/kg	0.04	0.04	0.05	0.02	0.04	0.02	<0.01	<0.01	0.02	0.06	<0.01	0.02	0.01

Company:	CE Jones & Associates											
Project ID #	Anvil Range											
Soilcon Job#	02-376											
Media:	vegetation											
Analysis:	ICP-Metals											
Batch #		FM240902a		FM240902a	FM240902a	FM240902a	FM240902a	FM240902a	FM240902a	FM240902a	FM240902a	FM240902a	
Date Run:		24-Sep-02		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**5-1 W**	**no sample**	**5-1 R**	**4-7 L**	**5-2 B**	**5-2 G**	**5-2 L**	**5-2 W**	**5-2 R**	**5-3 B**	**5-3 L**	**Detection**
Lab#		**02-376-160**	**02-376-161**	**02-376-162**	**02-376-163**	**02-376-164**	**02-376-165**	**02-376-166**	**02-376-167**	**02-376-168**	**02-376-169**	**02-376-170**	**Limit**
Analyte	**Units**												
Ag	mg/kg	0.10	0.00	0.25	0.10	0.01	0.02	1.83	0.04	0.19	0.04	1.19	0.01
As	mg/kg	<1	0	<1	<1	<1	<1	4	<1	<1	<1	2	1
Cd	mg/kg	2.54	0.00	0.54	0.09	0.10	0.07	0.66	0.71	0.33	0.12	0.56	0.02
Cr	mg/kg	0.38	0.00	6.09	0.44	0.17	0.19	2.71	0.20	0.32	0.16	1.53	0.05
Cu	mg/kg	6.60	0.00	11.4	2.30	5.10	1.99	35.4	3.74	6.20	4.73	22.0	0.05
Ni	mg/kg	3.1	0.0	5.6	0.6	1.3	1.0	1.9	1.8	1.2	1.4	1.5	0.1
Pb	mg/kg	21.0	0.0	18.4	96.7	61.7	21.4	748	6.3	58.4	39.5	566	0.3
Se	mg/kg	2	0	2	<1	3	<1	5	<1	2	1	4	1
Zn	mg/kg	389	0.0	129	103	584	101	1043	285	485	656	771	0.1
Hg	mg/kg	0.02	0.00	0.02	0.01	0.01	0.02	0.51	0.01	0.01	0.01	0.21	0.01

Company:		**CE Jones & Associates**										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM240902a	FM240902a	FM240902a	FM240902a	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**5-3 W**	**5-3 R**	**5-4 B**	**5-4 L**	**5-4 W**	**5-4 R**	**5-5 B**	**5-5 G**	**5-5 L**	**5-5 W**	**5-5 R**	**Detection**
Lab#		**02-376-171**	**02-376-172**	**02-376-173**	**02-376-174**	**02-376-175**	**02-376-176**	**02-376-177**	**02-376-178**	**02-376-179**	**02-376-180**	**02-376-181**	**Limit**
Analyte	**Units**												
Ag	mg/kg	0.04	0.36	0.02	0.32	<0.01	0.07	<0.01	<0.01	0.03	<0.01	0.02	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	2.54	3.69	0.08	0.19	1.24	0.48	-0.08	0.02	0.13	2.28	0.75	0.02
Cr	mg/kg	0.19	1.07	0.16	0.70	0.18	0.32	0.16	0.22	0.29	0.08	0.19	0.05
Cu	mg/kg	4.14	17.3	4.65	5.97	2.48	4.29	6.47	2.21	2.34	5.07	6.50	0.05
Ni	mg/kg	1.0	1.8	1.9	1.0	5.5	1.1	0.8	0.4	0.5	1.5	0.7	0.1
Pb	mg/kg	13.8	288	21.2	121	3.8	18.8	1.5	1.4	24.7	1.6	7.6	0.3
Se	mg/kg	1	3	2	1	<1	<1	<1	<1	<1	1	<1	1
Zn	mg/kg	663	802	477	225	51.9	119	252	41.8	62.5	88.5	157	0.1
Hg	mg/kg	0.02	0.17	0.02	0.01	0.03	0.01	0.02	0.03	<0.01	0.01	<0.01	0.01

