IDENTIFICATION OF POTENTIAL ENVIRONMENTAL PROBLEMS AT PORT RADIUM.

FIELD REPORT:

In search of uranium mill tailings.

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INTRODUCTION

Echo Bay Mines Limited is presently closing out its silver mine in Port Radium. Of particular environmental concern are uranium and silver mill tailings which have been deposited on and around the peninsula. Initiative was taken by EPS Yellowknife to assess the environmental conditions of the Port Radium sits in a joint venture with the Department of Northern and Indian Affairs and the Territorial Government. The work was contracted to the University of Toronto to carry out an environmental survey of the Port Radium site. This report summarizes the field investigation.

The complexities which are encountered in differentiating mining wastes, let alone identifying potential environmental problems at Port Radium, can be envisaged after a brief review of mining activities at Port Radium.

The ore body at Port Radium, discovered in the early 1930s by Labine, was mined by Eldorado Nuclear Limited from 1934 to 1960. During the first six years of this operation, radium and silver ore were produced. In 1942 Eldorado commenced to mine and mill uranium at Port Radium, in part by recovering and processing the tailings produced earlier from the radium and silver extraction. Between 1952 and 1960 approximately 340,000 tons of tailings had been dredged from Cobalt Channel (Map 1). In 1960 the uranium extraction ceased and the Port Radium operation was abandoned.

In 1964 a silver mine was opened by Echo Bay Mines Limited dewatering the old Shaft # 1 and restoring some of the facilities previously used by Eldorado Nuclear Limited. Since 1970 the silver mill operated at a rate of about 100 tons per day. Echo Bay Mines Limited ceased operation in early 1982.

The tailings resulting from these different mining activities were discharged to various places. Initially, the tailings from the radium and silver extraction by Eldorado Nuclear disappered into Cobalt Channel. To extract uranium they were recovered and subsequently discharged into small lakes on the peninsula and into a small bay around Discovery Point referred to now as Murphy Bay (Map 1 and Table 1). The silver tailings produced in the early 1960s by Echo Bay Mines Limited were used to create storage space by filling in en area between silver Point, a small spit across from Cobalt Island, and the mainland Later silver tailings were discharged into McDonough Lake, appropriately referred to presently as Garbage Lake.

Map 1 illustrates the locations of the sites discussed in this report. All sites have been given code numbers. Site code numbers, in addition to a brief site description are given in Table 1. It may be suggested from the descriptions in Table 1 and the close proximities indicated in Map 1 that the identification of waste types at Port Radium initially resembles a combination of art and science. The field observations on the origin of the wastes will be verified by chemical analysis of the material.

APPROACH AND METHODS

The survey was conducted by initially collecting grab samples to characterize areas of interest The grab samples were processed to determine pH and electrical conductivity in 1:1 (v/v) slurries of tailings with water from Labine Bay The measurements were repeated after 24 h of settling. Eased on an evaluation of the measurements, the locations of interest were mapped and resampled to obtain material for chemical analysis.

The shorelines around Port Radium peninsula were surveyed for signs of discharge areas (Map 1 - Location 13). The bottom of Cobalt Channel, Murphy Bay, Bear Bay and Labine Bay (Map 1 - Locations 8, 6, 10 and 9 respectively) were surveyed with an Eckman Grab Sampler. Locations for sampling of sediment were chooseh based on the results of the grab survey and visual inspection of the bottom substrate. Characteristics of the water column were investigated by determining profiles of temperature, dissolved oxygen and electrical conductivity. After the initial site investigation was completed. where appropriate, samples of algae, sediment and water were collected for analysis.

MAP 1: Overview of locations referred to in field report and Table 1.

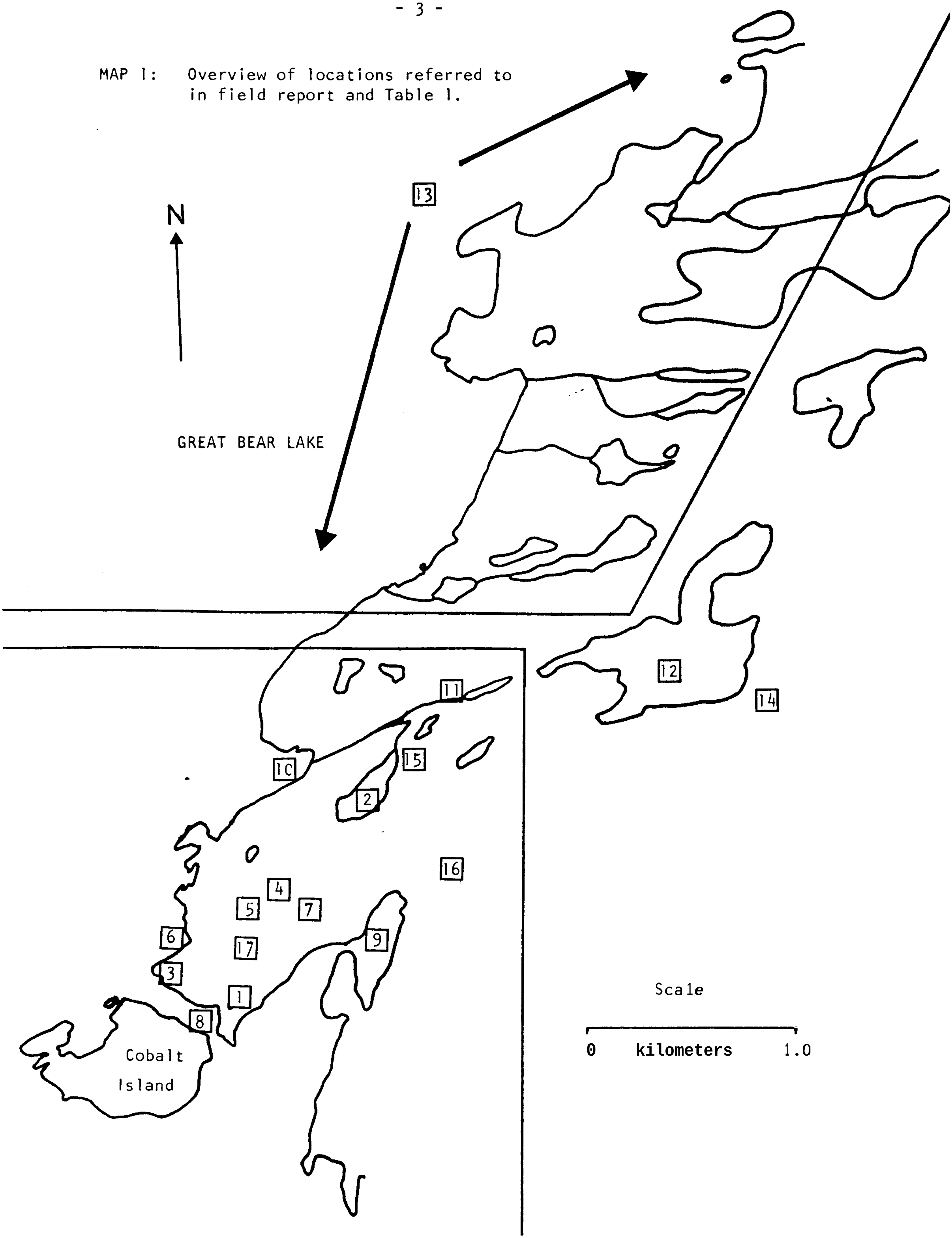


Table 1: Location numbers, names and description of sites investigated during the field work.

