Environmental Baseline Survey

Otisse Lake - Davidson Creek Watershed

prepared for

Royal Oak Mines Inc.

by

A. B. Bowman, B.E.S.
N.A.R. Environmental Consultants Inc.

October, 1995

N.A.R.
Environmental
Consultants Inc.

1012 Kelly Lake Rd.
Unit #1, Sudbury, ON.
P3E 5P4
Phone: (705) 677-0173
Fax: (705) 677-0923

October 16, 1996

Royal Oak Mines Inc.
Project Development Group
P.O. Bag 2010
Schumacher Mine
McIntyre Road
Timmins, Ontario
P4N 7X7

Attention: Mr. Reno Pressacco

Dear Sir:

As discussed two copies of the Environmental Baseline Survey are enclosed.

The Environmental Baseline Survey report was authored by myself. I am a Senior Environmental Scientist and Principal with N.A.R. Environmental Consultants Inc. I have 21 years of related site assessment, hydrogeological and water resources experience as an employee of the Ministry of the Environment and Energy and as a consultant. During this period I have carried out approximately 350 site and water resources investigations.

If you require additional information please don't hesitate to contact our office.

Sincerely

A. Brad Bowman, B.E.S.
Environmental Scientist/Principal

Table of Contents

	Page
1.0 Introduction	1
2.0 Background	2
2.1 General	2
2.2 Climate and Hydrology	2
2.3 Flora and Fauna	3
2.4 Geology and Landforms	3
2.5 Geomorphology and Soils	5
2.5 Tailings and Waste Rock Characteristics	5
3.0 Environmental Baseline Studies	7
3.1 Study Methodology	7
3.1.1 Bathometry and Hydrology	7
3.1.2 Water Quality and Sediments	7
3.1.3 Fisheries and Benthic Invertebrates	10
3.2 Shaft Sampling	11
4.0 Results and Discussion	12
4.1 Davidson Creek	12
4.2 Otisse Lake	12
4.3 Davidson Lake	16
4.4 Matachewan Consolidated Shaft	19
5.0 Recommendations	22
6.0 References	24

010C

List of Tables

		Page
Table 1:	Field Measurements and Station Rationale, Davidson Creek Watershed	8
Table 2:	Davidson Creek Watershed, Water Quality Results	13
Table 3:	Otisse and Davidson Lake, Water Quality Results	14
Table 4:	Otisse and Davidson Lake, Sediment Sampling Results	15
Table 5:	Matachewan Consolidated, Shaft Sampling Results	21

List of Figures

Figure 1:	Moose Habitat, Existing and Potential Tailings Disposal Sites	4
Figure 2:	Otisse Lake and Davidson Creek, Station Locations	9
Figure 3:	Davidson Lake, Net Set and Sampling Locations	17
Figure 4:	Davidson Lake, Bathymetry Map	18
Figure 5:	Length - Frequency Histogram for the White Suckers Captured in Davidson Lake	20
Figure 6:	Weight - Frequency Histogram for the White Suckers Captured in Davidson Lake	20

1.0 Introduction

Royal Oak Mines Inc. has conducted exploration diamond drilling on the Young-Davidson property and may proceed to advanced exploration in the near future. A successful advanced exploration program may lead to a feasibility study, production decision and permit application in 1996. In July 1995, Royal Oak retained Klohn-Crippen and N.A.R. Environmental Consultants Inc. to review the available environmental database for the Davidson Creek watershed and to make recommendations with regard to environmentally sensitive areas and resource values within the project area.

The claim area is in the order of 15 to 20 square kilometres and extends east from Mistinikon Lake to just west of the Montreal River. The boundary between Powell and Yarrow Townships is the southernly limit of the claim area. The claim limits to the north are less well defined by geographic features, but are roughly bounded by Otisse Lake. In general, the claim area covers the Davidson Creek watershed.

The report presents the results of a staged and on-going environmental baseline survey of the Davidson Creek watershed and adjoining Otisse Lake sub-watershed. The report has been prepared for Royal Oak Mines to serve as a basis for on-going permitting activities with the Ministries of Natural Resources, Environment and Energy, Northern Development and Mines and the Federal Department of Fisheries and Oceans.

The objectives of the environmental baseline survey were:

- to develop an environmental sensitivity map for the project area to aid in the selection of a tailings disposal area;

- to review and summarize the available surface and groundwater quality, meteorology, soils and tailings data for the Davidson Creek watershed;

- to collect preliminary data from which to develop a statistically sound environmental impact study; and

- to identify any environmental data shortfalls and to implement field programs required to fill any data gaps.

2.0 Background

2.1 General

The Davidson Creek watershed is located west of the Town of Matachewan, approximately 20 km south of the Arctic drainage divide. The watershed is bounded on the east by the Montreal River and on the west by Mistinikon Lake.

Tailings disposal areas are evident throughout the watershed including; the Matachewan Consolidated Mine; the east side of Davidson Lake, and an area along the north side of a roadway leading to Mistinikon Lake.

Prospecting in the Matachewan area began as early as 1909, with activity peaking in the 1930s, when several shafts and pits were sunk. In 1934, a 100 ton/day cyanide mill was constructed by Matachewan Consolidated Mines Ltd. Milling capacity was increased to 500 tons/day in 1937 and 1,000 tons/day in 1942. In 1953, both mining and milling were suspended. By that time, a total of 3,525,200 tons of ore had been processed.

On October 17, 1990, a failure occurred in the southeast corner of the main tailings impoundment. The breach released an estimated 55,000 m^3 of tailings that were deposited over 1.6 km of Davidson Creek and entered the Montreal River. During the next few months, over 1.5 km of Highway 566 was completely rebuilt. Davidson Creek was diverted away from the deposited tailings by constructing a new creek channel adjacent to the bedrock outcrops along the south side of the creek. Prior to the breach in the tailings embankment, the surface drainage from the main pond flowed north to an embayment of Otisse Lake. Otisse Lake drains to Hollinger Lake and hence the Montreal River. After the construction of a dam at the outlet of the tailings impoundment, drainage from the Matachewan Consolidated tailings was redirected to Davidson Creek (Klohn-Leonoff, 1993).

2.2 Climate and Hydrology

Based on data for the period 1951 to 1980, the mean daily maximum temperature for the Matchewan area is 9.4 °C. The mean daily minimum temperature is - 4.6 °C. Between 530 to 655 mm of rain and between 185 and 295 mm of snow (water equivalent) accumulate annually. As a result total precipitation ranges from 715 to 950 mm per year. Lake evaporation in the area averages 500 mm per year. The Montreal River Basin is characterized by 300 to 350 mm of annual runoff (Klohn-Leonoff, 1993).

Davidson Creek flows into the Montreal River at the Town of Matachewan, about 2 km east of the Matachewan Consolidated Mine site. The watershed area of Davidson Creek is approximately 3,250 ha. There are no flow records available for Davidson Creek.

2.3 Flora and Fauna

The project area is in the Boreal Forest Region and is described as the Missinaibi-Carbonga Forest Section by Rowe (1972). The dominant forest species are balsam fir (*Abies balsamea*), black spruce (*Picea mariana*) and white birch (*Betula papyrifera*), with scattered white spruce (*Picea glauca*) and trembling aspen (*Populus tremuloides*). Trembling aspen often dominates mid-slope positions. Mountain maple (*Acer spicatum*) and hazel (*Corylus cornuta*) are common shrubs. Jack pine (*Pinus banksiana*) are common on sandy soils. Jack pine/black spruce associations are common on stony/rocky soils. Organic areas are dominated by black spruce/tamarack (*Larix laricina*) associations. Alder (*Alnus rugosa*) is common in disturbed areas (Klohn-Leonoff, 1993).

The Davidson Creek watershed is managed as a forest resource with some cutting and operational activities planned for the area in the next five years (Leith-Bowman, personal communication).

Moose (*Alces alces*) and black bears (*Ursus americanus*) are common throughout the area as are beaver (*Castor canadensis*). The Davidson Creek watershed receives considerable usage as early and late winter moose range (Figure 1). A limited aquatic feeding area for moose has been identified within the watershed.

Davidson Creek is historically reported to have supported a brook trout (*Salvelinus fontinalis*) population.

2.4 Geology and Landforms

The Davidson Creek watershed forms part of the Superior Province of the Precmbrian Shield. The area was last glaciated between 8,000 to 10,000 years ago. Weathering and erosion by intense continental glaciation during the Pleistocene Epoch have smoothed the relief and covered the area with glacial drift and outwash consisting of sand and poorly sorted gravels. Although the region typically has gentle relief, rapid changes in elevation from 20 to 50 m, makes the Matachewan area relatively rugged. The level areas of volcanic rocks are disturbed by large syenite and granitic bodies and north-trending ridges formed by diabase dykes (Lovell, 1967).

The oldest rocks in the area are volcanic; mainly andesite, andesite porphyry, tuff and agglomerate. Some basalt, dacite, rhyolite, and amphibolite are also found to a lesser extent. The volcanic rocks have undergone regional metamorphism and contain some chlorite. They are overlain by sedimentary rocks and are cut by intrusive rocks.

Two groups of sedimentary rocks occur. Belts of tightly folded, grey to greenish-grey, highly metamorphosed conglomerates, greywacke, arkose, quartzite, and argillite belong to the Timiskaming sedimentary group. In places, these rocks contain green (chrome) mica and a high proportion of pyrite, and are cut by quartz-carbonate veins containing fluorite. The

LEGEND

MOOSE HABITAT

Early Winter

Late Winter

1 : 20 000

FIGURE 1 : MOOSE HABITAT – TAILINGS DISPOSAL OPTIONS

second group, younger in age (Proterozoic), consists of intermixed quartzite, argillite, arkose, and conglomerate of the Cobalt Formation. These flat-lying sedimentary rocks overlie all other types of rocks in the area except for younger diabase dykes and form the high lands in the vicinity of the Matachewan Consolidated Mine.

