

ARIS SUMMARY SHEET

District Geologist, Smithers

Off Confidential: 92.08.20

ASSESSMENT REPORT 21741

MINING DIVISION: Omineca

PROPERTY: Silver Queen

LOCATION: LAT 54 05 00 LONG 126 42 30
UTM 09 5995005 649910
NTS 093L02E

CAMP: 041 New Nadina - Equity Area

CLAIM(S): Silver Tip, Earl 3

OPERATOR(S): New Nadina Ex.

AUTHOR(S): Higgs, T.W.

REPORT YEAR: 1991, 24 Pages

COMMODITIES

SEARCHED FOR: Multielement

KEYWORDS: Remediation, Adit drainage, Zinc concentration

WORK

DONE: Geochemical
HYDG 36 sample(s) ;ME

RELATED

REPORTS: 06456, 07612

MINFILE: 093L 002, 093L 162

LOG NO:	FEB 24 1992	RD.
ACTION:	<i>dash from assessment</i>	
FILE NO:		

LOG NO:	OCT 23 1991	RD.
ACTION:		
FILE NO:		

NEW NADINA EXPLORATIONS LTD.

SILVER QUEEN PROPERTY

SITE REMEDIATION PROJECT

Location 54° 06' North, 126° 45' West

HTS 93 L 2E

Omimica M.D.

**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

21,741

by T. W. Higgs, M.E.Sc, P.Eng.

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Silver Queen Property - General Information

A. Introduction

A.1 Location and Access

The Silver Queen Mine of New Nadina Explorations Ltd., is located on the east side of Owen Lake 43.5 km southwest from Highway 16 and Houston British Columbia. Access is via paved road 4 km westerly along Highway 16 from Houston and then over well maintained gravel surfaced Morice-Owen forestry road.

A general location map for the property is provided in Figure A.1.

A.2 Property Definition

New Nadina Explorations Ltd., owns 125 claim units plus 17 crown granted mineral claims. The property is in open rolling ranch land and scrub timber east of Owen Lake with maximum relief of about 160m. Much of the area is open grassland with stands of pine and spruce near the lake. The property is mantled by unconsolidated glacial till. Outcrops are sparse except in the area of Wrinch Canyon.