LOCATION # ON MAP 1	SITE NAME	DESCRIPTION
1.	Silver Point tailings	- tailings area and beach built from silver tailings, used as a storage area for various materials.
2.	Garbage Lake or McDonough Lake	- silver tailings lake, one small tailings beach, one active garbage disposal beach (regular burning), one old scrap metal and mining equipment garbage beach.
3.	West Adit	- rocky slope with uranium mill tailings and small tailings area with process wastes (slimes and other yet unidentified chemical 'junk:
4.	Murphy Lake	- tailings area nearly all covered with mixture of waste rock and overburden.
5.	Murphy Creek	- Likely weathered uranium mill tailings mixed with silver tailings in small puddles and depressions along a steep sloping creek.
6.	Murphy Bay	- steeply sloped bay, lake sediments and tailings likely well mixed.
7.	Radium Lake	- uranium mill tailings area, covered solid with waste rock and overburden. used as ore storage from Contact Lake (waste rock), parts of former Radium Lake are now a road and some buildings are on the covered tailings.
8.	Cobalt Channel	- Silver Point tailings beach, former sewage discharge, tailings on bottom of channel.

Table 1: Location numbers, names and description of sites investigated during the field work.

LOCATION # ON MAP 1	SITE NAME	DESCRIPTION
9.	Labine Bay	- marina, float plane landing site, waste rock and over-burden beaches: received mine water from Shaft #2.
10.	Bear Bay	- discharge point of Garbage Creek and Bear Creek.
11.	Bear Creek	- relatively fast flowing creek, joins a presently dry Garbage Creek. Overland flow dis-appears completely some 500 m down creek, from the junction of both creeks.
12.	Cross Fault Lake	- Old mine working with waste rock beach on Cross Fault Lake.
13.	Area of shore-line survey	- rocky and gravely shores of the McTavish Arm of Great Bear Lake, north of Port Radium Peninsula.
14.	Trenches leading to shaft #2.	- area where weathered overburden was collected.
15.	Garbage Creek	- former creek leaving Garbage Lake and joining Bear Creek.
16.	Shaft #2	- silver mine working and origin of mine water discharged into Garbage Lake (1980 only).
17.	Shaft #1	- old Eldorado Nuclear shaft, reopened by Echo Bay Mines Limited.

NOTE: Detailed maps for some of the sites investigated will be prepared for the final report.

The pH and electrical conductivities determined in the field with Labine Bay water were verified later in the laboratory. Measurements were made with material sampled from the same locations, and the weight/volume ratios were adjusted according to the ratios used generally in tailings investigation These determinations facilitated a comparison between the field measurements and those measurements which are made in other uranium mill tailings studies.

DETAILED SITE DESCRIPTIONS:

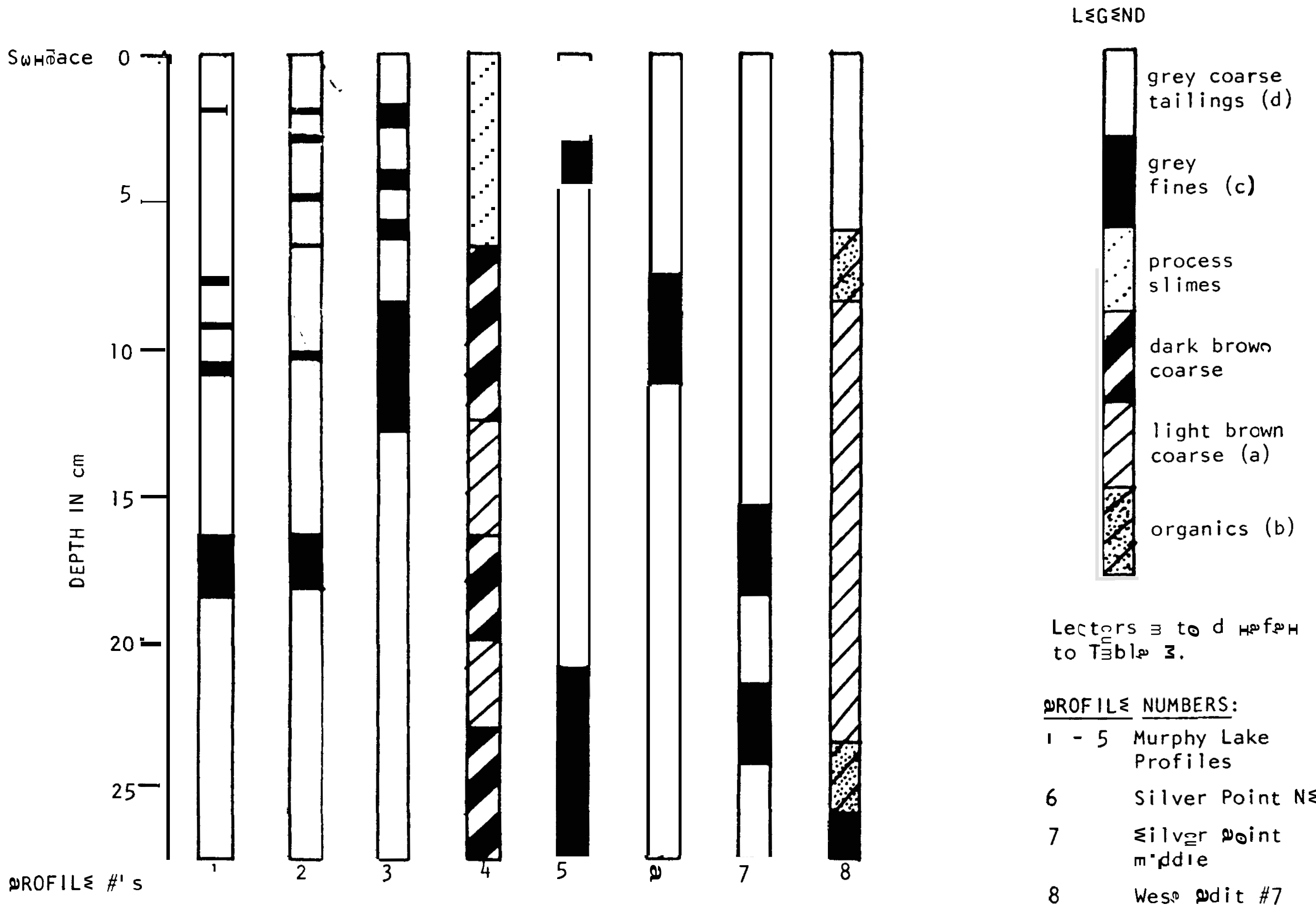
A. Presently Exposed Tailings Areas.