The volcanic and older sedimentary rocks are cut by mafic and siliceous intrusions which in turn, are cut by early diabase dykes. The Cobalt sedimentary rocks overlie all of these rocks and are themselves intruded by a few late diabase dykes.

The Matachewan Consolidated property is situated close to the contact between Timiskaming sedimentary rocks and volcanic rocks, both intruded by syenite porphyry dykes. To the west, Davidson Creek flows along the contact between Archean mafic metavolcanics on the north side and Huronian metasediments to the south. All rocks are cut by diabase dykes that are post-ore. The Montreal River channel is controlled along most of its course by a major north-south trending fault (Klohn-Leonoff, 1993)

2.5 Geomorphology and Soils

The Northern Ontario Engineering and Terrain map for the area (Roed and Hallett, 1979) classifies the Matachewan area as dominantly bedrock knobs with subdominant areas of ground moraine (till). The knobby and hummocky terrain is generally of moderate local relief. Drainage is classed as dry. The lower Davidson Creek watershed is more rugged with higher local relief. Local soil maps for the area are not available.

2.6 Tailings and Waste Rock Characteristics

The only available chemical characterization for the various historical tailings areas within the Davidson Creek watershed are those collected subsequent to the October 1990 Matachewan spill.

A series of tailings samples were studied by the Geoscience Laboratories Section of the Ontario Geological Survey (de Souza, 1991). The study concluded that the tailings were largely quarto-feldspathic with minor amounts of carbonate and pyrite. Zinc, cadmium, mercury, and arsenic levels in the tailings samples were similar to background levels. Lead was significantly higher than background, likely contained as galena and/or associated with k-feldspar. The report concluded a) that the tailings contained sufficient carbonate to buffer any acid production resulting from oxidation of the sulphide present and b) that the minerals present were insoluble so that the potential lead to be released was minimal.

The main tailings pond has a surface area of about 22 ha. In general, the tailings are fine grained with 35 to 75% in the silt size range. The tailings are non-plastic and have a specific gravity of 2.8. In total 42 samples were ultimately submitted for acid base accounting, chemical characterization, simulated porewater extraction tests and short-term leaching tests.

Within the main tailings pond all samples exhibited positive values for Net Neutralization Potential (NP) with reasonably high NP. The paste pH was neutral in all cases. The samples from the main tailings pond fell within a narrow range of values, indicating that potential future problems in terms of AMD and the release of metals was unlikely.

A second set of samples collected from a secondary tailings area south of the minesite exhibited considerable variability both spatially and as a function of depth. This may have been an emergency tailings pond, and served as the disposal area for tailings produced from custom milling of ore from other deposits at the end of the mine's life.

In total, 29 tailings samples were collected from this secondary area. Total sulphur in these samples ranged from 0.97 to 17.3%. The paste pH ranged from 1.8 to 8.6. Seven of the 29 samples exhibited negative NP as determined by acid consumption testing. Maximum Potential Acidity ranged from 2.2 to 537.5 and averaged 104.5 kg CaCO3/tonne. Two of the nine samples subjected to porewater simulation tests released high levels of copper, nickel, and zinc relative to Provincial Water Quality Objectives (PWQOs) (Klohn-Leonoff, 1993).

None of the waste rock piles and associated pits have been sampled to date. At least one waste rock pile exhibits characteristics of AMD (iron staining, surficial oxidation).

3.0 Environmental Baseline Studies

3.1 Study Methodology

The data presented in the report was collected during two rounds of sampling; one in July, the second in September, 1995.

3.1.1 Bathometry and Hydrology

A historical bathymetry map for Otisse Lake was secured from the Ministry of Natural Resources. A bathymetry map for Davidson Lake was developed using aerial photograph, a recording depth sounder and hip chain.

In July and September, flows in Davidson Creek were measured immediately upstream of the confluence of MC-2 using a Teledyne Gurley Model 625 Pygmy Water Current Meter and standard stream gauging methods.

In September, a staff gauge and still well/instrument shelter were installed at the same location. This station will be equipped with a continuous recording stage-height data logger, a thermistor, and a seasonally operated (summer) rain gauge. The station will be operated for one year to collect hydrometric data for the Davidson Creek watershed. A rating curve will be developed during this period for the station.

3.1.2 Water Quality and Sediments

A number of potential and actual surface water sampling stations were established throughout the Davidson Creek watershed upstream and downstream of identified point and non-point contaminant sources. The rationale for these stations is presented in Table 1. Station locations are shown on Figure 2. Stations which exhibited no water flow were not sampled, although in some cases field pH, conductivity, temperature and dissolved oxygen were measured.

Stream Stations

At each stream station, conductivity and pH were measured with a calibrated Presto-Teck Model DSPH-1 meter. Temperature was measured with a hand-held thermometer and dissolved oxygen was measured with a Hach D.O. kit. Grab samples were collected in two - 500 ml PET jars, of which one was preserved with nitric acid. The samples were iced and subsequently delivered the following day to Accurassay Laboratories in Kirkland Lake for analysis of pH, alkalinity, conductivity, sulphates, copper, nickel, lead, zinc and iron. Stream sediments were not sampled.

Three stations, DC-4, DC-5 and DC-6, were selected for long-term monitoring. The stations will be sampled monthly (bi-weekly during the spring freshet) over the next 12 months, to

Table 1: Field Measurements and Station Rationale, Davidson Creek Watershed

Station #	Flow (m3/sec)	pH	Conductivity	Dissolved Oxygen (mg/L)	Temperature (deg. C)	Rationale
DC-1	No Flow	ND	ND	ND	ND	Overflow from Davidson Lake
DC-2	No Flow	ND	ND	ND	ND	Seconday drainage, Davidson Lake tailings area
DC-3	No Flow	6.53	ND	6.0	21	Background control
DC-4	0.0015	6.72	ND	6.0	20	Cumulative impact; Davidson Lake sub-watershed
DC-5	ND	ND	ND	ND	ND	Background control; Mudpack Lake
DC-6	0.067	7.58	ND	ND	21	Cumulative impact; Matachewan consolidated
MC-1	No Flow	ND	ND	ND	ND	Drainage from secondary tailings area
MC-2	0.004	7.4	ND	ND	17	Drainage from main tailings area
MC-3	0.003	6.89	ND	ND	18	Secondary drainage from main tailings area

Note: ND - No Data

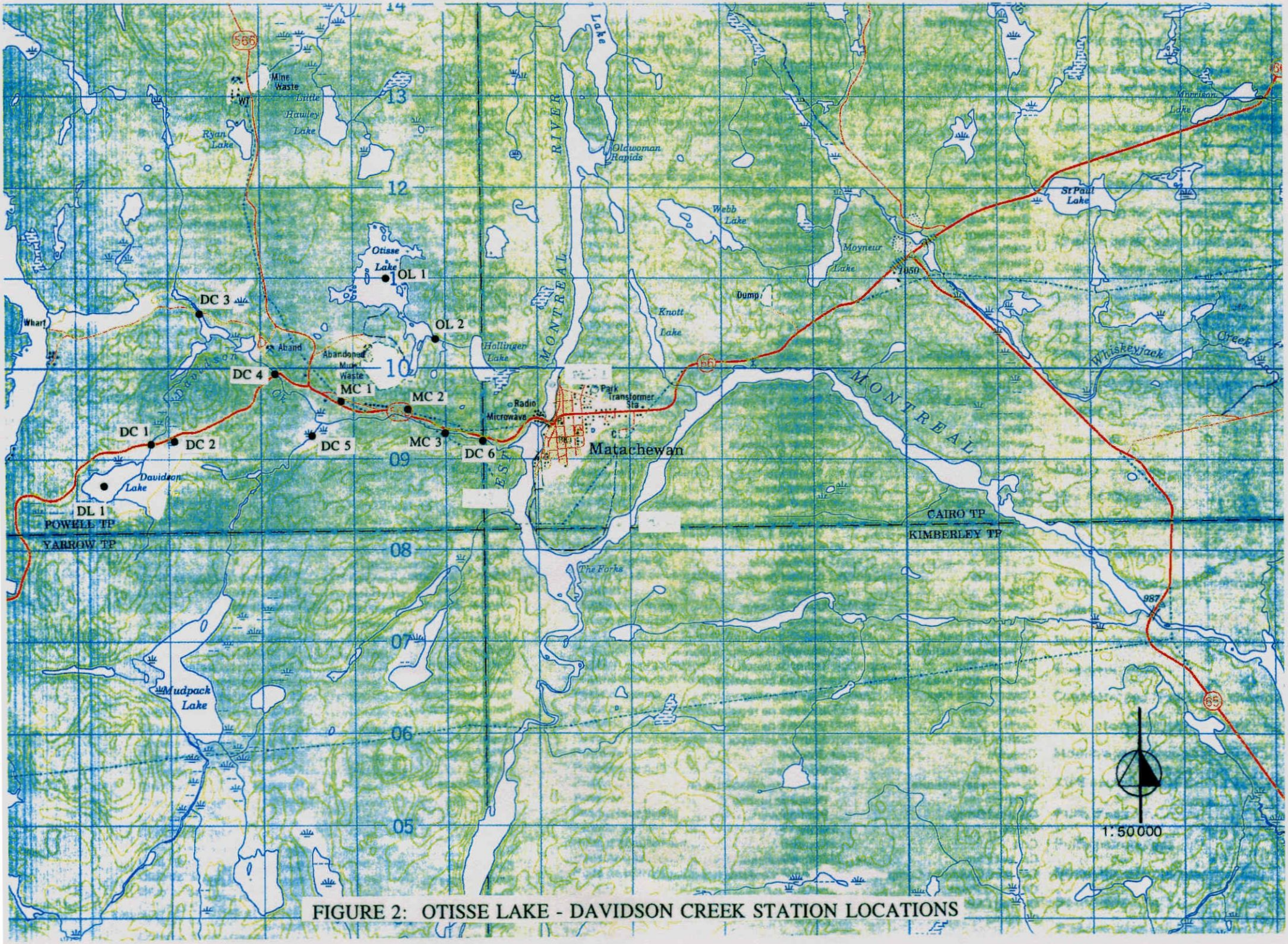


FIGURE 2: OTISSE LAKE - DAVIDSON CREEK STATION LOCATIONS

provide pre-operative environmental baseline data for the Davidson Creek watershed.