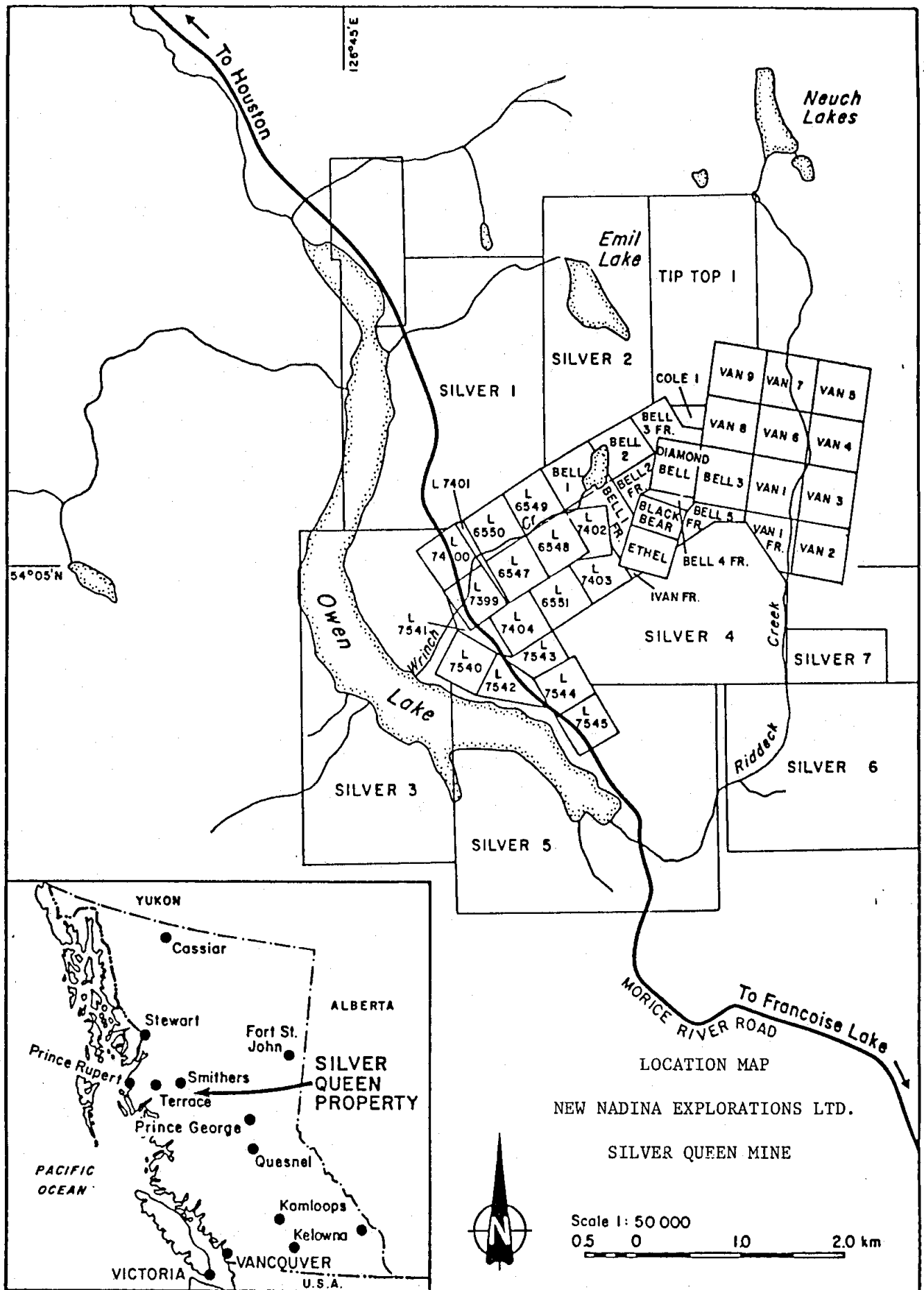


Figure A.1

A.3 History

Mineralization was first discovered in the Owen Lake camp in 1912. Additional showings were located and sporadic exploration and mining took place until 1923 when significant tunnelling was completed on the Wrinch Canyon veins. In 1928 the whole camp was optioned and extensive programmes of shaft sinking and tunnelling were completed including the driving of the Earl adit cross cut for 3,000 feet. Canex (Placer Development) acquired control of the bulk of the property in 1941 and carried out sporadic exploration until 1947. Nadina Explorations optioned the Canex claims in 1963 and began an aggressive programme of surface and underground exploration which continued until 1967 when the property was optioned to Kennco. At the same time Frontier Exploration Ltd. had been exploring the Diamond Belle and related prospects in the eastern half of the Owen Lake camp. Kennco carried out geochemical and geophysical surveys and diamond drilling in the search for a porphyry copper deposit until the end of 1967 when they dropped the option. Nadina continued exploration and drilling until 1970 when Northgate Explorations optioned both the Nadina and Frontier ground. After an extensive programme of drilling Northgate dropped their option the next year. In 1971 the Bradina Joint Venture was formed and the property went into production at 500 tons per day in 1972. Problems with mining and metallurgy forced the project to shut down in late 1973 after approximately 200,000 tons of material had been put through the mill. Nadina and Frontier, latterly New Nadina and Bulkley Silver continued exploration on both properties until 1985 when Bulkley optioned the New Nadina ground and put the entire camp under one management.

A.4 Mapping

A surface plan map for the property is provided in Appendix I. The location used for collection of adit drainage samples in the Site Remediation Program, outlined in the next section of this report, is marked as Location A.

Silver Queen Property Site Remediation Project

1.0 Approach

The approach taken for site remediation at the Silver Queen property has been to develop a passive system for treating zinc rich adit drainage prior to release. This has involved a combination of lab and field studies aimed at characterizing the drainage and evaluating zinc removal using limestone. The work conducted to date, follows:

2.0 Adit Drainage Hydrology and Chemical Characteristics

1. A gauging device was set-up downstream of the "adit pond", which consists of a 90 degree V notch weir set into the stream bed. The weir height is recorded and used to calculate flow using a standard weir formula. This device was set up in late March prior to spring run-off.
2. Flow measurement and sampling commenced on April 2 and continued every 2-3 days during April and May. Sampling frequency dropped back to weekly in June, July and August. All samples are submitted to ASL Labs for pH plus total and dissolved copper, iron and zinc.
3. The results from this sampling program are provided in Tables 1 through 4. Flowrates, zinc concentration and zinc loading data for the April 2 to July 25 period are plotted in Figure 1. This data has verified the previous results in that flows, zinc concentration and zinc loading increase rapidly peak during the first few weeks of spring run-off and drop steadily in the summer months. Zinc concentration reached a peak of 49.3 mg/L on April 15 and had dropped to 5.77 mg/L by July 25. Based on previous years results, it is anticipated that the total zinc concentration will remain in the 3-5 mg/L range during the summer.

3.0 Lab Studies

Bench studies were conducted on a 40 L sample of adit drainage collected on May 15. The analytical results for this sample were as follows;

Table 1

Adit Drainage Results 1991 - Silver Queen Property

April, 1991

Month		April														
Date		2	3	5	7	9	11	13	15	17	19	21	23	25	27	29
Flow	L/s	6.2	5.9	5.7	6.0	8.5	7.4	8.3	8.0	10.4	9.0	9.5	6.8	9.2	8.8	9.3
	m ³ /day	533	512	493	515	734	638	719	692	900	777	822	752	92	762	807
Weir Height	cm	11.35	11.17	11	11.2	12.9	12.2	12.8	12.6	14	13.2	13.5	13.1	3.3	13.1	13.4
Field pH		7.6	7.8	7.8	7.5	7.6	7.5	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Lab pH		7.79	7.55	7.45	7.33	7.2	7.12	7.11	7.08	7.17	7.17	7.2	7.2	7.3	7.28	7.35
Conductivity	umhos/cm	1480	1520	1580	1650	1620	1640	1650	1680	1520	1600	1510	1550	140	1540	1550
Sulfate		722	787	806	926	948	951	942	963	852	927	825	849	21	490	463
Total Metals																
Copper		0.07	0.126	0.383	0.792	1.23	1.43	1.4	1.54	1.28	1.65	1.16	1.12	1.05	1.09	0.869
Iron		1.49	1.38	4.27	10.9	16.2	18	17.6	17.3	13.3	15.5	12.3	13	2.1	12.1	9.27
Zinc		3.37	9.75	18.8	36.6	38.8	37.2	41.4	49.3	46.4	56.2	40.3	41	0.9	38.2	36.2
Dissolved Metals																
Copper		0.002	0.038	0.042	0.043	0.041	0.044	0.051	0.062	0.062	0.075	0.059	0.063	0.57	0.045	0.054
Iron		10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03	10.03
Zinc		2.48	9.06	14.9	20.6	33.3	27.7	29.3	37.9	36.6	45.7	33.8	34	2.8	28.7	29.8
Loading																
Total Zinc	kg/d	1.8	5.0	9.3	18.9	28.5	23.7	29.8	34.1	41.8	43.7	33.1	31.3	2.4	29.1	29.2
Dissolved Zinc	kg/d	1.3	4.6	7.3	10.6	24.4	17.7	21.1	26.2	32.9	35.5	27.8	25.9	1.8	21.9	24.0
Total Iron	kg/d	0.8	0.7	2.1	5.6	11.9	11.5	12.7	12.0	12.0	12.0	10.1	9.9	1.6	9.2	7.5
Total Copper	kg/d	0.04	0.06	0.19	0.41	0.90	0.91	1.01	1.07	1.15	1.28	0.95	0.85	0.83	0.83	0.70

