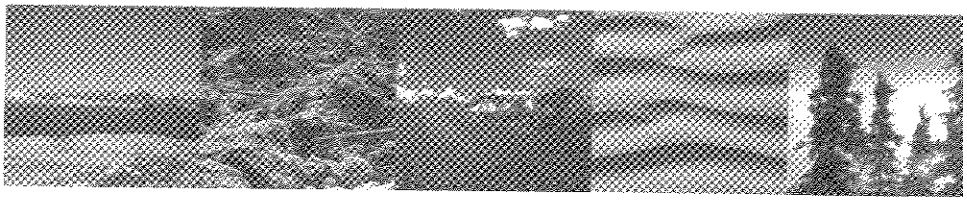
# 2005 Baseline Water Quality Monitoring Program – Hackett River Project



Prepared for
**Sabina Resources Limited**

Submitted by
**Gartner Lee Limited**

October 2005



Gartner Lee

# 2005 Baseline Water Quality Monitoring Program – Hackett River Project

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Reference: **GLL 50598**

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October 19, 2005

Harvey Klatt
Sabina Resources Ltd.
309 Court Street South
Thunder Bay, Ontario
P7B 2Y1

Dear Mr. Klatt:

**Re: 50598 – 2005 Baseline Water Quality Monitoring Program at Hackett River Project**

As per the request of Mr. Harvey Klatt of Sabina Resources Ltd., Gartner Lee Limited (GLL) carried out a baseline water quality monitoring program (initiated 2004[1]) at the Hackett River Project Area in Nunavut from July 5th to July 8th 2005. Sample collection, general site observations and subsequent analysis of results were completed by Chad Davey M.Sc, Environmental Technician of GLL's Whitehorse, Yukon office.

The scope of work conducted as part of this program included:

- Preparation of a revised sampling network to include streams in the Hackett and Mara drainages;
- Collection of water quality samples for chemical analysis from 19 locations plus a control lake;
- Measurement of surface flow on 8 streams within the Mara and Hackett River watersheds; and
- Summarization and reporting of the results from the water quality monitoring program.

This letter report contains a description of the 2005 water quality monitoring and flow measurement program and a presentation of the results.

## 1.0 Background

The Hackett River property is an advanced-stage base and precious metal property located in the Kitikmeot region of Nunavut at 66 degrees north and 108 degrees west, approximately 480

[1] Gartner Lee Limited. December 2004. *40655- Baseline Water Quality Program at Hackett River Project.* Prepared for Sabina Resources Limited.

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kilometers northeast of Yellowknife, NWT and 75 kilometers southwest of a potential deep water shipping port at Bathurst Inlet.

The Hackett River project area is situated in two watersheds; Hackett River and Mara River. Both rivers are tributaries of the Burnside River. Boot Lake, Cleaver Lake, Anne Lake and Turtle Lake are located in the Mara River drainage while Banana Lake, Camp Lake and Sunken Lakes are in the Hackett River drainage.

## 2.0 Methodology

GLL visited the property in July 2005 to continue the baseline water quality monitoring program that was initiated in 2004. The sampling program focused on the areas being targeted by current exploration activities and consisted of water quality sampling from the following 12 locations including one reference lake (Figure 1):

- Upper Sunken Lake;
- Boot Lake;
- Cleaver Lake;
- Anne Lake;
- Mara River (two locations);
- Unnamed tributary #1 entering Mara River
- Banana Lake;
- Camp Lake;
- Hackett River (two locations); and
- Cigar Lake (reference lake).

Water quality sampling and flow measurements were conducted at the following 8 locations:

- Outlet of Hood Lake;
- Outlet of Jo Lake;
- Outlet of Hood Lake;
- Outlet of Upper Sunken Lake (2 locations)
- Outlet of Boot Lake;
- Outlet of Turtle Lake;
- Unnamed Tributary #2 entering Mara River

## 2.1 Water Quality Sampling

In order to monitor the water quality of lakes and rivers within the Hackett and Mara watersheds in relation to the exploratory mining activities conducted by Sabina Resources, field collection and subsequent laboratory analysis was required.

GLL collected field measurements of pH, temperature and electrical conductivity at each site. Conductivity and temperature measurements were collected using a YSI-63 pH, Conductivity and Temperature probe. The pH was calibrated on site using pH 7 and pH 4 buffer solutions. Calibration of the conductivity probe was checked in standard solutions on site and indicated acceptable calibration.