1. **Silver Point Tailings (Site 1)** Site 1 was an exposed tailings area of approximately 1.3 ha surrounded by a nearly vertical rock face to the north and Silver Point *causeway* to the south. Silver Point causeway consists mainly of waste rock from the Eldorado Nuclear operation. Between the tailings beach on Cobalt Channel and the remaining open area of tailings, a waste rock berm covers large parts of the tailings beach, presumably preventing erosion of the beach. Attached *algae* have colonized the tailings beach, particularly *close* to an outlet of a pipe which was probably used for sewage discharge and which runs dong side the rock face of the Silver Point tailings. Most of the tailings surface area consists of coarse grey tailings with a pH of *7.2* to *7.6* and an electrical conductivity of 200 to 300 μmhos/cm.

By excavating small pits in these tailings, some layers of fines were differentiated *(Figure 1, Profiles 6 & 7)*. The fines have a slightly higher electrical conductivity than the coarse tailings. Some water soluble material is probably contained in the fines The electrical conductivity increased in fine tailings slurries *after* 24 h to 600 μmhos/cm from an initial reading of 300 μmhos/cm.

A *large* increase in electrical conductivity *after* 24 h of being slurried was observed in material which has formed on top of the tailings, mainly on the *edges* of the exposed tailings areas. Scrapings from rocks *along* the pipe and collections of this crystalline crust on the surface of the tailings had a pH of 8.0 to 8.3. The electrical conductivity of the slurries increased

Figure 1: Vertical profiles in pits of exposed tailings areas.



from 1000 μmhos/cm to 14000 μmhos/cm within 24 h. Evolution of gas occurred upon application of concentrated nitric add onto *the* crystalline crust. It is suggested that this white encrustment is some type of carbonate. The fine tailings may contain a *higher* proportion of these water soluble carbonates, producing the slight increase in electrical conductivity.

2. Murphy *Lake* and Murphy Creek (Sites 4 and *5):* Former Murphy Lake and its creek was located behind the town site to *the* north-east of Shaft # 1. It is a small area of approximatey 0.8 ha Murphy Lake is connected today to former Radium Lake by a blasted alley approximately the width of a mad. Tailings pits were excavated and profiles were recorded in the portion of Murphy Lake which has not yet been covered by overburden and waste rock. The profiles were *similar* to those excavated in the Silver Point tailings and which were discussed *earlier* (Figure 1, Profiles 1-5). Such profiles could be utilized in tracing the *discharge* history of the tailings

In Table 2, the pH values and electrical conductivities are reported for the various waste materials which were &———·ed by *their* texture and colour. In the legend of Figure 1, a description of the texture *can* be found.

If pH and electrical conductivity, together with texture and colour are taken as preliminary identification indices, then the *exposed* tailings of Murphy Lake are likely silver tailings. From the records it was suggested that Murphy Lake was originally filled with uranium mill tailings. However, the coarse tailings presently on the surface in Murphy Lake am finer than coarse uranium mill tailings. Further, the fine layers have a different smell and consistency than those fines from the uranium extraction process. These qualitative observations, combined with the similarity in pH and conductivity values with the Silver Point tailings *suggests* that silver tailings cover the uranium mill tailings in Murphy Lake. A pit of 1 m depth was not sufficiently deep to uncover different tailings material. A deeper pit would be required on Murphy Lake to determine if uranium mill tailings are underneath these neutral silver tailings.

The exposed tailings on the slopes *of* Murphy Creek are also neutral (pH *7.5)* and have an

Table 2: pH and conductivity of silver tailings material.

TYPE OF TAILINGS	MURPHY LAKE pH	MURPHY LAKE Conductivity in µmhos/cm	SILVER POINT TAILINGS pH	SILVER POINT TAILINGS Conductivity in µmhos/cm
Grey coarse	6.8 - 7.5	250	7.4 - 8.0	200 - 290
Grey fines	7.6 - 7.6	550 - 750	7.2 - 7.4	310 - 600
Process slurries	7.5 - 7.6	340 - 550	-	-
Dark brown coarse	4.2 - 3.2	1000 - 1600	type of material not present on this site.	
Light brown coarse	5.3 - 5.4	1300		
Organics	7.3 - 7.4	160 - 270		

electrical conductivity of 210 to 280 µmhos/cm. This suggests that they have the same origin as the tailings in Murphy Lake. At the mouth of Murphy Lake, towards Murphy Creek, tailings are extensively overgrown by horsetails. This area is moist and organic, peat-like material was found underneath the tailings. This layer had a pH of 7.5 and the *same* electrical conductivity as the tailings These observations suggest that the area may have been saturated with neutral tailings water, neutralizing the natural acidity of the peat.

A profile located *close* to the edge of the former lake (Figure 1, Profile 4), has brown layers of more acidic sandy material (pH 3.2 to 5.4, Table 2). Weathered coarse brown sand was collected in the area of Cross Fault Lake on the slopes where extensive trenching has occurred. These materials when slurried *gave* a pH value of 3.0 and an electrical conductivity of 1800 µmhos/cm. Coarse brown *sandy* material also surrounds Murphy Lake. A belt of horsetails (*Equisetum arvense* L.) grow immediately adjacent to the tailings area. on *such* weathered sand. This material, however, has a neutral pH ranging from 6.3 to 7.4 and a low electrical conductivity of 160 to 540 µmhos/cm. The brown sand on the shores of Murphy Lake are neutral, possibly neutralized by the tailiis liquors. Unfortunately, no material was collected from the more distant slopes of Murphy Lake, to determine their characteristics. Given the acidity of the weathered coarse sand on the Cross Fault area which likely has its origins in pyritic content of the rock, it may be possible that similarly acidic rocks exist around Murphy Lake. It could then be speculated that the sandy brown material in the profiles on the edges of Murphy Lake may be material which has washed from surrounding slopes into the silver tailings The texture of the material is too coarse and irregular to be a result of a milling process. Generally, it is concluded that the exposed silver tailings are neutral and have a low electrical conductivity.