All results expressed in mg/L unless otherwise noted

Table 2

Adit Drainage Results 1991 - Silver Queen Property

May 1991

Month		May											
Date		1	3	5	7	9	11	13	15	16	20	23	30
Flow	L/s	7.2	7.1	7.8	7.2	7.4	7.1	7.1	10.4	NA	NA	NA	NA
	m ³ /day	625	612	678	625	638	612	612	900	NA	NA	NA	NA
Weir Height	cm	12.1	12	12.5	12.1	12.2	12	12	14	NA	NA	NA	NA
Field pH		7.3	7.7	7.7	7.6	7.6	7.5	7.5	7.5	NA	NA	NA	NA
Lab pH		7.44	7.54	7.54	7.61	7.67	7.7	7.69	7.67	7.4	7.44	7.47	7.48
Conductivity	umhos/cm	1530	1500	1430	1490	1470	1470	1470	1460	1460	1440	1440	1440
Sulfate		444	442	450	1340	1020	1080	1220	1280	436	412	385	386
Total Metals													
Copper		0.833	0.778	1.06	0.62	0.573	0.583	0.52	0.426	0.242	0.209	0.159	0.178
Iron		8.62	7.88	10.4	5.54	4.36	4.22	3.36	3.43	0.242	2.64	2.6	3.62
Zinc		33.1	32.4	30.4	26.6	23.7	22.9	22.1	20.8	17.8	17.8	15.6	12.9
Dissolved Metals													
Copper		0.046	0.05	0.063	0.069	0.069	0.083	0.076	0.071	0.04	0.031	0.038	0.037
Iron		0.03	0.03	0.03	0.039	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Zinc		23.8	22.6	23.8	23.4	20	20.7	20.4	20	14.1	13.7	12.4	9.48
Loading													
Total Zinc	kg/d	20.7	19.8	20.6	16.6	15.1	14.0	13.5	18.7				
Dissolved Zinc	kg/d	14.9	13.8	16.1	14.6	12.8	12.7	12.5	18.0				
Total Iron	kg/d	5.4	4.8	7.1	3.5	2.8	2.6	2.1	3.1				
Total Copper	kg/d	5.39	4.82	0.72	0.39	0.37	0.36	0.32	0.38				

All results expressed in mg/L unless otherwise noted

Table 3

Adit Drainage Results 1991 - Silver Queen Property
June 1991

Month		June			
Date		6	13	20	27
Flow	L/s	9.9	9.5	8.7	9.5
	m ³ /day	853	822	748	822
Weir Height	cm	13.7	13.5	13	13.5
Field pH		7.8	7.5	7.7	7.9
Lab pH		7.65	7.72	7.7	7.86
Conductivity	umhos/cm	1420	1440	1440	1450
Sulfate		723	710	691	692
Total Metals					
Copper		0.207	0.189	0.182	0.123
Iron		3.62	3.59	2.99	2.58
Zinc		9.56	8.49	7.38	6.98
Dissolved Metals					
Copper		0.023	0.019	0.023	0.019
Iron		10.03	10.03	0.033	10.03
Zinc		9.05	6.96	6.4	6.18
Loading					
Total Zinc	kg/d	8.2	7.0	5.5	5.7
Dissolved Zinc	kg/d	7.7	5.7	4.8	5.1
Total Iron	kg/d	3.1	3.0	2.2	2.1
Total Copper	kg/d	3.09	2.95	0.14	0.10

All results expressed in mg/L unless otherwise noted

Table 4 Adit Drainage Results 1991 – Silver Queen Property
July 1991

Month	July				
Date	4	11	18	25	
Flow	L/s	8.7	8.7	8.7	8.7
	m ³ /day	748	748	748	748
Weir Height	cm	13	13	13	13
Field pH					
Lab pH		7.96	7.64	7.77	7.78
Conductivity	umhos/cm	1440	1440	1450	1440
Sulfate		718	725	703	696
Total Metals					
Copper		0.204	0.142	0.161	0.139
Iron		2.9	2.44	2.41	2.14
Zinc		7.48	5.22	6.19	5.77
Dissolved Metals					
Copper		0.013	0.011	0.027	0.02
Iron		10.03	10.03	10.03	10.03
Zinc		3.95	2.93	3.77	3.9
Loading					
Total Zinc	kg/d	5.6	3.9	4.6	4.3
Dissolved Zinc	kg/d	3.0	2.2	2.8	2.9
Total Iron	kg/d	2.2	1.8	1.8	1.6
Total Copper	kg/d	2.17	1.82	0.12	0.10