Lake Stations

Limnological sampling of Otisse Lake was undertaken on July 20, 1995. Davidson Lake was sampled on September 27, 1995.

At the lake's deepest location, a Secchi disc reading was taken and a water quality sample collected at the photic zone (2x Secchi disc) with a weighted metal composite can. Bottom waters were sampled with a non-metallic Kemmerer bottle. The samples were transferred to two - 500 ml PET bottles, preserved and forwarded to Accurassay for the same parameters as the stream water samples. Additional parameters included total ammonia and Total Kjeldahl Nitrogen (T.K.N.) in Otisse Lake. Dissolved oxygen/temperature were measured with a YSI model 51 oxygen meter.

Triplicate sediment samples were collected at the central lake stations in both Otisse and Davidson Lakes. Sediment samples were also collected from the embayment fronting the rock fill control dam constructed in Otisse Lake after the October 1990 tailings breach. This station is isolated from the main lake by a concrete weir that regulates water levels in Otisse Lake. The samples were collected with a 15 x 15 x 15 cm Ekman dredge. The surficial layer (top 5 cm) of each sample was transferred to 500 ml PET bottles and forwarded to Accurassay Laboratories for analysis of copper, nickel, lead, zinc, iron, total sulphur, loss-on-ignition. The sediments were visually/texturally classified after Roelofs (1944).

3.1.3 Fisheries and Benthic Invertebrates

On July 21, a 150 m section of lower Davidson Creek was electroshocked with a Smith Root Model VII electrofisher. The reach was shocked in an upstream direction, without blocking nets. The upper end of the reach was bounded by an area of relatively steep gradient riffle.

Fisheries assessment work on Davidson Lake was undertaken on September 26/27. A standard index net, consisting of eight 15.2 m long by 1.2 m deep panels graded in 1.3 cm increments from 2.54 to 12.7 cm, was set overnight in Davidson Lake. Four baited, minnow traps were deployed at the same time around the outlet of the lake. The weight and fork length of the fish captured, excluding minnows, were measured and recorded. The four minnow traps were also deployed on September 27th for a second overnight set at the inlet end of Davidson Lake.

Benthic invertebrate samples were collected from the lower reaches of Davidson Creek in September. Three samples were collected from a rapids/riffle habitat setting. An additional three samples were collected from an area of evenflow. Both sets of samples were collected with a standard Surber sampler. A qualitative sample was collected using a sweep net. The samples were subsequently preserved with 10% formalin.

To date, these benthic samples have not been processed or identified. Background control samples will be collected at station DC-5 in November. All of the benthic results, as well as the on-going hydrometric and water quality data, will be released as an addendum to this report.

3.2 Shaft Sampling

Water quality sampling of the Matachewan Consolidated shaft was undertaken on September 27, 1995. Samples were collected at depths of 14, 100, 200, 300, 620 and 725 m using a Kemmerer sampler and line. The samples were preserved, stored on ice and delivered to Accurassay Laboratories in Kirkland Lake. Field measurements of pH and conductivity were made with a calibrated Presto-Tech Model DS-PH meter. Differences in conductivity (low versus high) were used to select two samples for multi-element analysis using ICP methods. The other four samples were analyzed for copper, iron, lead, nickel and zinc. In that all the samples were free of visible particulates, total suspended solids concentrations were not measured.

4.0 Results and Discussion

4.1 Davidson Creek

Water quality data for Davidson Creek is presented in Table 2.

Flows in lower reaches of Davidson Creek were measured at 0.067 and 0.015 m^3/sec in July and September, 1995. During both months, stations DC-1 to DC-4 and MC-1 had no discernable flow. These observations support that the majority of the baseflow for Davidson Creek is from the 23.3 km^2 Mudpack Lake sub-watershed.

Surface water temperatures at all of the stations sampled in July were in the 20-21 °C range. Water temperatures had declined to the 12 to 13 °C range by September. With the exception of a few minnows that avoided the shocking field, no fish were captured in the lower reaches of Davidson Creek.

The existing thermal conditions, known geomorphological characteristics of the stream, and historical mining activities and impacts within the watershed are inconsistent with MNR's stated goal to rehabilitate Davidson Creek as a brook trout fishery. The lower reaches of Davidson Creek were channelized after the 1990 tailings breach. Bio-engineering of the creek to support brook trout would probably require an equivalent capital expenditure to the 1990 channelization.

Stations DC-3 and DC-5 were established as "background" water quality stations. Based on the data collected to date, both copper and iron exceed Provincial Water Quality Objectives (PWQO) because of natural background water quality. If on-going monitoring confirms this receiver as Policy 2 (water quality does not presently meet PWQO), a deviation from the Ministry of the Environment and Energy may be required. Detailed procedures for preparing a deviation are described in MOEE's document, Deriving Receiving Water Based, Point Source Effluent Requirements for Ontario Waters (1994).

4.2 Otisse Lake

The water and sediment quality data for Otisse (and Davidson) Lake(s) is presented in Tables 3 and 4, respectively.

Dissolved oxygen levels in Otisse Lake ranged from 8.6 ppm at surface to 0.3 ppm at a depth of 7 m. Water temperatures ranged from 22 °C at surface to 7.5 °C at 7 m. The temperature/oxygen profile was clinograde, consistent with mesotrophic nutrient levels. The high loss-on-ignition of the sediments, elevated ammonia/TKN levels in the bottom water, and a Secchi disc reading of (2.25 m) are also consistent with this trophic status.

The lake's fishery is reported to consist of smallmouth bass (*Micropterus dolomieu*), white suckers (*Catostomus commersonii*), and various unidentified baitfish. The lake's surface area

Table 2: Davidson Creek Watershed, Water Quality Results

Sample ID	Date	pH	Alkalinity (as CaCO3)	Conductivity (uS/cm)	Sulphate	Total Hardness (as CaCO3)	Total Suspended Solids	Total Copper	Total Nickel	Total Lead	Total Zinc	Total Iron
PWQO (mg/L)		-	-	-	-	-	-	0.005	0.025	0.025	0.03	0.3
MC-2	20/7/95	8.00	241.5	1380	638.2	-	-	0.007	<0.005	<0.005	<0.005	0.503
MC-3	20/7/95	8.19	229.6	600	133.4	-	-	0.011	<0.005	<0.005	<0.005	0.628
DC-3	20/7/95	7.21	57.9	239	59.3	-	-	0.011	<0.005	<0.005	<0.005	0.24
DC-4	20/7/95	7.35	92.0	286	52.11	-	-	0.006	<0.005	<0.005	<0.005	0.107
	26/9/95	7.65	111.7	336	67.29	165	<5	0.007	<0.005	<0.005	0.005	0.096
DC-5	26/9/95	6.65	11.0	47.2	8.85	18.1	<5	0.024	0.016	<0.005	<0.005	0.116
DC-6	20/7/95	7.11	42.1	185	42.78			0.008	<0.005	<0.005	<0.005	0.19
	26/9/95	7.8	72.9	337	95.71	153.2	<5	0.008	<0.005	<0.005	<0.005	0.206

Note: All results are in mg/L unless otherwise noted.

Table 3: Otisse and Davidson Lake, Water Quality Results

Parameter	MDL	OL-1T	OL-1B	OL-2	DL-1T	DL-1B	PWQO
Total Kjeldahl Nitrogen (mg/L)	.10	0.4	0.64	-	-	-	-
Total Ammonia (mg/L)	0.05	<0.05	0.34	-	-	-	-
Total Hardness as (CaCO3)	0.1	-	-	-	243.6	241.7	-
Total Suspended Solids	5	-	-	-	<5	<5	-
pH	-	6.78	6.41	6.61	8.00	7.89	6.5-8.5
Alkalinity (mg/L)	0	18.2	25.6	25.3	106.7	108.1	-
Conductivity (uS/cm)	1	50.5	65.3	67.9	478	480	-
Sulphate (mg/L)	0.05	5.56	4.51	6.74	159.9	160.5	-
Copper (mg/L)	0.005	0.021	0.014	0.011	0.009	0.010	0.005
Nickel (mg/L)	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.025
Lead (mg/L)	0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.020
Zinc (mg/L)	0.005	<0.005	0.013	<0.005	<0.005	0.008	0.005
Iron (mg/L)	0.005	0.103	0.963	1.07	0.093	0.216	0.300

PWQO - Provincial Water Quality Objective

Table 4: Otisse and Davidson Lake, Sediment Sampling Results

Parameter	Otisse Lake - Stn 1			Otisse Lake - Stn 2			Davidson Lake			MOEE Sediment Guideline	
	R1	R2	R3	R1	R2	R3	R1	R2	R3	LEL	SEL
Moisture content (%)	94.2	94.6	95.0	63.5	66.8	67.8	43.6	73.2	62.6	-	-
% Total Sulphur	1.85	2.02	2.01	2.02	2.40	1.87	1.57	2.23	2.03	-	-
L.O.I. (%)	41.7	41.2	40.4	3.8	5.0	5.2	5.4	5.6	5.4	-	-
Total Copper (ppm)	80.95	70.09	69.46	545.00	967.80	704.1	53.49	72.88	62.95	16.00	110.00
Total Nickel (ppm)	31.78	40.94	31.78	71.13	86.86	76.37	72.51	69.27	70.57	16.00	75.00
Total Lead (ppm)	141.1	101.5	89.7	494.3	631.2	488.2	51.83	61.66	58.71	31.0	250.0
Total Zinc (ppm)	181.6	179.3	173.0	675.4	902.0	755.7	91.53	111.8	100.2	120.0	820.0
Total Iron (%)	1.86	1.79	1.72	3.76	4.63	3.86	2.65	3.19	3.02	2	4
Sediment Type	1.	1.	1.	2.	2.	2.	2.	2.	2.		