At the time of writing this report, the exposed tailings in Murphy Lake have probably already been covered with waste rock or' other cover material. If uranium mill tailings were ever discharged into Murphy Lake, they are at p e n t well covered by assorted mining wastes. Further, if Echo Bay Mines Limited proceeds with its decommissioning plan (required under Water Licence No. N2L3-0038 - Part C21), the Silver Point tailings will ultimately also be covered, as will those tailings in Murphy Lake. In this case, no exposed tailings areas will remain at Port Radium.

3. West Adit tailings (Site 3): From the sites investigated so far, it is indicated that probably all of the presently exposed tailings areas are tailings from the silver extraction. The search for exposed uranium mill tailings appeared to be in vain. This changed with the discovery of the West Adit area (Map 1 - Location 3). This area is located below Shaft. # 1 slightly to the north-west

Shaft # 1, in preparation for silver mining, was furnished with a conveyor belt which discarded waste rock in the direction of the West Adit slope. Terraces of waste rock now tower over a steep rock face below which the old add plant, required for the uranium extraction, has been buried. The acid plant required a fresh water intake. Fresh water appeared to come from Cobalt Channel, indicated by remnants of an old pump station. It seemed logical that the uranium tailings were discharged into the opposite direction from the fresh water intake, i.e., towards the direction of Murphy Lake, Radium Lake and into a bay mound Discovery Point, This direction would also be distant enough from the area of the dredge which was recovering

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the old radium and silver tailings. With this in mind. there appeared to be a possibility of finding uranium mill tailings in the West Adit area. Pieces of a tailings line, typically used for the discharge of uranium mill tailings, were discovered among the silver waste rock. A characteristically decayed lining and tailings fines positively identified the slurry pipe. All these observations and conjectures, together with a bit of luck, lead to the finding of "pure" uranium mill tailings on the slopes around the West Adit area

In Table 3, the pH values and electrical conductivities of slurries of these tailings, prepared with distilled water are given and compared to measurements of slurries prepared in the same way as those in the field, i.e., with Labine Bay water. For comparison to the field results some silver tailings collected for analysis were also slurried with distilled and with Labine Bay water. The same ratios of weight of tailings and volume of water was used for uranium mill tailings as for silver tailings. These solid to liquid ratios (1:1) with distilled water are also used in investigations of other uranium mill tailings sites.

The uranium mill tailings were discharged unneutralized and the ore was pyritic. The acidic nature of the tailings slurries is therefore not surprising. The different ratios of tailings water (w:v), as compared to those used on (v:v) site, and the distilled water used in the laboratory, may contribute to the slight increase in the electrical conductivity. However, generally the agreement between the field and laboratory measurements, is indeed very good. This is particularly the case considering the natural variability of tailings samples and the measurement errors.

In Figure 2, different ratios of distilled water and tailings are plotted for the resulting pH values and the electrical conductivities of the slurries. For both selected tailings samples the slurries remained acidic regardless of the distilled water and the tailings ratio. The electrical conductivity decreased more for the coarse tailings in sample # 7 than for those of sample # 2 located on the slopes. This may be a reflection of the weathering and the drainage of the West Adit area. The location of which sample # 7 was collected was wet and drained poorly, whereas the sloped area was dry from which sample # 2 originated.

Table 3: West Adit tailings slurries compared to silver tailings.

LOCATION AND SAMPLE NUMBER		LABINE BAY WATER pH	LABINE BAY WATER Conductivity in µmhos/cm	DISTILLED WATER pH	DISTILLED WATER Conductivity in µmhos/cm
West Adit Slope:	1	3.5	2600	3.5	2600
	2	3.2	2600	3.1	2600
	3	2.9	3800	2.9	3600
	4	3.2	5600	3.2	4800
	5a	3.3	7200	3.3	6000
	5b	3.6	2700	3.5	2800
West Adit tailings area:	7a	4.3	1800	4.3	1700
	7b	5.8	2300	5.5	2000
	7c	6.9	1000	6.7	640
Murphy Lake profile:	5c	7.0	610	6.9	420
	5d	6.8	560	6.9	560
Murphy Creek Site 4:		7.4	260	7.5	210
Murphy Creek Site 3:		7.3	260	7.4	220
Silver Point NE		7.2	410	7.2	240
Silver Point NE		7.5	480	7.4	300
Control Sand		3.0	1600	3.1	1200

Legend: Letters a to d refer to samples from vertical profiles. Figure 1 profile 5 - Murphy Lake and profile West Adit sampling site #7.

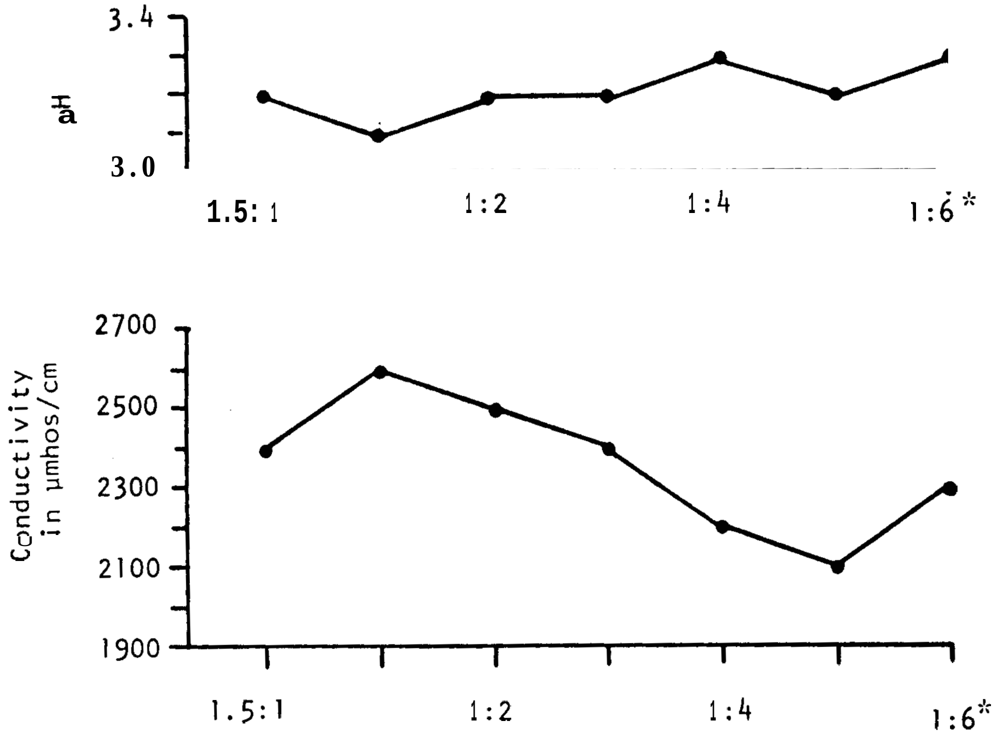
Slurries in 1:1 ratio w:v (tailings:water) measured after 24 h.