All results expressed in mg/L unless otherwise noted

**Silver Queen Property - Adit Drainage
Comparison of Flows and Loading
April - July 1991**

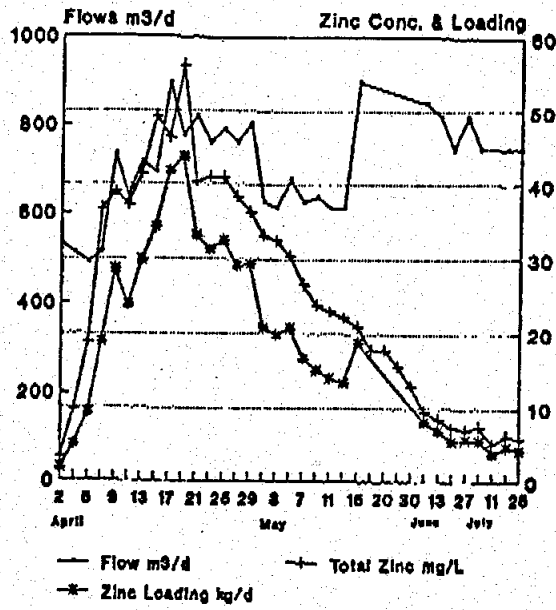


Figure 1

**Dolomitic Limestone
Size Distribution - Lab Studies**

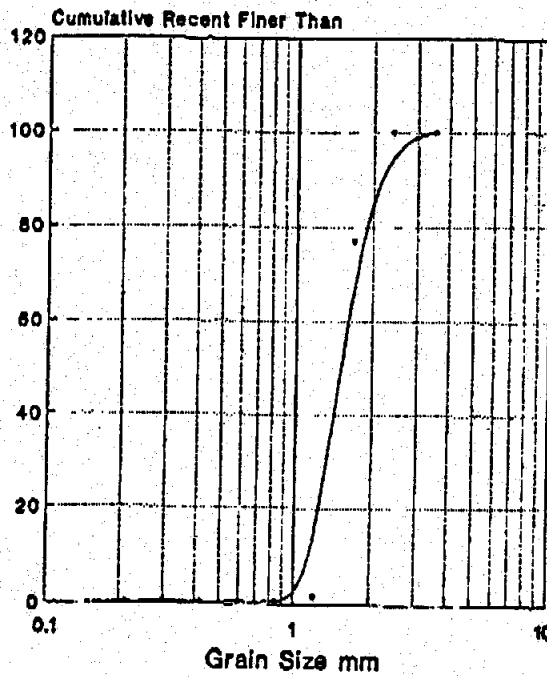


Figure 2

Adit Drainage May 15/91

<u>Parameter</u>	<u>Conc.</u>	<u>Units</u>
pH	7.86	
Conductivity	1420	umhos/cm
Sulphate	716	SO ₄ mg/L
Total Metals		
Copper	0.216	mg/L
Iron	1.25	mg/L
Zinc	17.0	mg/L
Dissolved Metals		
Copper	0.072	mg/L
Iron	10.030	mg/L
Zinc	14.4	mg/L

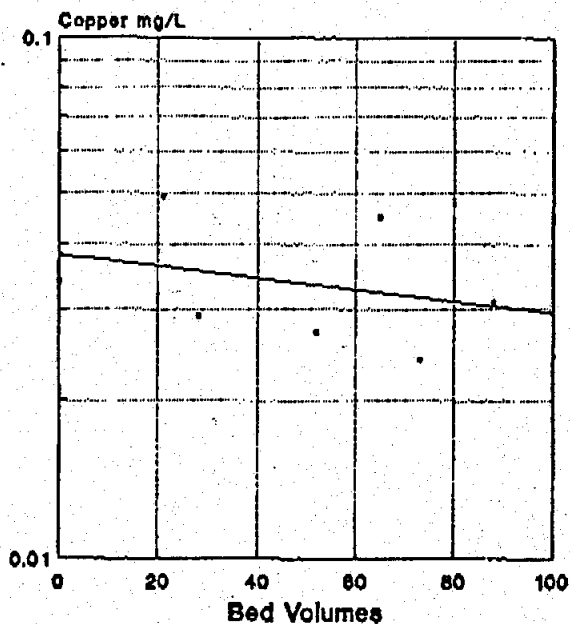
Preliminary bench tests conducted using this sample showed that both sodium carbonate and limestone were capable of reducing zinc to acceptable levels. After receipt of the tests results from the bench tests, a column experiment was set-up to measure the ability of limestone to remove zinc, as follows;

Granular dolomitic limestone (37% MgCO₃) was screened to generate material with a uniform size gradation (- 12 to + 20 mesh). Sieve analyses were conducted and used to calculate a surface area for the material of 159 m²/kg, (assuming spherical particles). A cumulative size distribution plot from the sieve analyses is provided in Figure 2.

The column consisted of a 1.8 m length of 21 mm I.D. PVC pipe (nominal 3/4"). The column was packed wet to a height of 1600 mm with the dolomitic limestone. The bed was supported by glass wool inserted above a flow control stopcock valve attached to the bottom of the column.