Note: all results reported on a dry basis.
LEL - Lowest Effect Level
SEL - Severe Effect Level
Sediment Type 1. Puply peat
2. Silt/silty like ie. Tailings

is 32.4 ha. From 1945 to 1950, the lake was stocked with brook trout. They seemed to have died out. Smallmouth bass were subsequently introduced and have flourished (MNR, 1968).

In 1968, the aquatic plant species identified in Otisse Lake were yellow water lily (*Nuphar spp.*), cattails (*Typha latifolia*), coontail (*Ceratophyllum demersum*), and curly leaf pondweed (*Potamogeton amplifolius*). This vegetation plus bur reeds (*Sparganium*) and rushes (*Juncus spp.*) were noted as common during the current shoreline survey. Some of the macrophytes identified are valuable as food sources for moose. No juvenile waterfowl, osprey nests (*Pandion carolinensis*), etc. were noted during the field studies.

Assuming station 1 in Otisse Lake has not been impacted by historical mining activities, background levels of copper, nickel, lead and zinc exceed the Lowest Effect Levels (LEL) to protect benthic macroinvertebrate communities. Metal concentrations in sediments from Station 2, located downstream of the historical discharge from the Matachewan Consolidated tailings area, exceed the Severe Effect Level (SEL) guideline.

Otisse Lake supports a warmwater fishery. As such, its potential usage as a tailings repository is low in light of the Department of Fisheries and Oceans No Net Loss Policy (DFO, 1986).

4.3 Davidson Lake

Ground-truthing and 1:50,000 map for the area indicate that the lake was historically used for tailings disposal. The area of infilling is largely confined to the southern and easterly shoreline of Davidson Lake.

A map of Davidson Lake showing sampling stations, net set, tailings deposits and shoreline wetlands (monotypic cattails stands, *Typha latifolia*) is presented in Figure 3. A bathymetry map for the lake is presented in Figure 4. The lake's maximum depth is approximately 15.2 m. The estimated total volume of Davidson Lake is 3,300 m^3.

On September 20th, dissolved oxygen levels ranged from 12 mg/L at surface to < 1.0 mg/L at a depth of 7 m. Corresponding water temperatures at those depths were 12 and 8 °C. The dissolved oxygen profile was clinograde, consistent with mesotrophic nutrient levels.

Additional, water chemistry data for the lake is presented in Table 3. Field measurements of pH and conductivity ($n=2$) averaged 7.25 pH units and 450 ppm. The lake is therefore neutral in terms of pH. Alkalinity levels averaged 160.0 mg/L. On the basis of this limited data, there is no evidence of acid mine drainage (AMD) from the abutting tailings.

Copper levels in Davidson Lake exceeded PWQO by a factor of 2. Sulphate and conductivity levels are also elevated relative to typical Precambrian shield lakes, reflecting historical tailings discharges.

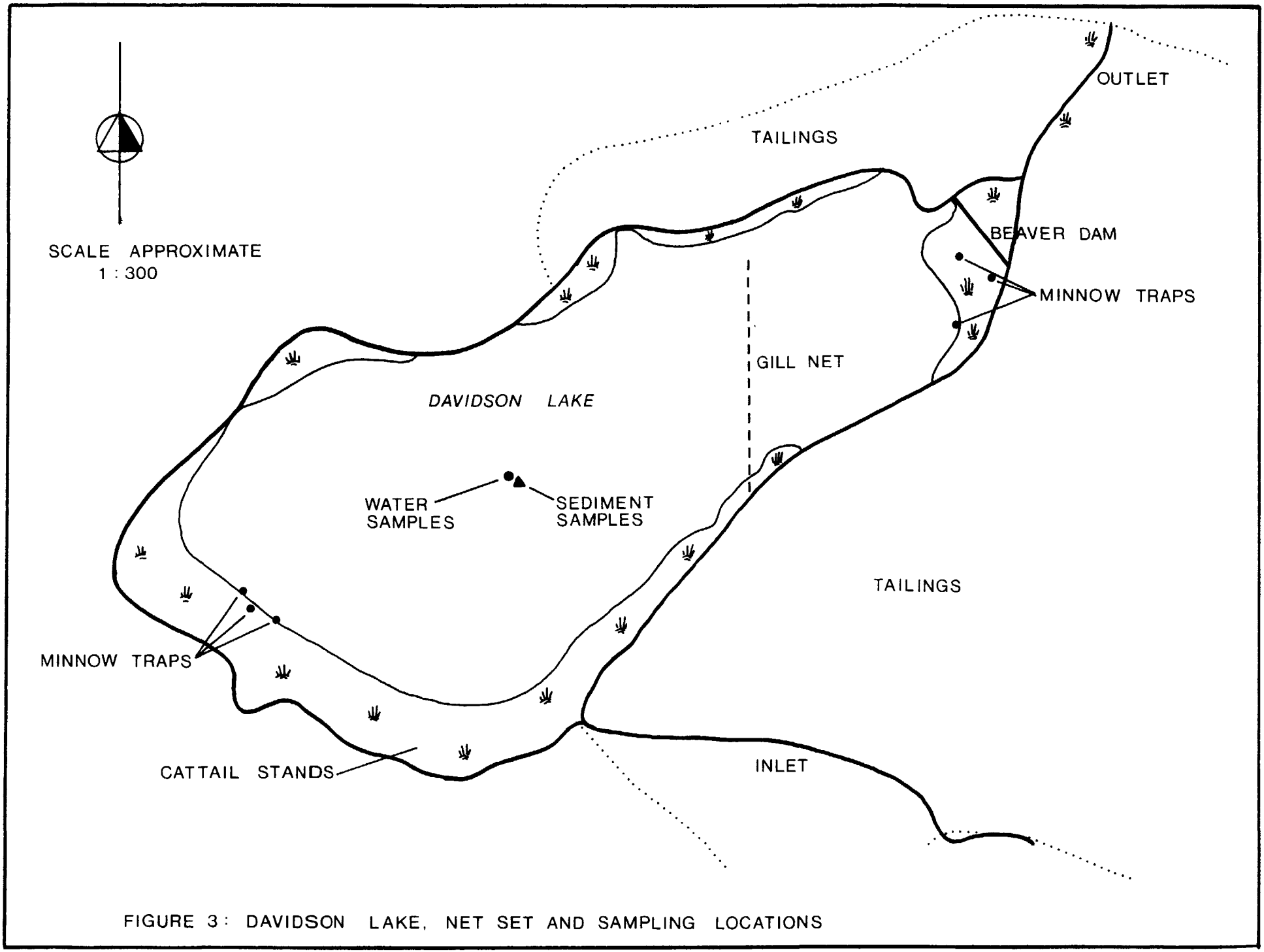


FIGURE 3: DAVIDSON LAKE, NET SET AND SAMPLING LOCATIONS

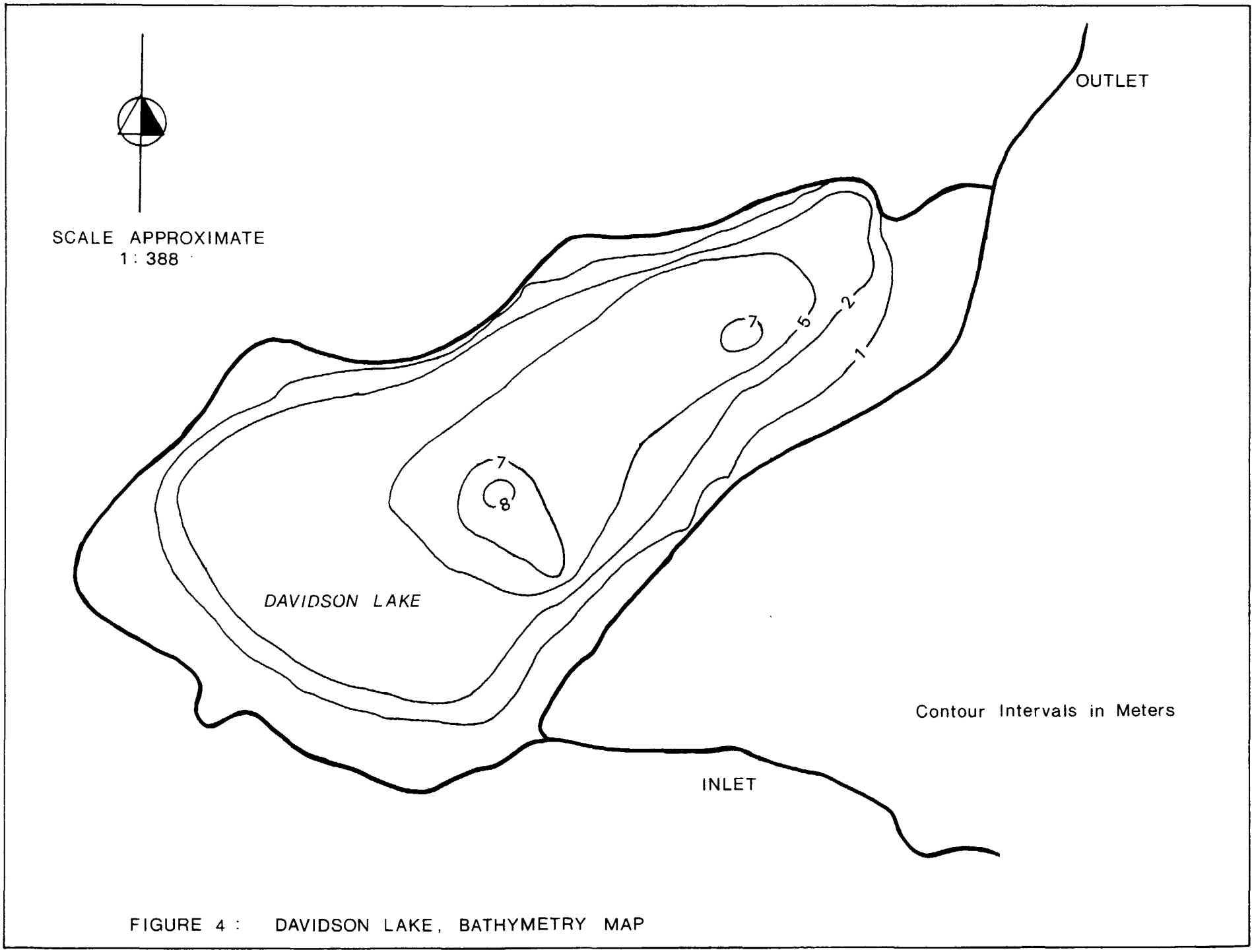


FIGURE 4 : DAVIDSON LAKE, BATHYMETRY MAP

Levels of copper, nickel, lead and iron in the lake's sediment exceeded the Lower Effect Level (LEL) above which impacts on benthic communities have been documented. The concentrations present, with the exception of nickel, are somewhat lower than those found in Otisse Lake. The nickel levels present are higher than those at station 1 and lower than those at station 2 in Otisse Lake. Both the elevated metal levels and observed physical characteristics of the sediments (silt) are consistent with the historical usage of the lake as a tailings repository.