NOTE: Labine Bay water: pH 7.0
Conductivity 100 µmhos/cm

Distilled water: pH 6.3
Conductivity 10 µmhos/cm

Figure 2: West Adit tailings slurries.

West Adit Slope - Sample #2



West Adit tailings area - Sample #7

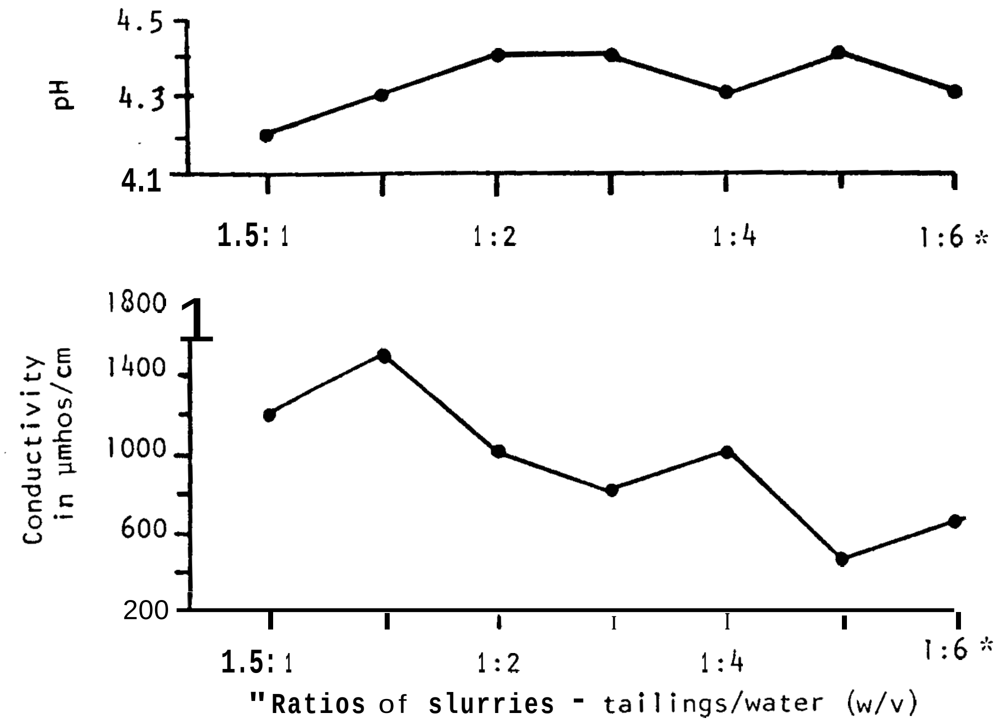
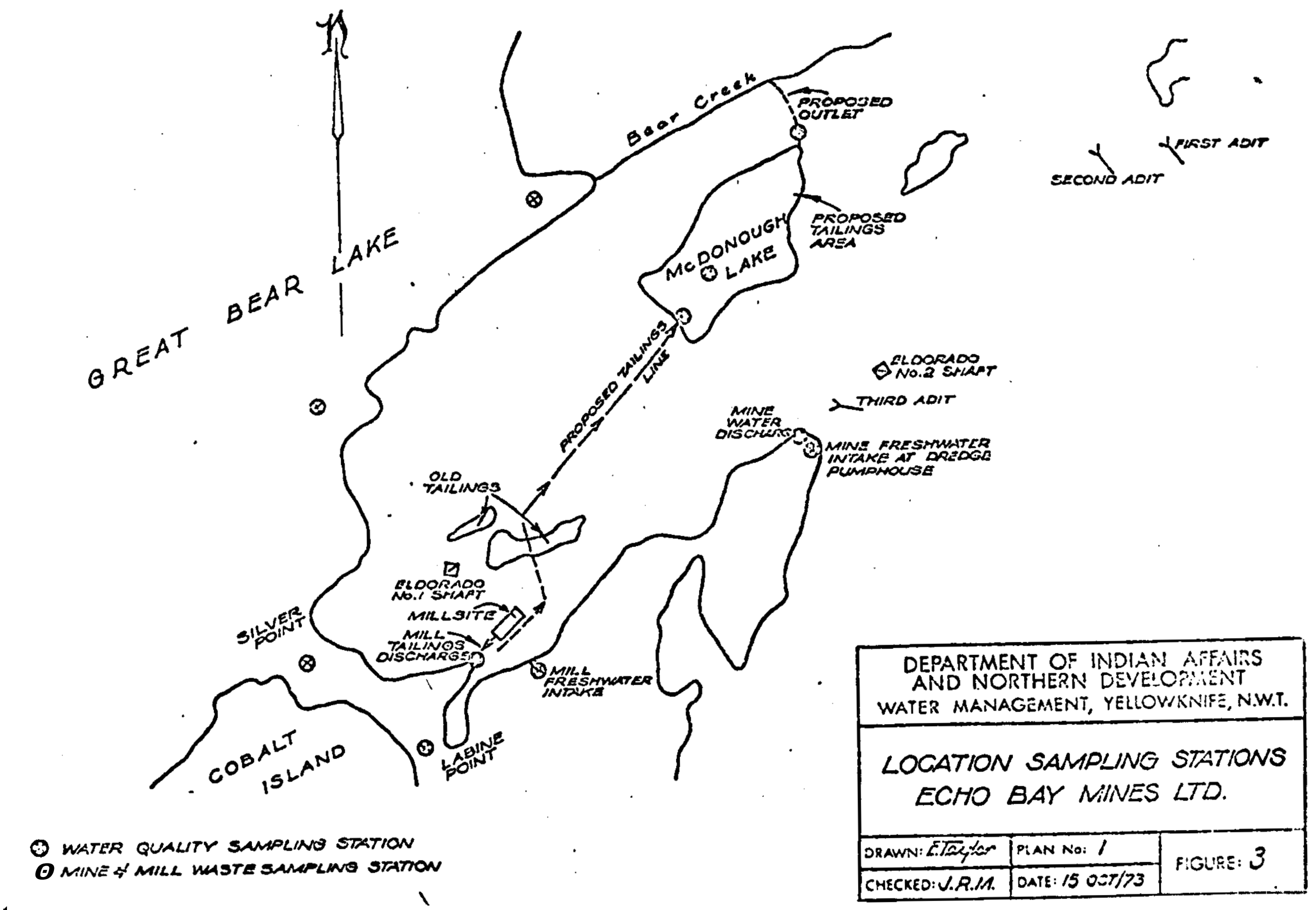


Figure 3: Old tailings reference. Source: Consolidated **DOE-DIAND** Paper, November 15, 1973.