A constant head apparatus was set up using a reservoir and circulating pump. The flow through the column was adjusted to between 0.8 and 1.5 mL/min equivalent to 3 - 5 empty bed volumes (BV)/day. A series of samples were collected at regular intervals over a 25 day period and submitted to ASL Labs for total copper, iron and zinc. The results for copper and zinc analyses are plotted in Figures 3 and 4. Since the initial copper concentration was low, very little change was noticed. The zinc concentration however appeared to trend upwards after the first 20 bed volumes and then drop steadily reaching 0.238 mg/L after 88 BV. It was observed that the samples collected at the 20 BV mark contained a minor amount of solids,

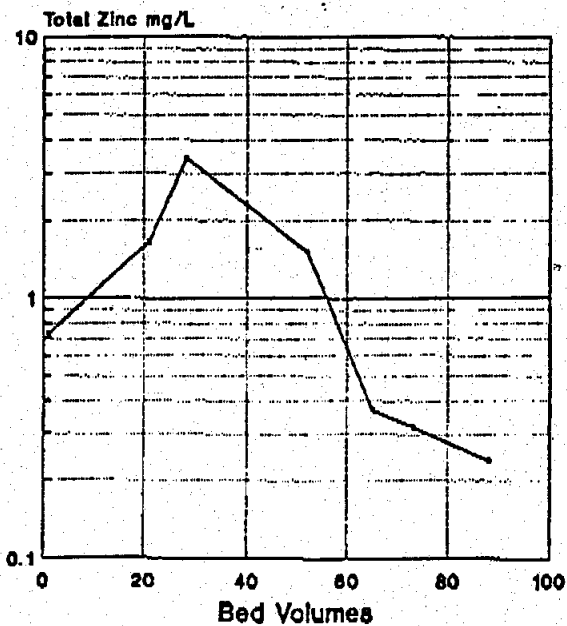
Copper Concentration Bench Scale Column Studies



Cu Feed Concentration = 0.034 mg/L
Surface Area = 227 m²
Flow Rate = 3-5 BV/day

Figure 3

Zinc Concentration Lab Scale Column Studies



Zn Feed Concentration = 17.0 mg/L
Surface Area = 227 m²
Flow Rate = 3-5 BV/day

Figure 4

potentially explaining the results obtained. At the termination of the experiment all samples were completely clear.

After 88 BV the column was removing 98.6 % of the zinc in the feed without any deterioration in treatment efficiency.

4.0 Field Studies

Based on successful completion of the bench tests a large column was constructed to pilot test the process under field conditions. This column was constructed using a 1.8 m length of 150 mm diameter PVC pipe containing an internal perforated grid to support the media and a valve attached to a cap at the bottom of the column to control flow. The column was installed on site on July 31. A bed of 1.6 m of screened dolomitic limestone was added to the column. Adit drainage was fed directly to the top of the column from a road culvert near the adit, using a length of garden hose. The flowrate through the column was set at approximately 100 mL/min, equivalent to 5 BV/day. The analytical results for an initial sample, collected after 24 hours (5 BV) are as follows:

Pilot Column Effluent Aug 1/91

<u>Parameter</u>	<u>Conc.</u>	<u>Units</u>
pH	7.43	
Conductivity	1450	umhos/cm
Sulphate	573	SO4 mg/L
Total Metals		
Copper	0.007	mg/L
Iron	0.030	mg/L
Zinc	0.156	mg/L
Dissolved Metals		
Copper	0.007	mg/L
Iron	0.030	mg/L
Zinc	0.155	mg/L

Based on samples collected on July 25 the column feed concentration was assumed to be in the 5-7 mg/L range suggesting that the column was removing 97.2 % of the zinc.

5.0 Schedule

Based on the results obtained with the initial sample, it is anticipated that the hydraulic loading to the column can be increased potentially to 10 BV/day. A decision on this will be made on receipt of additional results. At this point it is anticipated that potentially 300 BV will be processed through the column prior to freeze up, giving a good indication of the feasibility of the process.

6.0 Recommendations

Besides site remediation using a passive limestone system, there several other alternatives for site remediation that need to be considered ;

6.1 Construction of Adit Bulkhead

A bulkhead could be constructed in the adit, which would potentially flood the workings, eliminate acid generation and the release of zinc. The success of this measure would depend on what elevation(s) in the workings that acid generation is taking place and on what elevation the workings would flood to once the bulkhead is in place. Whether a bulkhead provides complete elimination of acid generation or not, it would still provide a means of equalizing flows and loadings. The liquid level behind the bulkhead could be drawn down in the fall so as to provide storage for spring meltwater. The release of water from behind the bulkhead could therefore be controlled to ensure that maximum dilution is available in the receiving environment. The actual storage available in the workings would have to be determined to evaluate this option.

6.2 Downstream Treatment

It may be possible to construct a pond lower down on the property that would intercept adit drainage and provide equalized loading to a treatment system such as a limestone bed. This arrangement could take advantage of any renovation that is occurring naturally as the drainage moves through the ground prior to surfacing in Wrinch Creek. The discharge from this pond or treatment system would then effectively become the "last point of control".

6.3 Mine Reactivation

Upon reactivation of the mine, the current adit drainage would no longer be a major concern since potentially it would be incorporated in the mine water and either be treated in the mill or discharged to the tailings pond, depending on zinc concentration.

STATEMENT OF QUALIFICATIONS

T W (Tom) HIGGS, M.E.Sc., P.Eng.