A total of 77 white suckers were captured during a 24 hour set. These results have been summarized as both weight and length frequency histograms in Figures 4 and 5. The fish weighed from 85 g to 3.6 kg. Fork lengths ranged from 10 cm to 40 cm. The results support that this population is reproducing in Davidson Lake. With the exception of one fish with a spinal deformity, the specimens captured appeared healthy with no noticeable lesions or tumours. Trace contaminant levels in these fish were not addressed in the study. No other sportfish were captured.

A total of 394 fish were captured in the minnow traps during two 24 hour sets. Three species of minnows were captured; northern redbelly dace (*Chrosomus eos Cope*), finescale dace (*Chrosomus neogaeus*) and lake chub (*Couesius plumbeus*). One brook stickleback (*Culaea inconstans*) and a white sucker (*Catostomus commersoni*) were also captured.

4.4 Matachewan Consolidated Shaft

The water quality results for the Matachewan Consolidated Shaft are presented in Table 5, as well as the daily MISA effluent guidelines for the mining sector.

Concentrations of arsenic, copper, lead, nickel and zinc in all samples were less than MISA guidelines. Based on the heavy metals levels present, there would appear to be no need to address treatment requirements to dewater the underground workings. A Permit to Take Water would be required from the Ministry of Environment and Energy.

Iron concentrations in all six samples exceeded the PWQO (0.3 mg/L) by factors ranging from 5 to 14 times. At the observed pH, and assuming the groundwater in the shaft is anaerobic, the iron present would be in Fe 2+ (ferrous) form (Stumm and Morgan, 1981). Upon atmospheric exposure, Fe-oxyhydroxides could form (Appelo and Postma, 1993). This could result in aesthetic problems in the proposed receiver i.e. Davidson Creek.

Further sampling and bench scale testing is proposed to assess this potential aesthetics issue and the need to consider pre-treatment options (e.g. chemical additions, aeration and settling).

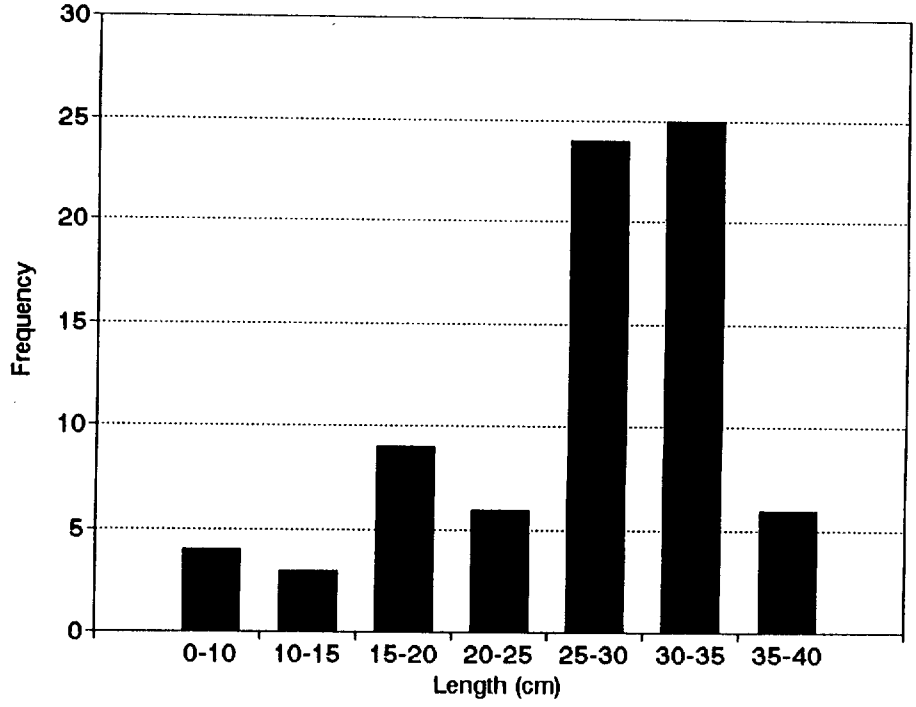


Figure 5: Length - Frequency Histogram for the White Suckers Captured in Davidson Lake

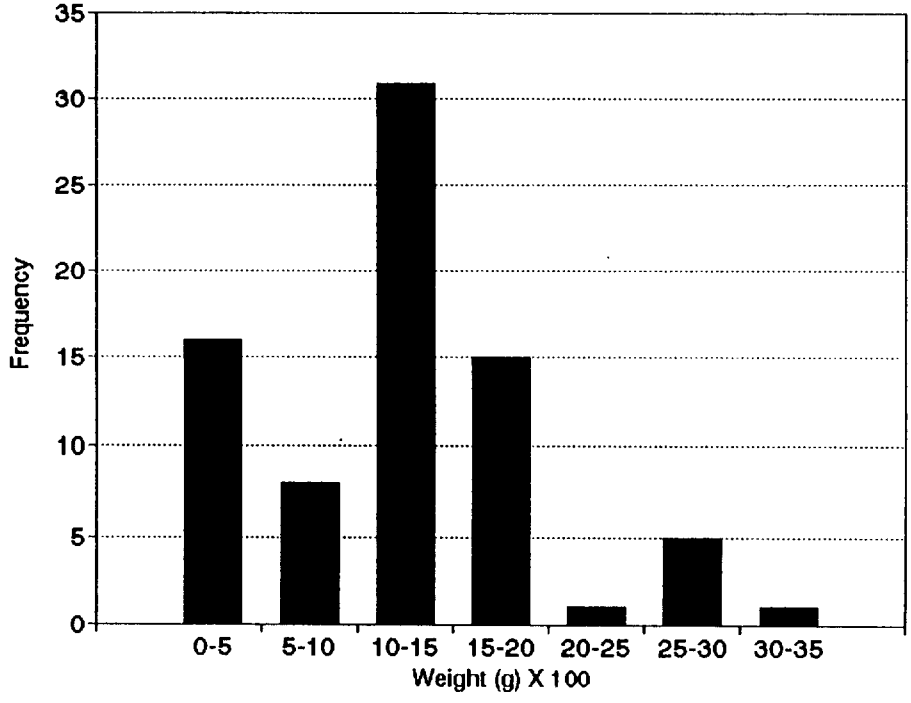


Figure 6: Weight - Frequency Histogram for the White Suckers Captured in Davidson Lake

Table 5: Matachewan Consolidated, Shaft Sampling Results, September 27, 1995.

Parameter	SH-1	SH-2	SH-3	SH-4	SH-5	SH-6	MISA Guidelines Daily Concentration mg/L
Depth (m)	14	100	200	300	620	725	
pH	6.62	6.74	6.76	6.85	6.93	7	
Aluminum					0.91	1.02	
Antimony					<0.02	<0.02	
Arsenic					<0.02	<0.02	1
Barium					0.056	0.042	
Beryllium					0.001	0.001	
Bismuth					<0.04	<0.04	
Boron					0.47	0.63	
Cadmium					<0.002	<0.002	
Calcium					95.7	103.5	
Chromium					<0.005	<0.005	
Cobalt					<0.005	<0.005	
Copper	0.014	0.013	0.008	0.009	0.005	0.004	0.6
Gold					<0.01	<0.01	
Iron	1.763	1.871	4.331	4.292	1.46	3.88	
Lanthanum					<0.005	<0.005	
Lead	0.017	0.009	0.005	<0.005	<0.02	<0.02	0.4
Magnesium					17.9	20	
Manganese					0.73	0.85	
Mercury					<0.03	<0.03	
Molybdenum					0.002	0.006	
Nickel	0.005	0.006	<0.005	<0.005	0.013	0.005	1
Phophorous					<0.04	<0.04	
Silicon					0.82	1.12	
Silver					<0.003	<0.003	
Sodium					2	11	
Strontium					0.467	1.233	
Titanium					<0.005	<0.005	
Tungsten					<0.02	<0.02	
Vanadium					<0.005	<0.005	
Zinc	0.027	0.013	0.005	<0.005	0.02	0.01	1

Note: All results expressed as mg\L unless otherwise stated.
SH - Shaft samples

5.0 Recommendations

1. Davidson Lake would appear to be the best alterative for a new tailings disposal area based on environmental considerations
and the historical usage of the lake for tailings disposal.

The effluent from the tailings facility would likely discharge to Davidson Lake via station DC-4. A Certificate of Approval for the facility would be required under Section 53 of the Ontario Water Resources Act. Effluent quality and monitoring requirements for the discharge would be regulated under Regulation 560/94 (Effluent Monitoring and Effluent Limits - Metal Mining Sector) of the Environmental Protection Act.

Although fish are present in Davidson Lake, no sportfish were captured. In accordance with the Department of Fisheries and Ocean (DFO) No Net Loss Policy, the Royal Oak Mines must assess compensation options with the Ministry of Natural Resources and DFO to use Davidson Lake as a tailings repository (DFO, 1986).

2. A Permit to Take Water is required prior to dewatering the shaft at the Matachewan Consolidated Mine. Bench scale testing should be undertaken to assess the aesthetics issue associated with the potential formation of Fe-oxyhydroxides during the dewatering operations to Davidson Creek.