The water samples were collected using recognized sampling protocols. Appropriate measures were taken to mitigate sample contamination from all sources. Field staff wore disposable latex gloves when sampling. Surface water samples were grab samples taken from either the lakeshore or collected from a stream.

Samples were collected by GLL for general chemical parameters (laboratory pH, conductivity, sulphate, alkalinity, hardness, nitrate, nitrite, phosphate, total dissolved solids, total suspended solids and turbidity) in a pre-cleaned 1 L plastic bottle supplied by the analytical laboratory. Samples for total metals were collected in 250 mL acid washed plastic bottles supplied by the laboratory and preserved with nitric acid. Dissolved metals were vacuum filtered in the field through 0.45 micron disposable filterware and preserved with nitric acid immediately after filtration. Samples for total organic carbon (TOC), dissolved organic carbon and total nitrogen were collected in 125 mL amber glass bottles. TOC and total nitrogen samples were preserved on site using hydrochloric acid.

All samples were kept cold, but not allowed to freeze, at all times between sample collection and delivery to the laboratory. Samples were shipped via air cargo from Yellowknife to ALS Environmental, a CAEAL accredited environmental laboratory in Calgary, Alberta. Chain of custody forms were prepared and accompanied the samples. A copy of the Chain of Custody is attached to the analytical laboratory report (Attachment A).

## 2.2 Flow Measurements

In order to characterize the hydrology and assess the potential loading of various water quality parameters within the watershed, measurements of stream flow at several lake and stream outlets was conducted.

The Swoffer Model 2100 propeller-type meter was the preferred method to calculate flow velocity in streams. In some streams the flow was extremely low, rendering the Swoffer meter impossible to employ. In these situations the float method was used to calculated flow velocity, in which a floating object was placed within the water and its travel time over a fixed distance downstream was recorded.

### 2.3 Quality Control/Quality Assurance

Quality Control/Quality Assurance protocols are a necessary component to any environmental sampling program. For the purposes of maintaining data quality a number of industry and corporate protocols were applied to this project including field replicates and laboratory duplicates. Field replicate sampling is designed to provide a measure of field variability and the repeatability of sampling. Variability of less than 25 % indicates very low field variability. Two replicate sample locations were chosen randomly and two samples collected sequentially. The surface sample for Camp Lake and Banana Lake was taken in replicate. Laboratory duplicates provide a measure of the analytical variability (precision). Laboratory variability of less than 25% is generally considered acceptable.

In accordance with GLL's stream gauging protocols for propeller-type meters, all site locations were straight channels, free from obstructions upstream or downstream and point velocities were taken at 10% intervals of the total channel width. Regardless of which method was used to calculate flow velocity, carefully planning in selecting each site was taken to ensure representative hydraulic conditions.

## 3.0 Results

The 2005 sampling program sites were chosen based upon previous work carried out in the area, as well as focusing on areas of exploration and potential development. The results of the 2005 water quality program are presented in Tables 1, 2, 3 and 4 and discussed in the following section. Data were evaluated based upon the Canadian Council of Ministers for the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (2003). Values that exceed guidelines are highlighted within the data tables. Since the 2004 and 2005 baseline water sampling programs were conducted at different times of the year (2004 - August 20$^{th}$ to 24$^{th}$; 2005 - July 5$^{th}$ to 8$^{th}$), direct comparisons of water quality parameters were difficult to interpret due to limnological cycles that naturally occur within lakes. However general water quality similarities between the two sample years were observed. All results presented here are

within the context of the 2005 sampling program only. Photographs of the sampling locations are presented in Attachment B.

Generally, the overall surface water system can be characterized as a series of isolated lakes with moderate surface water drainage systems at the time of sampling (Photograph 1 and 2). The following observations can be made:

- Cigar Lake was sampled as a potential reference lake to provide an overview of the regional and background water chemistry. The water quality at Cigar Lake is similar to the other locations in the area not receiving drainage from mineralized areas (Boot Lake, Mara River, and Hackett River).
- The majority of surface waters sampled were very soft[2] (hardness less than 30 mg/L) with the exception of Boot Lake, Mara Inflow #2 and Turtle Outflow which are considered soft[2] (hardness between 30 and 60 mg/L) and Cleaver Lake and Anne Lake, which are moderately soft[2] (hardness between 60 and 120 mg/L);
- The majority of surface waters sampled contained Alkalinity levels that were generally low (< 10 mg/l $CaCO_3$) indicative of high sensitivity[3] to acidic inputs with the exception of Anne Lake, Mara Inflow #1, Mara Inflow #2, Banana Lake and Turtle Outflow which had slightly higher (10 to 20 mg/l CaCO3) alkalinity levels and therefore moderate sensitivity to acidic inputs[3];
- Alkalinity levels in the rivers were also low indicating a sensitivity to acid inputs[4];
- Organic carbon levels in all waters sampled were low and nutrient levels, specifically phosphorus, are indicative of nutrient poor surface waters[5];
- There were no detectable levels of total suspended sediment in any of the surface samples and turbidity levels are extremely low (< 2.0 NTU).
- Sulphate levels are elevated in lakes/streams potentially receiving drainage from mineralized areas, specifically Camp Lake, Cleaver Lake, Anne Lake, Banana Lake and Upper Sunken Lake, Upper Sunken Lake Outflow, Sunken Lakes Outflow, Mara Inflow #2, Turtle Outflow.
- Generally, most metal levels in lakes/streams were low and within the recommended CCME guidelines with the exception of cadmium, copper, zinc and aluminum.

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[2] McNeeley, R.N., V.P. Neimanis and L. Dwyer. 1979. *Water Quality Sourcebook – A Guide to Water Quality Parameters.* Inland Waters Directorate, Water Quality Branch, Minister of Supply and Services Canada.

[3] Saffran, K.A. and D.O. Trew. 1996. *Sensitivity of Alberta Lakes to Acidifying Deposition: An Update of Maps with Emphasis on 109 Northern Lakes.* Water Management Division. Alberta Environmental Protection.

[4] Boward, D., P. Kayzak, S. Stranko, M. Hurd and A. Prochaska. 1999. *From the Mountains to the Sea: The State of Maryland's Freshwater Streams.* Maryland Department of Natural Resources.

[5] Canadian Council of Ministers of the Environment (CCME). 2003. *Canadian Guidance Framework for the Management of Phosphorus in Freshwater Systems.* National Guidelines and Standards Office, Environment Canada.

- The levels of cadmium and zinc exceed the recommended CCME guidelines in Camp Lake and Banana Lake, as well as lakes/streams downstream: Upper Sunken Lake, Upper Sunken Lake Outflow, Sunken Lakes Outflow, Camp Creek and Hackett River Downstream.
- The level of zinc exceeds the recommended CCME guidelines in Camp Lake as well as lakes/streams downstream: Upper Sunken Lake, Upper Sunken Lake Outflow, Sunken Lakes Outflow, and Camp Creek.
- Elevated levels of cadmium, copper and zinc that exceed the recommended CCME guidelines occur in Cleaver Lake and lake/streams downstream; Anne Lake and Turtle Lake Outflow.
- Elevated levels of cadmium that exceed the recommended CCME guidelines also appear in Boot Lake and downstream to Boot Lake Outlet.
- Upper Sunken Lake, Upper Sunken Lake Outflow, Sunken Lakes Outflow and Boot Lake had elevated levels of aluminum compared to the other sampling locations.
- Elevated levels of lead that exceed the recommended CCME appear in Cleaver Lake and elevated levels of iron that exceed the recommended CCME appear in Mara Inflow #2.

### 3.1 Quality Control/Quality Assurance

The surface sample from Camp Lake and Banana Lake was collected in replicate (e.g. two samples collected sequentially) and summarized in Table 5. Generally, the two water samples had similar water quality. The highest relative percent difference (RPD) was noted in dissolved lead for Banana Lake with a RPD between samples of 116%. Typically, RPD's greater than 25% can be an indication of field variability, and as parameters approach their detection limit high variability is more likely to occur. Lead values for Camp Lake also had a high RPD's; 51% for total and 44% for dissolved. A comparison of dissolved and total lead indicates that the majority of the lead in these samples is associated with particulate matter (> 0.45 micron), which could be the cause of this variability. Dissolved zinc and turbidity for Banana Lake also had high RPD values (38% and 55% respectively). The remainder of the parameters had variability of 24% or less. Laboratory precision is summarized in Table 6 with total dissolved solids having RPD's of over 100% for both lab duplicates (Cleaver Lake and Banana Lake Replicate).

I trust that this summary of the 2005 Baseline Water Quality Monitoring Program at Hackett River Project meets your current needs. If you have any questions, or if we can be of further assistance, please do not hesitate to contact me at (867) 633-6474 ext. 34.

Yours very truly,
GARTNER LEE LIMITED

Leslie Gomm, Ph.D., P.Eng.
Senior Environmental Engineer

Attachments: A – Surface Water Quality Laboratory Data Sheets
B – Photo log