EDUCATION

M.E.Sc., Biochemical Engineering, University of Western Ontario, 1974
B.E.Sc., Chemical Engineering, University of Western Ontario, 1969

PROFESSIONAL AFFILIATIONS

Association of Professional Engineers of British Columbia,
Canadian Institute of Mining and Metallurgy

CORPORATE POSITIONS

T.W. Higgs Associates Ltd., President, Consulting Process Engineering Practice
Bion Research Inc., President and Manager, Biotechnology Research and Environmental Consulting Company
Neptune Aquafarms International Ltd., Vice-President and Director, Commercial Shellfish Company

EXPERIENCE

Mr. Higgs has more than 16 years of experience in municipal and industrial pollution control and environmental assessment, including research, pilot plant operation, process development, detailed design and construction supervision. He has extensive experience in the areas of industrial, domestic and mine waste treatment and associated environmental monitoring. Technical services provided on behalf of clients has involved planning, preparation of project description and supporting information reports, design and specification of treatment facilities, representation at meetings and negotiation of permit specifications. Mr. Higgs owns and operates, Bion Research Inc, which is a biotechnology research and environment consulting company in addition, he is an active director of a commercial oyster operation in Washington State.

MINING

- * Technical Advisor to Yukon Territory Water Board on Matters associated with Chemical Engineering - Dept of Indian and Northern Affairs, Whitehorse Yukon
- * Water License Amendment Application Services, Hearing Representation, plus Water Balance, Groundwater and Natural Degradation Evaluations - Canamax Resources Inc, Ketzka River Mine, Yukon.
- * Process Development, Plant Design, Construction Supervision, Commissioning and Start-Up, Reclaim Water Treatment Plant, Ketzka River Mine, Canamax Resources Inc, Yukon.
- * Evaluation of Waste Management Aspects, Stage I Environmental Program - Eskay Creek Project, B.C. Prime Explorations Ltd
- * Risk Assessment of Cinola Project, B.C. Mining Steering Committee - Rescan Environmental Services.
- * Technical Evaluation of Sherwood Ferrochromium Project, Port Hardy, B.C. - Nadler, Roberts and Lee.
- * Evaluation of the Chemistry of Copper in Treatment Plant Effluent, Canamax Resources Inc - Canada/Yukon Agreement on Economic Programming, Mineral Resource Program
- * Technical Evaluation of Cinola Gold Project for Council of Haida Nations - Sigma Engineering Ltd.
- * Preparation of Treatment Section of Acid Mine Drainage Technical Guide - BC Acid Mine Drainage Task Force.
- * Technical and Economic Review of Equity Silver Closure Plan for Acid Mine Drainage Treatment, B.C. Ministry of Energy Mines and Petroleum Resources.
- * Preliminary Review of Waste Management Options for Equinox Resources, J&L Property, Revelstoke, B.C.
- * Environmental Project Review of Ketzka Silver Project for Yukon Minerals, Yukon.

MINING

- * Waste Treatment Process Development and Alternative Evaluation, Lihir Project, BP Minerals, Papua New Guinea - Rescan Environmental Services.
- * Technical and Environmental Review of Heap Leaching in Northern Canada, Indian and Northern Affairs Canada, Ottawa.
- * Project Review, Water License Application Services and Hearing Representation for Canamax Resources Inc., Ketzia River Mine, Yukon.
- * Process Development, Design, Start-up of a Treatment System for Tailings Pond Overflow Containing Cyanide and Arsenic - Con Mine, Yellowknife, NWT.
- * Process Development, Cost Estimates, Design, Start-up of a Cyanide Waste Treatment Plant - Canada Tungsten Mining Corp Ltd, Tungsten NWT.
- * Water License Amendment Services - Canada Tungsten Mining Corp Ltd, Tungsten NWT.
- * Process Development, Preliminary Design, Pilot Plant and Cost Estimates for Waste Treatment System, Amax of Canada, Mactung Project, NWT
- * Monitoring and Evaluation of Groundwater Hydrology, Attenuation Chemistry and Contaminant Migration, Canada Tungsten Mining Corporation, Tungsten, NWT
- * Project Review of Waste Treatment, Tailings Pond and Water Supply Alternatives, Amax of Canada, Mactung Project.
- * Preliminary Design, Cost Estimates and Process Development, Cyanide Waste Treatment Plant, Long Lac Minerals, Val D'Or, P.Q.
- * Design of Sediment Control Systems for Gold Placer Mining Operation, Canada Tungsten Mining Corp, Dublin Gulch, Mayo, Yukon.
- * Technical Evaluation of Placer Mining Water Use Technology - Indian and Northern Affairs Canada, Yukon.
- * Environmental Review of Jason Property, MacMillan Pass, NWT - Billiton Minerals - Rescan.

INDUSTRIAL

- * Final Design and Specifications of Treatment Plant Upgrade, Westcoast Transmission Company, Fort Nelson Gas Plant.
- * Process Evaluation and Design of Treatment System Upgrade for Toxic Organic Waste, Department of National Defence, Colwood Firefighting School, Colwood B.C.
- * Process Development, Design, Start-up and Operation of a Waste Treatment System - Pacific Marine Training Institute, Maple Ridge Fire Fighter Training Centre, Maple Ridge B.C.
- * Process Design for Treatment Plant Expansion - Westcoast Transmission Company, Fort Nelson Gas Plant.
- * Evaluation of Chromium Discharge from Saskatoon Chemicals' Sodium Chlorate Facility, Pearson & Spence.
- * Waste Characterization Study of Paint and Resin Plants - Environmental Protection Service, Pacific Region.
- * Evaluation of Special Wastes Treatment and Disposal Options - Cyanide and Metals, Progressive Manufacturing, Burnaby, B.C.
- * Decommission of PCB Transformers to a Short Term Storage Site - Victoria, B.C.
- * Due Diligence Environmental Audit of Commercial Property, Annacis Island B.C. - EuroInvestors Inc.
- * Review of Process Chemistry for Stabilization of Special Wastes from Aluminum Sulphate Plant, Westcoast Energy Inc.
- * Technical Assessment of Sludge and Special Wastes Disposal from Drycleaning Facility - Ace of Suedes, Vancouver, B.C.
- * Assessment of Biodegradability of Selected Commercial Detergents - Planet Products.