During the discharge period; pH, total suspended solids, turbidity, copper, lead, nickel and zinc should be monitored thrice-weekly per MISA guidelines. Once a statistical database of six to twelve samples over a range of concentrations is established between TSS and turbidity, the latter should be used as a day-to-day monitoring parameter.

2) Stations DC-4, DC-5 and DC-6 should be sampled monthly for the next twelve months and bi-weekly during the spring freshet to establish baseline and background water quality conditions in the Davidson Creek watershed. Stations MC-1 and MC-2 should be sampled when flow is present to characterize the quality of the drainage from the two historical tailings areas at the Matachewan Consolidated Mine.

The samples should be analyzed for pH, alkalinity, temperature, sulphates, conductivity, hardness, total suspended solids and metals by I.C.P. The Method Detection Limits for the metals analyzed should be less than the applicable Provincial Water Quality Objectives (PWQO). A QA/QC program (blanks, duplicates) should be incorporated into the program.

The constructed hydrometric station should be operated continuously during this pre-operative monitoring period with a recording rain gauge operated during the ice-free season.

3) Additional pre-operative benthic data should be collected from Davidson Creek if the project advances to production. The data collected to date should be reviewed and assessed with regard to the statistical precision of the pre-impact data. Sample variance should be

within plus or minus 30 percent of the mean. To test whether the discharge has an effect, samples must be collected where the condition is present and the condition is absent, but all else is the same i.e. upstream and downstream. An impact can only be demonstrated by comparison with a control.

4) Additional fisheries investigations should be completed on Davidson Creek in accordance with the USEPA Rapid Bioassessment Protocals.

6.0 References

Appelo, C.A.J. and D. Postman. 1993. Geochemistry, groundwater and pollution. A.A. Balkema Publishers, Brookfield, VY.

Department of Fisheries and Oceans (DFO). 1986. Policy for the Management of Fish Habitat. Ottawa, Ontario.

de Souza, H.A.F. 1991. Minerology and Chemistry of Matachewan Tailings. Ontario Ministry of Northern Development and Mines. Report 43. Project Unit 91-16.

Klohn - Leonoff. 1993. Matachewan Tailings Rehabilitation Project: Phase I - Preliminary Engineering. Prepared for Ministry of Natural Resources.

Leith, R. Matachewan Area Biologist. Personnel Communication. A. B. Bowman, Senior Environmental Scientist, N.A.R. Environmental Consultants Inc.

Lovell, H.L. 1967. Geology of the Matachewan Area. Ontario Department of Mines. Geological Report 76-77.

Ministry of Environment and Energy (MOEE). 1993. Guidelines for the Protection and Management of Aquatic Sediments in Ontario.

Ministry of Environment and Energy. 1994. Water Management: Policies, Guidelines and Provincial Water Quality Objectives.

Ministry of Natural Resources (MNR). 1968. Otisse Lake, Powell Twp. Lake Survey Summary Sheet.

Roed, M.A. and D.R. Hallet. 1979. NOEGTS Map 5020 - Elk Lake.

Roelofs, E.W. 1944. Water Soils in Relation to Lake Productivity. Tech. Bull. 190. Agr. Exp. Sta., State College, Lansing, Mich.

Rowe, J.S. 1972. Forest Region of Canada. Publication 1300. Environment Canada.

Stumm, W. and J.J. Morgan. 1981. Aquatic Chemistry: An introduction emphasizing chemical equilibria in natural waters. 2nd Edition. John Wiley and Sons, N.Y., N.Y.

ROYAL OAK MINES INC

MATACHEWAN PROJECT

Summary of Claims Covered by the Environmental Baseline Study

Claim No.	Type	No. Units	Acres	Ownership	Parcel No.
MATACHEWAN CONSOLIDATED OPTION					
MR5379	Lease, MR+SR	1	39.80	Matachewan Consolidated	3193 LT
MR5380	Lease, MR+SR	1	49.30	Matachewan Consolidated	3194 LT
MR5397	Lease, MRO	1	32.20	Matachewan Consolidated	5126 LT
MR5398	Lease, MRO	1	56.00	Matachewan Consolidated	5126 LT
MR5401	Lease, MRO	1	49.60	Matachewan Consolidated	5126 LT
MR5402	Lease, MRO	1	47.30	Matachewan Consolidated	4901 LT
MR5403	Lease, MRO	1	38.20	Matachewan Consolidated	5126 LT
MR5406	Lease, MRO	1	32.10	Matachewan Consolidated	5126 LT
MR5408	Lease, MRO	1	40.60	Matachewan Consolidated	5126 LT
MR5412	Lease, MRO	1	52.00	Matachewan Consolidated	5125 LT
MR5413	Lease, MRO	1	47.30	Matachewan Consolidated	5127 LT
MR5414	Lease, MRO	1	46.70	Matachewan Consolidated	5125 LT
MR5415	Lease, MRO	1	51.30	Matachewan Consolidated	5125 LT
MR5991	Lease, MRO	1	38.86	Matachewan Consolidated	5287 LT
SHIRRIFF OPTION					
5386	Lease MR+SR	1	34.90	Royal Oak (60%), Shirriff (40%)	4982 LT
5568	Lease MR+SR	1	49.40	Royal Oak (60%), Shirriff (40%)	4982 LT
5569	Lease MR+SR	1	39.42	Royal Oak (60%), Shirriff (40%)	4982 LT
5570	Lease MR+SR	1	57.87	Royal Oak (60%), Shirriff (40%)	4982 LT
5657	Lease MR+SR	1	11.40	Royal Oak (60%), Shirriff (40%)	4982 LT
5659	Lease MR+SR	1	28.50	Royal Oak (60%), Shirriff (40%)	4982 LT
5922	Lease MR+SR	1	47.50	Royal Oak (60%), Shirriff (40%)	4982 LT
6032	Lease MR+SR	1	32.00	Royal Oak (60%), Shirriff (40%)	4982 LT
9835	Lease MR+SR	1	73.50	Royal Oak (60%), Shirriff (40%)	4982 LT
33919	Lease MR+SR	1	36.43	Royal Oak (60%), Shirriff (40%)	5060 LT
33920	Lease MR+SR	1	33.16	Royal Oak (60%), Shirriff (40%)	5060 LT
33921	Lease MR+SR	1	38.83	Royal Oak (60%), Shirriff (40%)	5060 LT
33922	Lease MR+SR	1	39.32	Royal Oak (60%), Shirriff (40%)	5060 LT
33923	Lease MR+SR	1	37.11	Royal Oak (60%), Shirriff (40%)	5060 LT
33924	Lease MR+SR	1	30.37	Royal Oak (60%), Shirriff (40%)	5060 LT
34242	Lease MRO	1	20.15	Royal Oak (60%), Shirriff (40%)	5365 LT
34243	Lease MRO	1	30.75	Royal Oak (60%), Shirriff (40%)	5365 LT
34250	Lease MR+SR	1	38.51	Royal Oak (60%), Shirriff (40%)	5060 LT
34251	Lease MR+SR	1	22.51	Royal Oak (60%), Shirriff (40%)	5060 LT
34252	Lease MR+SR	1	40.76	Royal Oak (60%), Shirriff (40%)	5060 LT
34253	Lease MR+SR	1	28.56	Royal Oak (60%), Shirriff (40%)	5060 LT
35807	Lease MR+SR	1	55.28	Royal Oak (60%), Shirriff (40%)	5390 LT
512587	Staked	1		Royal Oak (60%), Shirriff (40%)	
512588	Staked	1		Royal Oak (60%), Shirriff (40%)	
1207503	Staked	2		Royal Oak (60%), Shirriff (40%)	
1207509	Staked	4		Royal Oak (60%), Shirriff (40%)	
1207512	Staked	1		Royal Oak (60%), Shirriff (40%)	
1207522	Staked	1		Royal Oak (60%), Shirriff (40%)	
YOUNG-DAVIDSON OPTION					
5371	Lease MR+SR	1	36.90	Young-Davidson	3104 LT
5372	Lease MR+SR	1	33.30	Young-Davidson	3105 LT
5374	Lease MR+SR	1	26.00	Young-Davidson	3106 LT
5383	Lease MR+SR	1	28.10	Young-Davidson	3108 LT
5399	Lease MR+SR	1	54.10	Young-Davidson	4314 LT
12506	Lease MR+SR	1	54.95	Young-Davidson	3858 LT
12507	Lease MR+SR	1	37.96	Young-Davidson	3857 LT
12508	Lease MR+SR	1	31.95	Young-Davidson	3856 LT
12509	Lease MR+SR	1	24.07	Young-Davidson	3861 LT
12510	Lease MR+SR	1	35.15	Young-Davidson	3860 LT
12511	Lease MR+SR	1	32.43	Young-Davidson	3859 LT
12512	Lease MR+SR	1	30.52	Young-Davidson	3855 LT
12610	Lease MR+SR	1	9.51	Young-Davidson	3854 LT
ROYAL OAK CLAIMS					
1207508	Staked	3		Royal Oak Mines	
1207518	Staked	4		Royal Oak Mines	
1207521	Staked	1		Royal Oak Mines	

R. Ineson
Nov 15/96

ROYAL OAK MINES INC.
MATACHEWAN PROJECT

Summary of Exploration and Development Work

Mining activities in the Matachewan area were initiated in 1916 with the discovery of gold on the Davidson Claims. The following years saw gold production from both the Young-Davidson and Matachewan Consolidated (Ventures) properties during the 1934 to 1957 period, and again from 1980 to 1982.

The current ownership of the Matachewan Project comprises 6 principle claim groupings as follows:

- the Matachewan Consolidated Option
- the Young-Davidson Option
- the Shirriff Option
- the Welsh Option
- the Christie Option (Schaus - Shirriff), and
- wholly owned claims

In all, these 6 claim groups include a total of 219 claim units consisting of 8689.6 acres of mining rights and 1674.8 acres of surface rights. The land tenure includes patented claims, leased claims, unpatented mining claims, and licences of occupation. A brief history of the exploration and development activities carried out on the first four claim groups are provided in the following sections. Only limited activities have been carried out on the last two claim groups, and no histories will be provided for them.