B. Covered Tailings Areas

1. **Former Radium Lake (Site 7):** Virtually all maps inspected in government files and site plans of the Port Radium peninsula make reference to two small areas behind the old townsite which are labelled 'old tailings', as for example in Figure 3. One of these areas was easily identified on site. It is referred to in this report as Murphy Lake. The larger more elongated area, however, is more difficult to identify. The former Radium Lake is covered with a solid layer of overburden and possibly some waste rock. It served many purposes including space for the *curling* rink, a walk-in cooler, a road to Shaft # 1 and presently the cookhouse and the trailers This area was also used as an ore stock pile area and as storage space for heavy machinery and ultimately as a general parking lot As a consequence, at present this tailings area is covered and well compacted. It is hardly an old uranium mill tailings site, but rather a flat area, which is rare on the Port Radium peninsula The ditch alongside of the road when closely inspected, reveals that at one point this area had possibly something to do with tailings. Material resembling fine tailings mixed with sand and peat-like organics and smelling of diesel oil has a pH of 7.1 and an electrical conductivity of 310 to 480 μmhos/cm. Overburden from *this* area has a pH of 8.0 and an electrical conductivity of 240 to 500 μmhos/cm, indeed not different from the 'junk' in the wet ditch. These 'old tailings' *can* be considered *history,* as neither silver nor uranium mill tailings are presently exposed

2. **Garbage Lake (Site 2):** Formerly called McDonough Lake was used as a silver tailings disposal site until the shutdown of the Echo Bay operation in early 1982. Mine water from Shaft # 2 (Map 1 - Location 16), located at the end of Labine Bay was also discharged into the lake. The water level of Garbage Lake fluctuated as a result of the liquid discharges which could reach *one* million gallons/day. This lake was investigated some months after discharge of tailings slurry ceased.

The pH of the water was consistently around 8.1 to 8.4 in all locations measured on the surface of the lake and at all depths sampled. Profiles of dissolved *oxygen,* temperature and

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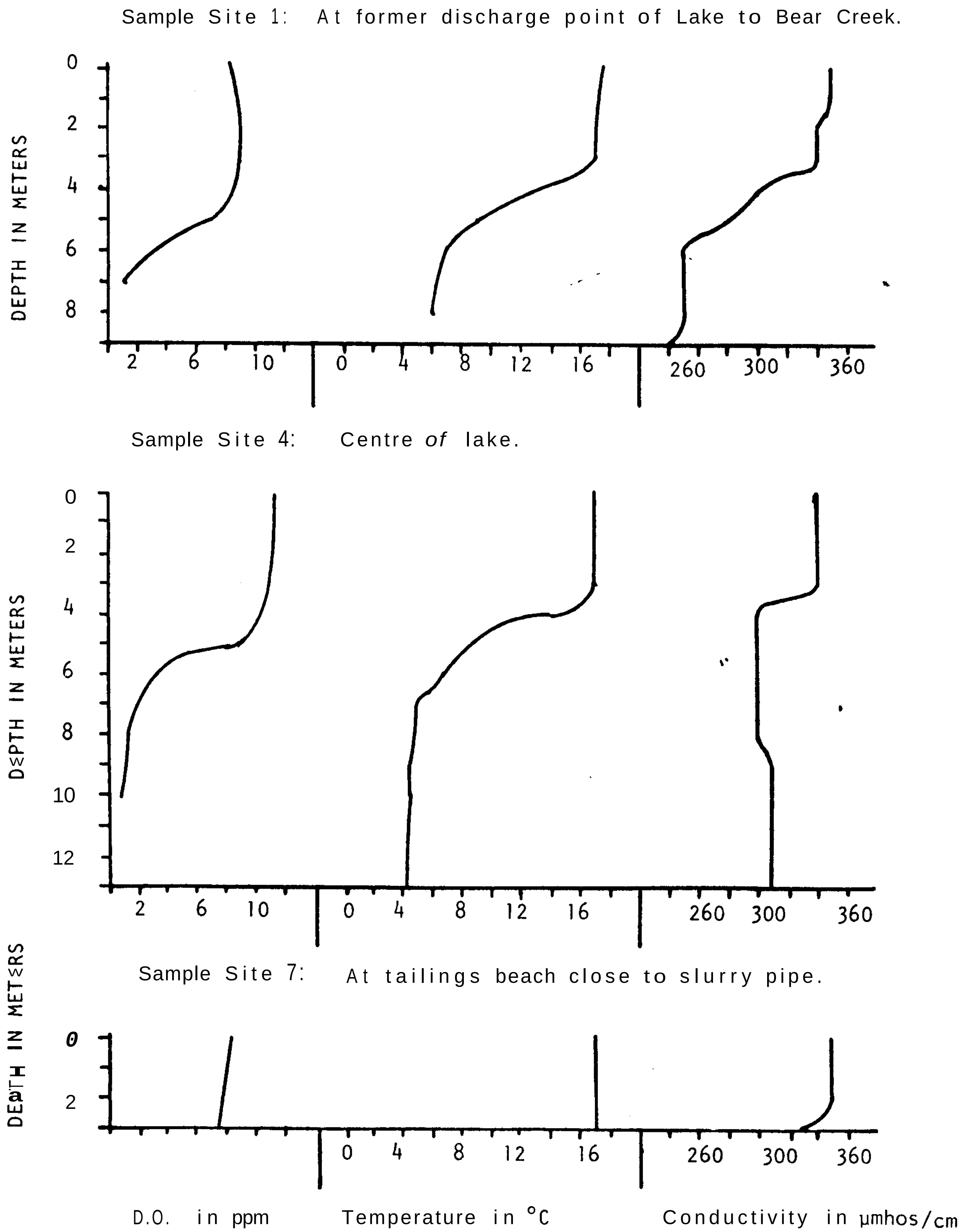
The pH of the water was consistently around 8.1 to 8.4 in all locations measured *on* the surface of the lake and at *all* depths sampled. Profiles of dissolved *oxygen,* temperature and electrical conductivity (Figure 4) indicate that some stratification occurs at 4 to 8 m depth. The decrease in electrical conductivity in the water is accompanied by a decrease in temperature which is to be expected. The lower portion of the water column is free of oxygen. On the shallow tailings beeches (Figure 4 - sample site 7) the water characteristics a m identical to those of the upper part of the water column. The analysis of sediments and the water may facilitate the determination of some important dynamic environmental characteristics of this tailings area for the long-term.