PULP AND PAPER

- * Process Evaluation of Aerated Stabilization Basin Installation at Paperboard Industries - Hipp Engineering.
- * Evaluation of Process Treatment Alternatives - Quesnel River Pulp Company - Hipp Engineering.
- * Evaluation of Outfall Dilution Characteristics of Expanded CTMP/TMP Mill - Quesnel River Pulp Company, Hipp Engineering Ltd.
- * Evaluation of Organochlorine and Dioxins from Celgar Pulp Company, Castlegar, B.C. for Keenleyside Project, B C Hydro.

MUNICIPAL

- * Municipal Wastewater Treatment Plant Toxicity Evaluations Environmental Protection Service, Pacific Region.
- * Supervision and Operation of Physical/Chemical Pilot Plant Involving Activated Carbon, Sand Filtration, Carbon Regeneration, Ion Exchange, and Powder Activated Carbon, Research Branch, Ontario Ministry of Environment.
- * Investigation of Alum, Lime, Ferric Chloride, Ferrous Sulphate Use for Phosphorous Removal at Ontario Municipal Treatment Plants, Research Branch, Ontario Ministry of Environment.
- * Evaluation of Snowmaking/Freeze Concentration Process for Disposal of Lagoon Effluent, Kobes, B.C.
- * Evaluation of Water Quality Impact of Municipal Discharge on Okanagan Lake - Okanagan Indian Band and Okanagan Save Our Lakes Society
- * Evaluation of Water Quality Impact of Septic Tank Discharge on Marine Environment, Bowen Island, B.C., J. Rich.
- * Tracer Study and Evaluation of Outfall Dilution Patterns, Campbell River, B.C. Environmental Protection Service.
- * Groundwater Tracer Study - Four Mile Village, Bella Coola Indian Band.

WATER

- * Process Development and Evaluation of Iron Removal System, Westcoast Transmission, Kobes Compressor Station, Kobes, B.C.
- * Process Evaluation of Iron Removal System, B.C. Hydro, Burton, B.C.
- * Water Quality/Corrosion Evaluation, Air Conditioning System, Oakridge Shopping Centre.
- * Design and Fabrication Supervision of Irrigation Pump Station Desanding Equipment - Sunnymede Agrico Ltd, Lillooet, B.C.
- * Floating Pump Station Design for Anaham Agricultural Society, Alexis Creek B.C.

AQUACULTURE

- * Water Quality Assessment for Hotham Sound Hatchery, Pacific Aquafarms.
- * Water Quality On-site Analyses at Salmonid Enhancement Sites - Fisheries and Oceans, Canada.
- * Shellfish Water Quality Program : Treatment plant evaluations, Environment Canada, Pacific Region.
- * Management and Operation of Oyster Farm - Drayton Harbor, Blaine, Washington - Neptune Aquafarms International.
- * Research and Development of New Aquaculture Feed from Fish Offal - Bion Research Inc.
- * Evaluation of Cryogenic Freezing Process for Whole Shellstock Oysters - Neptune Aquafarms International.
- * Evaluation of Cold Smoked Oyster Process - Margetis Fish Co.

SEMINARS AND WORKSHOPS

* Presented Paper entitled " Metals Removal Technology for Gold Mill Effluent " at Gold Mill Effluent Treatment Seminar sponsored by Environment Canada, B.C. Ministry of Environment and EMR, January 1989, Vancouver, B.C.

* Presented Paper entitled " Use and Control of Cyanide in the Gold Mining Industry" at the Yukon Science Institute's Yukon Water Conference, March, 1989, Whitehorse, Yukon.

* Presented talk on Cyanide Chemistry, Treatment and Disposal at a Heap Leaching Seminar, 17th Annual Geoscience Science Forum, November, 1989, Whitehorse, Yukon.

* Presented Treatment Section of Acid Mine Drainage Short Course sponsored by the Mining Association of B.C., December, 1989 and February, 1990.

* Presented Paper entitled, " AMD Treatment Plant Sludge - Chemical Stability and Disposal Considerations" at Acid Mine Drainage Conference, GAC/MAC Joint Annual Meeting, Vancouver, May 18, 1990.

WORK HISTORY

* June 1987 to Present: T W Higgs Associates Ltd., Vancouver, B.C.

* Nov 1986 to June 1987: Self Employed Consulting Engineer - Contracted to Sigma Engineering, Vancouver, B.C.

* Jan 1986 to Present: President and Manager of Bion Research, Vancouver, B.C.

* Aug 1977 to Nov 1986: Sigma Engineering Ltd., Vancouver, B.C.

* Oct 1975 to Aug 1977: Environmental Protection Service, West Vancouver, B.C.

* 1972-1975: Research Branch, Ontario Ministry of Environment, Toronto, Ontario.