Company:		CE Jones & Associates										
Project ID #		Anvil Range										
Soilcon Job#		02-376										
Media:		vegetation										
Analysis:		ICP-Metals										
Batch #		FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	FM240902b	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**6-1 B**	**6-1 G**	**6-1 W**	**6-1 R**	**6-1 BLUE washed**	**6-1 BLUE unwashed**	**6-2 B**	**6-2 G**	**6-2 L**	**6-2 W**	**Detection**
Lab#		**02-376-182**	**02-376-183**	**02-376-184**	**02-376-185**	**02-376-186A**	**02-376-186B**	**02-376-187**	**02-376-188**	**02-376-189**	**02-376-190**	**Limit**
Analyte	**Units**											
Ag	mg/kg	0.03	0.02	0.08	0.11	<0.01	<0.01	<0.01	<0.01	0.52	0.03	0.01
As	mg/kg	<1	1	1	<1	<1	<1	<1	<1	1	<1	1
Cd	mg/kg	0.36	0.19	4.93	2.79	0.10	0.11	0.18	<0.02	0.70	14.2	0.02
Cr	mg/kg	0.24	0.36	0.39	0.57	0.19	0.11	0.20	0.18	1.78	0.21	0.05
Cu	mg/kg	6.45	4.30	7.19	9.62	4.73	4.59	5.25	2.54	11.1	7.04	0.05
Ni	mg/kg	1.1	1.1	2.0	1.4	0.8	0.7	1.4	2.1	1.4	7.1	0.1
Pb	mg/kg	23.1	30.0	34.6	66.3	3.7	2.3	10.9	2.6	277	6.2	0.3
Se	mg/kg	1	<1	<1	1	1	<1	1	<1	1	1	1
Zn	mg/kg	438	143	616	487	29.8	27.3	423	97.5	320	446	0.1
Hg	mg/kg	0.02	0.03	0.02	0.01	0.01	<0.01	0.02	0.03	0.15	<0.01	0.01

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	FM240902c	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**6-2 R**	**6-3 B**	**6-3 G**	**6-3 L**	**6-3 W**	**6-3 R**	**6-4 B**	**6-4 W**	**6-4 R**	**7-1 B**	**7-1 G**	**7-1 W**	**7-1 R**	**Detection**
Lab#		**02-376-191**	**02-376-192**	**02-376-193**	**02-376-194**	**02-376-195**	**02-376-196**	**02-376-197**	**02-376-198**	**02-376-199**	**02-376-200**	**02-376-201**	**02-376-202**	**02-376-203**	**Limit**
Analyte	**Units**														
Ag	mg/kg	0.21	0.02	<0.01	0.22	0.02	0.07	<0.01	0.05	0.13	<0.01	<0.01	0.02	0.11	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	9.88	<0.02	0.19	0.56	7.93	3.08	0.10	2.24	0.89	<0.02	0.05	2.32	1.56	0.02
Cr	mg/kg	1.43	0.09	0.11	0.63	0.12	0.29	0.14	0.09	0.55	0.12	0.09	0.11	1.88	0.05
Cu	mg/kg	23.4	4.44	2.14	5.18	4.02	6.46	5.37	4.23	6.37	5.10	2.42	3.30	7.84	0.05
Ni	mg/kg	5.2	1.1	0.9	0.8	1.3	2.2	3.5	5.6	3.9	2.2	0.9	0.7	5.6	0.1
Pb	mg/kg	210	7.0	0.9	59.8	2.1	27.5	10.4	1.7	13.1	4.9	1.2	3.0	11.6	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	926	347	65.8	184	172	178	310	66.6	155	207	48.6	272	192	0.1
Hg	mg/kg	0.13	0.02	0.02	0.03	0.01	0.01	0.01	<0.01	0.02	0.03	0.02	0.02	0.02	0.01

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM240902c	FM240902c	FM240902c	FM240902c	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	
Sample ID		**6-5 W**	**7-2 B**	**7-2 W**	**7-2 R**	**7-3 W**	**7-3 B**	**7-4 B**	**7-4 G**	**7-4 L**	**7-4 W**	**7-4 R**	**8-1 B**	**Detection**
Lab#		**02-376-204**	**02-376-205**	**02-376-206**	**02-376-207**	**02-376-208**	**02-376-209**	**02-376-210**	**02-376-211**	**02-376-212**	**02-376-213**	**02-376-214**	**02-376-215**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.04	<0.01	0.03	0.08	0.03	<0.01	<0.01	<0.01	0.22	0.01	0.04	<0.01	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	17.27	<0.02	1.95	1.54	0.47	<0.02	<0.02	<0.02	0.19	1.37	0.98	<0.02	0.02
Cr	mg/kg	0.11	0.10	0.15	1.11	0.19	0.18	0.37	0.48	4.60	0.37	0.53	0.13	0.05
Cu	mg/kg	7.35	5.42	4.62	6.06	6.97	6.86	5.30	3.00	5.63	3.22	5.44	3.78	0.05
Ni	mg/kg	17.4	2.2	2.1	3.4	5.0	2.4	1.6	1.4	4.6	2.8	1.4	1.1	0.1
Pb	mg/kg	2.6	1.1	1.1	8.9	0.9	0.9	1.7	3.1	53.7	1.7	13.0	7.5	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	545	204	212	234	235	128	202	47.7	107	190	171	250	0.1
Hg	mg/kg	0.01	0.04	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.04	<0.01	<0.01	<0.01	0.01