C. Areas Associated with the Tailings Discharge Locations.

1 Bear Creek and Bear Bay (Sites 10 and 11): No overland water flow was observed leaving Garbage Lake through Garbage Creek The old outflow from Garbage Lake has been dosed off by an overburden dam. Some seepage occurred underground, discharging what appeared to be a trickle of water just above the junction of Bear Creek and Garbage Creek The creek bed of Bear Creek or Garbage Creek bears evidence of extensive discharges, as a white mat of fines from past overflow can be traced from Garbage Lake all the way into Bear Bay throughout the creek bed Soil samples coated with fine tailings from the Garbage Creek collected around the V-notch weir, just above the junction of Bear Creek, below the junction with Bear Creek and 100 m above Bear Bay had pH measurements of 7.3, 7.9 and 6.9 and electrical conductivities of 810, 230 and 1110 µmhos/cm respectively. These values indicate that some fines travelled with the overflow down to Bear Bay. Some dilution or lower retention of fines occurred immediately after the junction of Bear Creek to Garbage Creek, reflected in the lower electrical conductivity of these samples One hundred meters above the gravelly shores of Bear Bay the material was collected from a depression which may have retained the liquors for longer periods of time. Therefore, this soil sample has the highest electrical conductivity compared to all other samples collected from this creek system. On the gravelly Bear Bay beach an extensive bloom of attached periphyton was observed, possibly a result of dissolved material

Figure 4: Water column of Garbage Lake.



discharging into Bear Bay.

2. Shoreline survey (Site 13): The northern shores of the peninsula where searched to find evidence of a similar periphytic bloom compared to that of Bear Bay on beaches not affected by tailings discharge. On Map 2 the locations investigated are indicated by circles. Material was collected where possible. In most locations only small pockets of attached algae could be detected. Slight variations in pH and conductivity can be observed around the southern part of the shores (Figure 5), discussed later with the tailings discharges on the peninsula. Only on the West Bear Bay a somewhat larger periphyton population was observed. However, it was not at all comparable to the extent of the bloom on Bear Bay beach. The pH and the electrical conductivity of the water was consistent on all sites at 0.2 and 120 µmhos/cm, respectively. The shoreline survey lead to the conclusion that the periphyton bloom observed on the Bear Bay beach is unique and likely related to the discharge from Garbage Creek and Garbage Lake.

3. Shores around the peninsula (Sites 1, 6, 8 & 9): The surface water surrounding the Port Radium peninsula was investigated thoroughly, particularly bays and beaches that could be affected by mining wastes and mill tailings

In Figure 5, the pH values and the electrical conductivities of the water within the first 1 m from the surface are given Locations of these measurements are indicated by dots in Figure 5. From the results of the shoreline sun-ey, the pH of the water is consistently around pH 8.2 to 8.3. The electrical conductivity increases slightly on the beaches of Bear Bay, Murphy Creek, Silver Point tailings and in Labine Bay. This increase may be a result of dissolved material from the tailings, but the dilution is rapid and the increase small. However, in order to substantiate the slight increase ranging from 110 to a maximum of 190 µmhos/cm at the Bear Bay beach, repeated measurements would be required at different times throughout the year and under conditions of comparable wave action and weather. The shoreline survey was carried out during relatively calm waves, wereas the measurements on Murphy Bay ad Cobalt Channel were obtained during considerable winds The observed increase in electrical conductivity may

MAP 2: Locations of shoreline survey (#13) and other sampling points around the Port Radium Peninsula.