FAX TRANSMITTAL

FROM : T W HIGGS ASSOCIATES LTD
612-1200 W PENDER ST
VANCOUVER, B C
V6E 2S9

DATE: 24 August, 1991
Time: 12:16
NUMBER OF PAGES: 1
(INCLUDING THIS PAGE)

TEL: 604-688-8939
FAX: 604-688-9502

FILE: 354

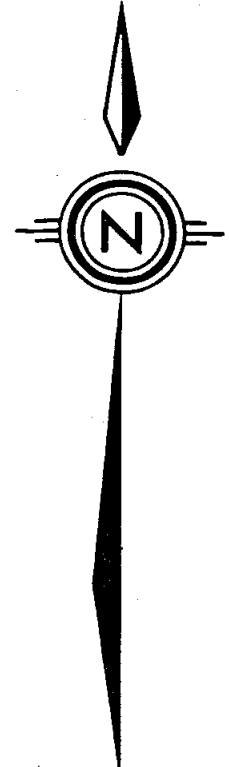
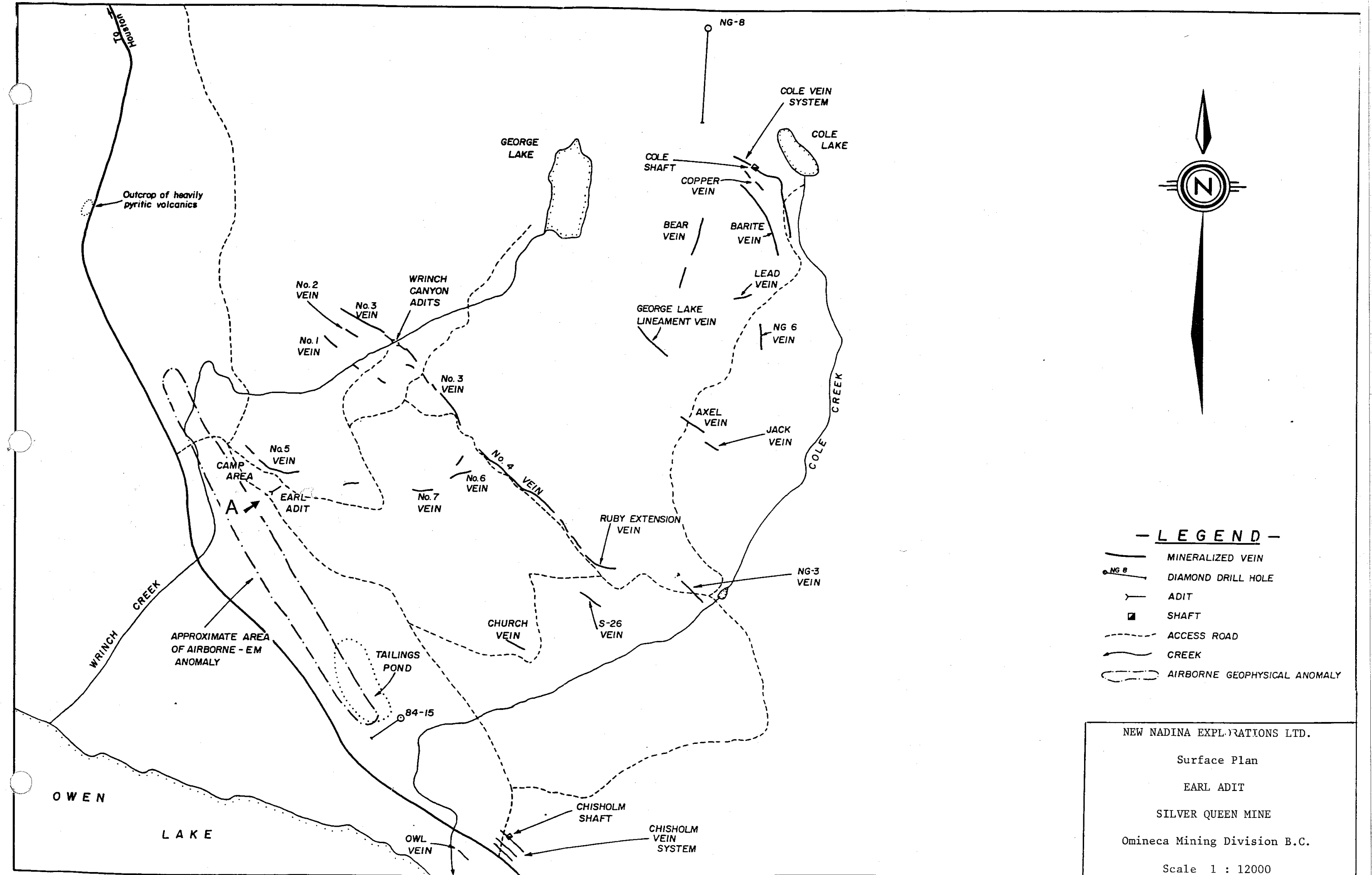
TO: George Stewart
Fax 1-445-6177

MESSAGE : Attached is my report on the site remediation work to date. My two invoices to date were for \$ 2278.88 to the end of January and \$ 4680.37 to the end of June for a total of \$6959.25. I have not completed an invoice for July and August as yet but I would estimate that it will be approximately \$3200 - 3500. I trust this report meets your requirements.







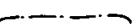
Tom Higgs

Appendix I

Silver Queen Mine
Surface Plan



- LEGEND -

-  MINERALIZED VEIN
-  DIAMOND DRILL HOLE
-  ADIT
-  SHAFT
-  ACCESS ROAD
-  CREEK
-  AIRBORNE GEOPHYSICAL ANOMALY

NEW NADINA EXPLORATIONS LTD.
 Surface Plan
 EARL ADIT
 SILVER QUEEN MINE
 Omineca Mining Division B.C.
 Scale 1 : 12000