MATACHEWAN CONSOLIDATED OPTION

The Matachewan Consolidated (also known as the Ventures) property is located in Powell and Cairo townships, and consists of 24 claim units. Exploration and development on this property has included 3 shafts and 11 production levels, with production of gold taking place mostly during the 1934 to 1954 period. A brief chronological summary is detailed below:

1916 - 1933	**Ventures Limited**: surface prospecting, hand trenching and stripping. Pre-production activities.
1934 - 1954	**Ventures Limited (Matachewan Consolidated)**: production period.
1980:	**Pamourex Minerals**: concluded Option Agreement.
1981:	**Pamourex Minerals**: gold production from small open pits (Nos. 2 to 6 pits), whole ore trucked back to Pamour mill for processing. Diamond drill testing for east extension of Boundary Pit.

SHIRRIFF OPTION

The Shirriff Option is located in Powell and Yarrow townships, and consists of a total of 105 claim units. A brief chronological summary of the exploration and development work on the Shirriff Option is detailed below:

1936:	**Matachewan Consolidated**: 3 diamond drill holes just south of the Young-Davidson Mine. One hole was successful in penetrating the Gowganda Formation.
1949:	**British Matachewan Gold Mines Ltd.**: Diamond drilling, 1 hole to a depth of 1,001 feet.
1960 - 1966:	**British Matachewan Gold Mines Ltd.**: Diamond drilling, 7 holes totalling 3, 858 feet.
1971:	**British Matachewan Gold Mines Ltd.**: Magnetic and EM surveys, Mistinikon Lake. Diamond drilling, 2 holes (71-2: 836feet).
1973:	**British Matachewan Gold Mines Ltd.**: Induced Polarization surveys.
1990:	**Royal Oak / Pamourex Minerals**: Line cutting, magnetic and CSMAT surveys, geological mapping, diamond drilling (4,335 ft in hole complete hole, 1 partial hole crossing claim boundary (YD90-21)).
1994: in	**Royal Oak Mines**: Minor Line cutting, diamond drilling (9,568 ft 3 holes).

WELSH OPTION

The Welsh property is located entirely in Powell township and consists of 2 claim units. Very little development work has occurred on the property during the active periods of the other properties (ie 1934 - 1957). A brief chronological summary is given below:

1979:	**Pamourex Minerals**: concluded Option Agreement.
1986:	**Pamourex Minerals**: diamond drilling to test for the western extension of the Boundary Pit mineralization.

YOUNG - DAVIDSON OPTION

The Young - Davidson property is located in Powell township and consists of 17 claim units in two separate blocks. Since the initial gold discovery in 1916, much exploration has been done on the property. Gold production took place from 1934 to 1957, with the mine consisting of 2 shafts, 6 production levels, and 1 exploration level. A brief chronological summary is given below:

1916:	discovery of gold by Jake Davidson.
1916 - 1933:	**Young - Davidson Mines Ltd.**: surface prospecting, hand trenching and stripping. Pre-production activities.
1934 - 1957:	**Hollinger Corporation**: production of gold under contract from

Young - Davidson Mines.

1979: **Pamourex Minerals**: concluded Option Agreement.

1980: **Pamourex Minerals**: diamond drill testing for the west extension of the Boundary Pit mineralization.

1986: **Pamourex Minerals**: addition diamond drilling in the Boundary Pit area.

1988: **Pamourex Minerals**: diamond drilling, 10 holes testing shallow targets and upper portions of the Boundary Zone.

1989: **Pamourex Minerals**: diamond drilling, 34 holes testing several targets in the syenite.

R. Thomas
Nov 15/96

DOCUMENT No.
W 9680 • 00576

Transaction Number

Ministry of Northern Development and Mines
Ontario

Report of Work Conducted After Recording Claim

Mining Act

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

2.16948

Instructions: - F ... and submit in duplicate
- f ... f
- / ...
- ...
- /

41P15NE0013 2.16948 POWELL

900

ing assessment work or consult the Mining
Group.
icate.
company this form.

Recorded Holder(s)		Client No.
Royal Oak Mines Inc., Matachewan Project		136226
Address: % P.O. Bag 2010, Timmins, Ont P4N 7X7		Telephone No.: (705) 268-3388
Mining Division: Larder Lake	Township/Area: Powell, Cairo Twps	M or G Plan No.: G-3218 et. al.
Dates Work Performed — From: July 1, 1995	To: Dec 31, 1995	

Work Performed (Check One Work Group Only)

	Work Group	Type
X	Geotechnical Survey	Enviromental Baseline Survey (OTHER)
	Physical Work, Including Drilling	
	Rehabilitation	
	Other Authorized Work	
	Assays	
	Assignment from Reserve	

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Total Assessment Work Claimed on the Attached Statement of Costs $ 18,576

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
NAR Enviromental Consultants	1012 Kelly Lake Rd., Sudbury, Ont P3E 5P4

(attach a schedule if necessary)

Certification of Beneficial Interest * **See Note No. 1 on reverse side**

	Date	Recorded Holder or Agent (Signature)
I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	Nov 15/96	R. Pressacco

Certification of Work Report

I certify that I have a personal knowledge of the facts set forth in this Work report, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying		
Reno Pressacco, % P.O. Bag 2010, Timmins, Ont P4N 7X7		
Telepone No.: 268-3388	Date: Nov 15/96	Certified By (Signature): R. Pressacco

For Office Use Only

Total Value Cr. Recorded	Date Recorded	Mining Recorder	Received Stamp
Appl 27?	96 Nov 20	Gary Rooney	
	Deemed Approval Date: 97 Feb 18	Date Approved	

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
✓	~~Lease #~~ Mafeking Consolidated ~~MR 5379~~ 184177	1	$277	0	0	$277
	5380					
	~~5397~~					
	~~5398~~	10				
	~~5401~~	6				
	5402					
	~~5403~~					
	~~5406~~	10				
	~~5408~~	6				
	5412					
	5413					
	5414					
	5415					
	5991					
	(see attached table for details)		14 Claims 14 Units			
	(14)		(3,878)	0	0	(3,878)
	Total Number		Total Value Work	Total Value	Total Assigned	Total Reserve

(83)

(109)

2.16948

939

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Page 2/5

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☒ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: **Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.**

Note 2: **If work has been performed on patented or leased land, please complete the following:**

Signature

Date

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	~~Shimit/Royal Oak AR 5386 106655~~	1	$277	0	0	$277
	~~5568~~					
	~~5569~~					
	~~5570~~					
	~~5857~~					
	~~5859~~ 106655					
	~~5922~~					
	~~6032~~					
	~~9935~~					
	33919					
	33920					
	33921					
	33922					
	33923					
	33924					
	34242					
	34243					
	(17)		(4,709)	0	0	(4,709)
	Total Number		Total Value Work	Total Value	Total Assigned	Total Reserve

2x10

2.16948

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Page 3/5

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☒ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

certify that the recorded holder had a beneficial interest in the patented | Signature | Date

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	34250	1	$277	0	0	$277
	34251	1		2,159.48		
	34252	1				
	34253	1				
	35807	1				
	512587	1				
	512588	1				
—	1207503	2	555			555
—	1207509	4	1,109			1,109
—	1207512	1	277			277
—	1207522	1	277	32 Units 28 Claims		277
	Young-Davidson		$277	0	0	$277
✓	018297 ~~AR5371~~	1				
✓	018298 ~~5372~~					
✓	018299 ~~5374~~					
✓	018301 ~~5383~~					
	5399					
	(16)		(5542)	0	0	(5542)
	Total Number		Total Value Work	Total Value	Total Assigned	Total Reserve

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Page 415

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☒ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

Signature | Date

Number for Applying Reserve	Claim Number (see Note 2)	Claim Units	Work Done on this Claim	Applied to this Claim	Transferred from this Claim	Claimed at a Future Date
	12506	1	$277	0	0	$277
	12507					
	12508					
	12509					
	12510					
	12511					
	12512					
	12610		13 Units 13 Claims			
✓	~~Royal Oak 100~~ 1207508	3	832	0	0	832
✓	1207578	4	1,109	0	0	1,109
✓	1207521	1	277	$277	0	0
			3 claims 8 Units.			
			Total Claims = 58			
			Total Units = 67			
	(11)		(4434)	(277)	(0)	(4157)
	67		$18,576	$277	(0)	$18,299
	Total Number		Total Value Work	Total Value	Total Assigned	Total Reserve

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Page 5/5

redits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate fr
Which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☒ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

n the event that you have not specified your choice of priority, option one will be implemented.

te 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with res to the mining claims.

te 2: If work has been performed on patented or leased land, please complete the following:

ertify that the recorded holder had a beneficial interest in the patented

Signature

Date Nov 15/96

Ministry of Northern Development and Mines

Ontario

Ministère du Développement du Nord et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction

Personal information collected on this form is obtained under the authority of the **Mining Act**. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre		
	Field Supervision Supervision sur le terrain		[redacted]
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type Enviromental	18,576	
	Survey		
			$18,576
Supplies Used Fournitures utilisées	Type		
			[redacted]
Equipment Rental Location de matériel	Type		
			[redacted]
	Total Direct Costs Total des coûts directs		[redacted]

2. Indirect Costs/Coûts indirects

** Note: When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
	2.16948		
Food and Lodging Nourriture et hébergement			[redacted]
Mobilization and Demobilization Mobilisation et démobilisation			[redacted]
	Sub Total of Indirect Costs Total partiel des coûts indirects		[redacted]
Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)			[redacted]
Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs) / **Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles**			$ 18,576

RECEIVED
DEC 17 1996
MINING LANDS BRANCH

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit	Total Assessment Claimed
× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation	Évaluation totale demandée
× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as Senior Geologist (Recorded Holder, Agent, Position in Company) I am authorized

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de _____ (titulaire enregistré, représentant, poste occupé dans la compagnie) je suis autorisé

à faire cette attestation.