Company:		**CE Jones & Associates**												
Project ID #		Anvil Range												
Soilcon Job#		02-376												
Media:		vegetation												
Analysis:		ICP-Metals												
Batch #		FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM240902d	FM270902	FM270902	FM270902	FM270902	
Date Run:		24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	24-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	
Sample ID		**8-1 L**	**8-1 W**	**8-1 R**	**8-2 B**	**8-2 L**	**8-2 W**	**8-2 R**	**8-3 B**	**8-3 L**	**8-3 W**	**8-3 R**	**8-4 B**	**Detection**
Lab#		**02-376-216**	**02-376-217**	**02-376-218**	**02-376-219**	**02-376-220**	**02-376-221**	**02-376-222**	**02-376-223**	**02-376-224**	**02-376-225**	**02-376-226**	**02-376-227**	**Limit**
Analyte	**Units**													
Ag	mg/kg	0.18	0.02	0.01	0.01	0.07	<0.01	0.14	0.02	0.07	0.01	0.09	0.02	0.01
As	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Cd	mg/kg	0.18	0.53	0.38	<0.02	<0.02	0.80	0.37	0.69	0.03	0.70	0.12	0.07	0.02
Cr	mg/kg	0.67	0.15	0.46	0.19	0.47	0.12	12.5	0.22	1.64	3.24	6.10	3.56	0.05
Cu	mg/kg	3.62	3.36	4.47	4.73	2.05	3.45	13.0	3.19	1.74	3.38	6.29	3.64	0.05
Ni	mg/kg	0.5	2.1	0.9	1.2	0.6	1.3	10.5	0.7	0.4	0.4	0.3	0.8	0.1
Pb	mg/kg	71.9	1.0	37.4	3.6	26.3	0.6	6.1	1.2	20.5	1.1	1.3	1.9	0.3
Se	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Zn	mg/kg	124	86.9	181	396	62.4	94.0	82.4	107	45.6	116	105	250	0.1
Hg	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01

Company:		**CE Jones & Associates**							
Project ID #		Anvil Range							
Soilcon Job#		02-376							
Media:		vegetation							
Analysis:		ICP-Metals							
Batch #		FM270902	FM270902	FM270902	FM270902	FM270902	FM270902	FM270902	
Date Run:		27-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	27-Sep-02	
Sample ID		**8-4 G**	**8-4 L**	**8-4 W**	**8-4 R**	**8-5 L**	**4-1R**	**2-1R**	**Detection**
Lab#		**02-376-228**	**02-376-229**	**02-376-230**	**02-376-231**	**02-376-232**	**02-376-233**	**02-376-234**	**Limit**
Analyte	**Units**								
Ag	mg/kg	<0.01	0.08	<0.01	0.06	0.09	0.42	0.08	0.01
As	mg/kg	<1	<1	<1	<1	<1	4	1	1
Cd	mg/kg	0.06	0.11	2.03	2.27	0.11	1.50	0.80	0.02
Cr	mg/kg	2.11	1.29	3.69	7.92	1.48	20.48	9.9	0.05
Cu	mg/kg	2.29	1.44	3.82	8.02	1.59	20.70	10.0	0.05
Ni	mg/kg	0.5	0.3	0.8	1.2	0.4	10.6	4.9	0.1
Pb	mg/kg	1.5	23.5	0.8	36.6	24.8	131	31.3	0.3
Se	mg/kg	<1	<1	<1	2	<1	<1	2	1
Zn	mg/kg	40.3	35.7	140	180	41.8	204	191	0.1
Hg	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	0.01

Moisture Content

		Sample ID	Lab #	Gravimetric Moisture Content (moisture/solids) (%)	Gravimetric Moisture Content (moisture/entire sample) (%)	Total Oven Dry Biomass (g)	Comments
Company:	CE Jones	VAN-1W moist	235	226.3	69.3	10.17	willow
Contact:	Justin Straker	VAN-8B moist	236	183.0	64.7	9.82	shrub like
Project ID:	Anvil Range	VAN-7 clover moist	237	508.7	83.6	6.63	clover
Soilcon Job#	02-376	GRASS moist	238	315.2	75.9	11.47	grass
Analysis:	MC	CROW moist	239	504.9	83.5	7.62	blueberries
Date Complete:	26-Aug-02	FARO 4B moist	240	135.8	57.6	15.27	shrub like
		4-5L moist	241	161.2	61.7	12.39	lichen
		4-3L moist	242	173.4	63.4	12.16	lichen
		6-2W moist	243	154.8	60.8	5.29	willow
		FARO-4 BLUE moist	244	546.8	84.5	5.34	blueberries