Signature	Date
R. Provencal	Nov 15/96.

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Ontario

Geoscience Assessment Office
933 Ramsey Lake Road
6th Floor
Sudbury, Ontario
P3E 6B5

Telephone: (705) 670-5853
Fax: (705) 670-5863

February 18, 1997

Roy Spooner
Mining Recorder
4 Government Road East
Kirkland Lake, ON
P2N 1A2

Dear Sir or Madam:

Submission Number: 2.16948

Subject: Transaction Number(s):		Status
	W9680.00576	Approval

We have reviewed your Assessment Work submission with the above noted Transaction Number(s). The attached summary page(s) indicate the results of the review. WE RECOMMEND YOU READ THIS SUMMARY FOR THE DETAILS PERTAINING TO YOUR ASSESSMENT WORK.

If the status for a transaction is a 45 Day Notice, the summary will outline the reasons for the notice, and any steps you can take to remedy deficiencies. The 90-day deemed approval provision, subsection 6(7) of the Assessment Work Regulation, will no longer be in effect for assessment work which has received a 45 Day Notice.

Please note any revisions must be submitted in DUPLICATE to the Geoscience Assessment Office, by the response date on the summary.

NOTE: This correspondence may affect the status of your mining lands. Please contact the Mining Recorder to determine the available options and the status of your claims.

If you have any questions regarding this correspondence, please contact Bruce Gates by e-mail at gates_b@torv05.ndm.gov.on.ca or by telephone at (705) 670-5856.

Yours sincerely,

ORIGINAL SIGNED BY
Ron C. Gashinski
Senior Manager, Mining Lands Section
Mines and Minerals Division

Correspondence ID: 10521
Copy for: Assessment Library

Work Report Assessment Results

Submission Number: 2.16948

Date Correspondence Sent: February 18, 1997 **Assessor:** Bruce Gates

Transaction Number	First Claim Number	Township(s) / Area(s)	Status	Approval Date
W9680.00576	18417	POWELL, CAIRO	Approval	January 27, 1997

Section:
18 Other ENVIRO

Correspondence to:

Mining Recorder
Kirkland Lake, ON

Resident Geologist
Kirkland Lake, ON

Assessment Files Library
Sudbury, ON

Recorded Holder(s) and/or Agent(s):

Reno Pressaco
ROYAL OAK MINES INC.
Timmins, Ontario

Correspondence ID: 10521

2.16948

Ministry of Natural Resources
Ontario

Ministry of Northern Development and Mines

INDEX TO LAND DISPOSITION

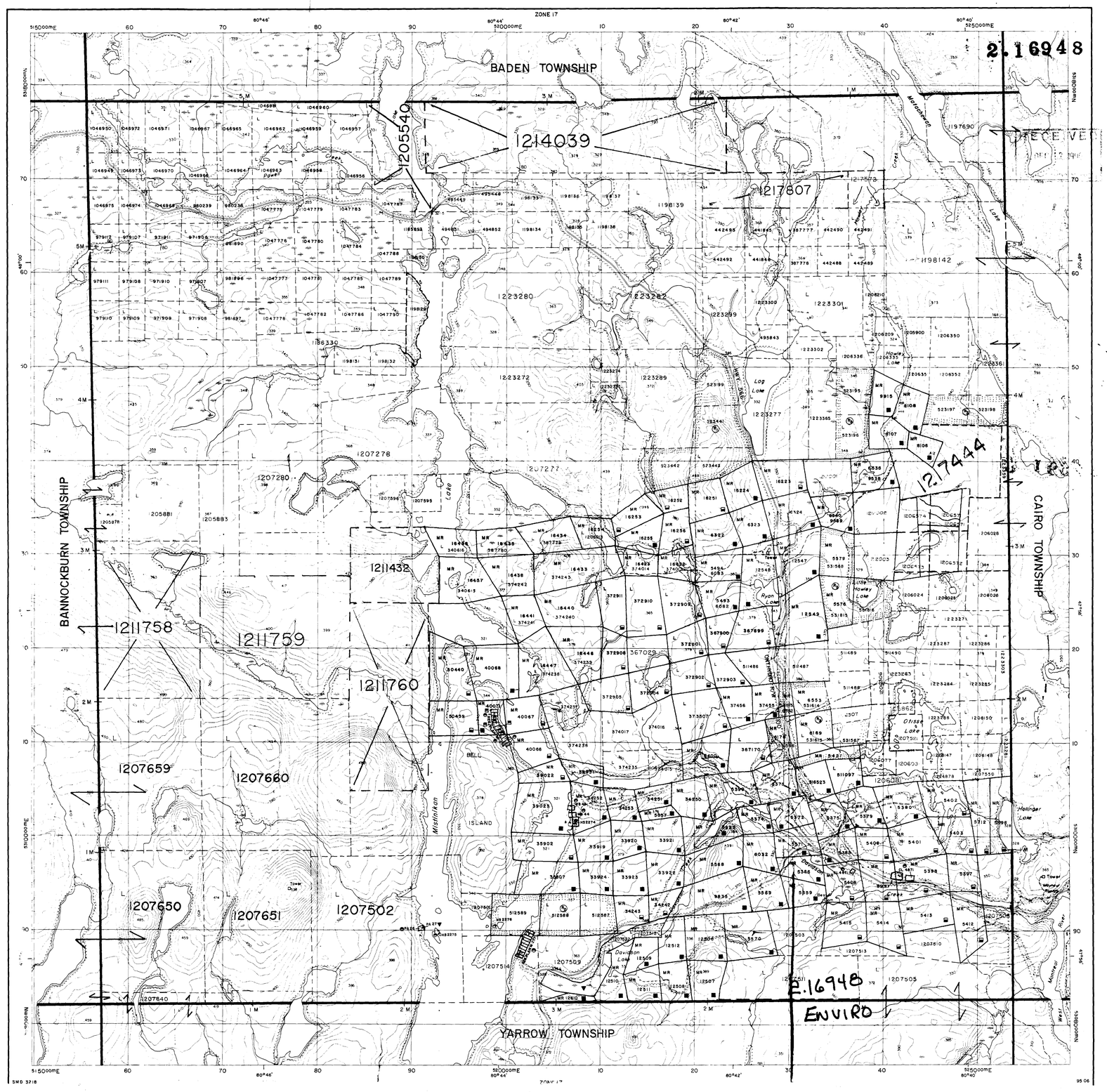
PLAN
G-3218

TOWNSHIP
POWELL

M.N.R. ADMINISTRATIVE DISTRICT
KIRKLAND LAKE

MINING DIVISION
LARDER LAKE

LAND TITLES / REGISTRY DIVISION
TIMISKAMING



Scale 1:20 000

Metres 1000 0 1000 2000 Metres

Feet 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 Feet

Contour interval 10 Metres

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M + S - Mining and Surface Rights

Description	Order No.	Date	Disposition	File
1	W-L-18/95	MAR. 30/95	M + S	
2	W-L-19/95	MAR. 30/95	M + S	
3	W-L-20/95	MAR. 30/95	M + S	

SYMBOLS

- Boundary
  - Township, Meridian, Baseline
  - Road allowance; surveyed
    - shoreline
  - Lot/Concession; surveyed
    - unsurveyed
  - Parcel; surveyed
    - unsurveyed
  - Right-of-way; road
    - railway
    - utility
  - Reservation
- Cliff, Pit, Pile
- Contour
  - Interpolated
  - Approximate
  - Depression
- Control point (horizontal)
- Flooded land
- Mine head frame
- Pipeline (above ground)
- Railway; single track
  - double track
  - abandoned
- Road; highway, county, township
  - access
  - trail, bush
- Shoreline (original)
- Transmission line
- Wooded area

DISPOSITION OF CROWN LANDS

- Patent
  - Surface & Mining Rights
  - Surface Rights Only
  - Mining Rights Only
- Lease
  - Surface & Mining Rights
  - Surface Rights Only
  - Mining Rights Only
- Licence of Occupation
- Order-in-Council
- Cancelled
- Reservation
- Sand & Gravel

NOTES

L.O. 7601 COVERS FLOODING RIGHTS IN THIS TOWNSHIP TO CONTOUR 870 TO ONTARIO HYDRO. FILE 12290 VOL. 2.

CIRCULATED DEC 14 1995 KP

Map base and land disposition drafting by Surveys and Mapping Branch, Ministry of Natural Resources

The disposition of land, location of lot fabric and parcel boundaries on this index were compiled for administrative purposes only.

SMD 3218

95 06

G-3218 POWELL TWP.

2.16948

DUPLICATE COPY

LEGEND

RYO Royal Oak 100%
MCM Matachewan Consolidated Option
YD Young–Davidson Option
Shirriff Shirriff Option
Christie Schauss–Shirriff Option
Welsh Welsh Option

Area of Environmental Baseline Study

POWELL TWP.

CAIRO TWP.

KIMBERLY TWP.

YARROW TWP.

RYO

Welsh

Christie

MATACHEWAN

WEST MONTREAL RIVER

1207502 (16 units)

1207504 (16 units)

1207505 (12 units)

1207506 (15 units)

1207507 (16 units)

1207509 (4 units)

1207510 (1 unit)

1207511 (3 units)

1207513 (1 unit)

1207516 (8 units)

1207518 (4 units)

1207503 (2 units)

1207515 (2 units)

Leased Claims:

- Mining Rights Only
- Surface and Mining Rights

0 5000 feet

TIMMINS MATHESON KIRKLAND LAKE MATACHEWAN ENGLEHART ELK LAKE ONTARIO QUEBEC

10 MILES

41P15NE0013 2.16948 POWELL

210

Royal Oak Mines Inc. TIMMINS DIVISION

MATACHEWAN PROJECT
Land Holdings

TRACED:	DATE:	NTS: 41 P/15	PROJECT:
DRAWN: REP	DATE: JAN '96	MAP No:	FILE: CLAIMS
SUPERVISED:	DATE:		
REVISED:	DATE:		