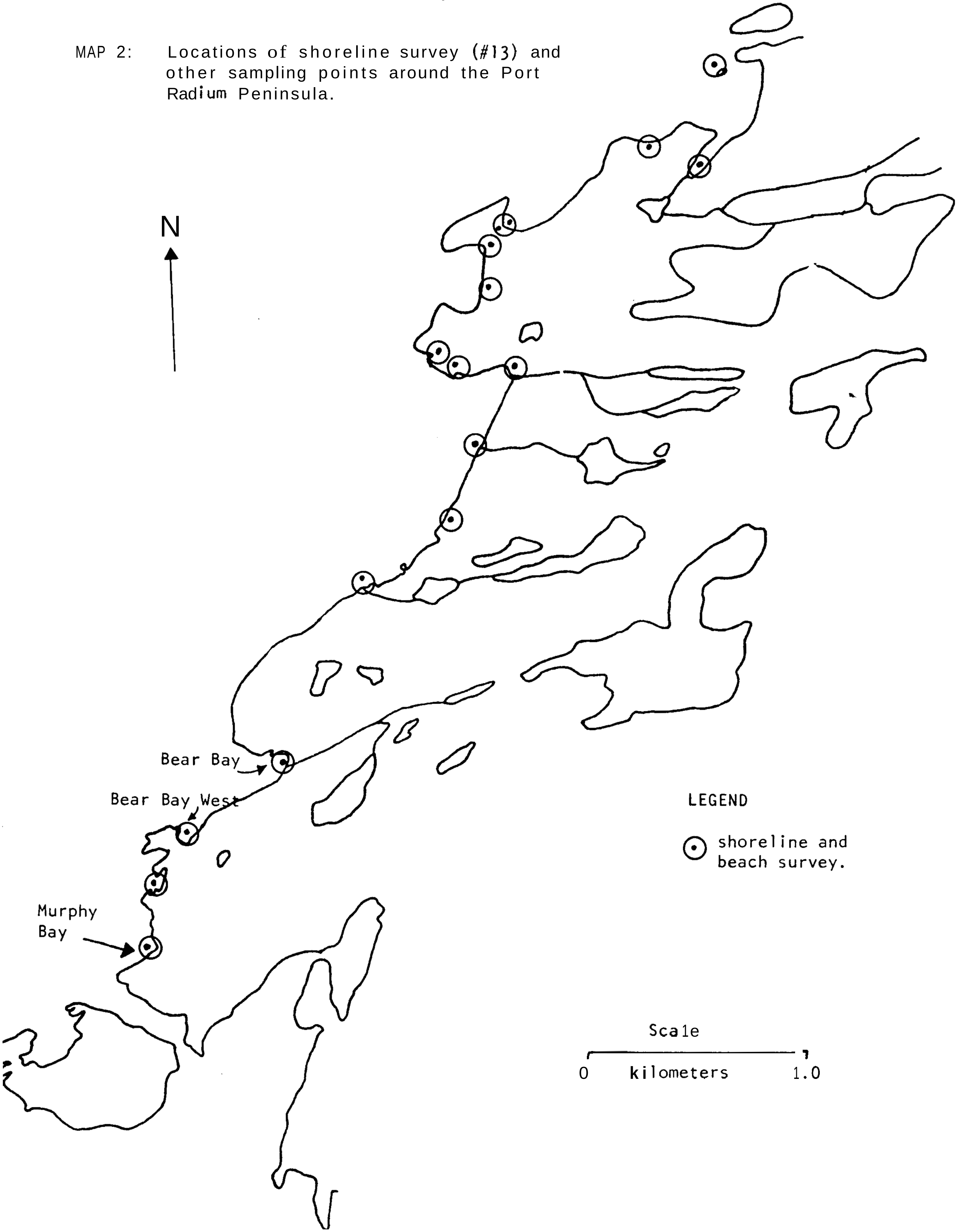
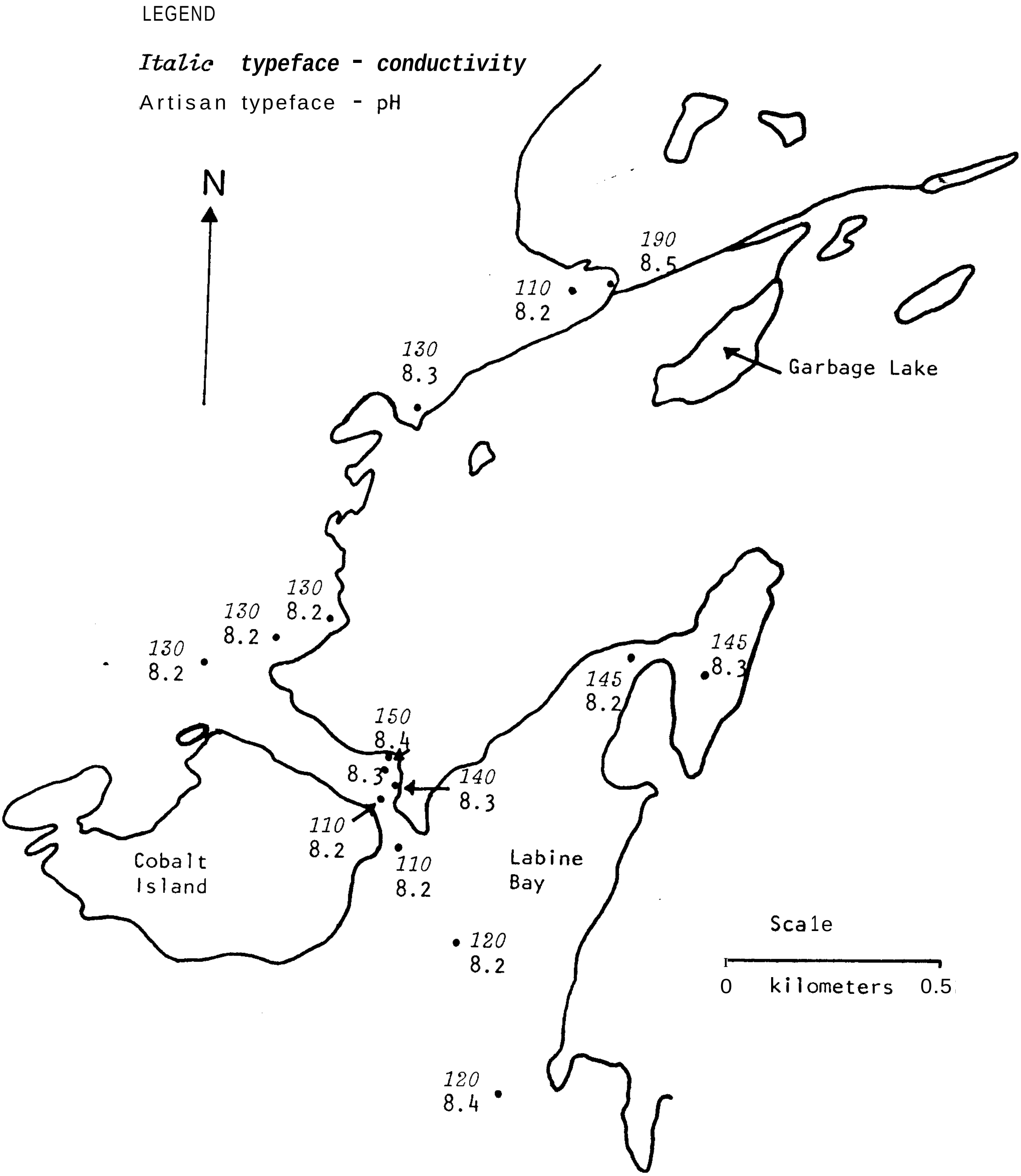


Figure 5: Field measurements of pH and conductivity in surface water around the Port Radium Peninsula.



thus be an artifact of the different wave action.

Comparison of the pH values and the electrical conductivities of the sediments (Figure 6) obtained from the same locations as the surface water reported earlier (Figure 5) showed that the sediment values were generally similar to those for the overlying water column. The sediments are slightly less alkaline, although the range of electrical conductivities is slightly larger from 80 to 240 μmhos/cm. The significance of them different conductivities nay lie in the character of the sediment.

Visually gyttja (natural lake sediment) can be easily separated from tailings. If an Eckman grab was brought to the surface carefully, the material could be separated and immediately pH, electrical conductivity and oxygen concentrations were W hen such a sampling procedure was successful, it was found that gyttja generally had a higher electrical conductivity, the same pH as tailings and both materials were free of oxygen. The sediments were sampled, separating the material such that a differentiation by chemical analysis would be possible. Samples at the mouth of Labine Bay, in the direction of water flow through Cobalt Channel (indicated by stars in Figure 6), contained generally tailings and gyttja. The thickness of the tailings layer decreased with distance from Cobalt Channel, i.e., the Silver Point tailings beach. All of the sediment samples were free of oxygen

The water column was investigated in Cobalt Channel (Figure 7). The lower electrical conductivity of the uppermost 2 m of the water column is probably a result of extremely strong winds in the morning of that day on which the profiles were obtained. Off-shore water with lower conductivity did not have sufficient time to mix with the deeper waters. On the other hand the difference may be a measurement artifact given that the instrument failed shortly after these measurements. Based on oxygen concentrations and temperature the water appeared completely mixed at sample site # 4 in the middle of the Channel across from the Silver Point tailings beach. Unfortunately, because of equipment failure. it was not possible to obtain similar data on sampling pints in Labine Bay and at the mouth of Labine Bay.

Figure 6: Field measurements of pH and conductivity for sediment or tailings around Port Radium Peninsula.

LEGEND

Italic typeface - conductivity

Artisan typeface - pH

* sampling points in direction of water flow through Cobalt Channel.

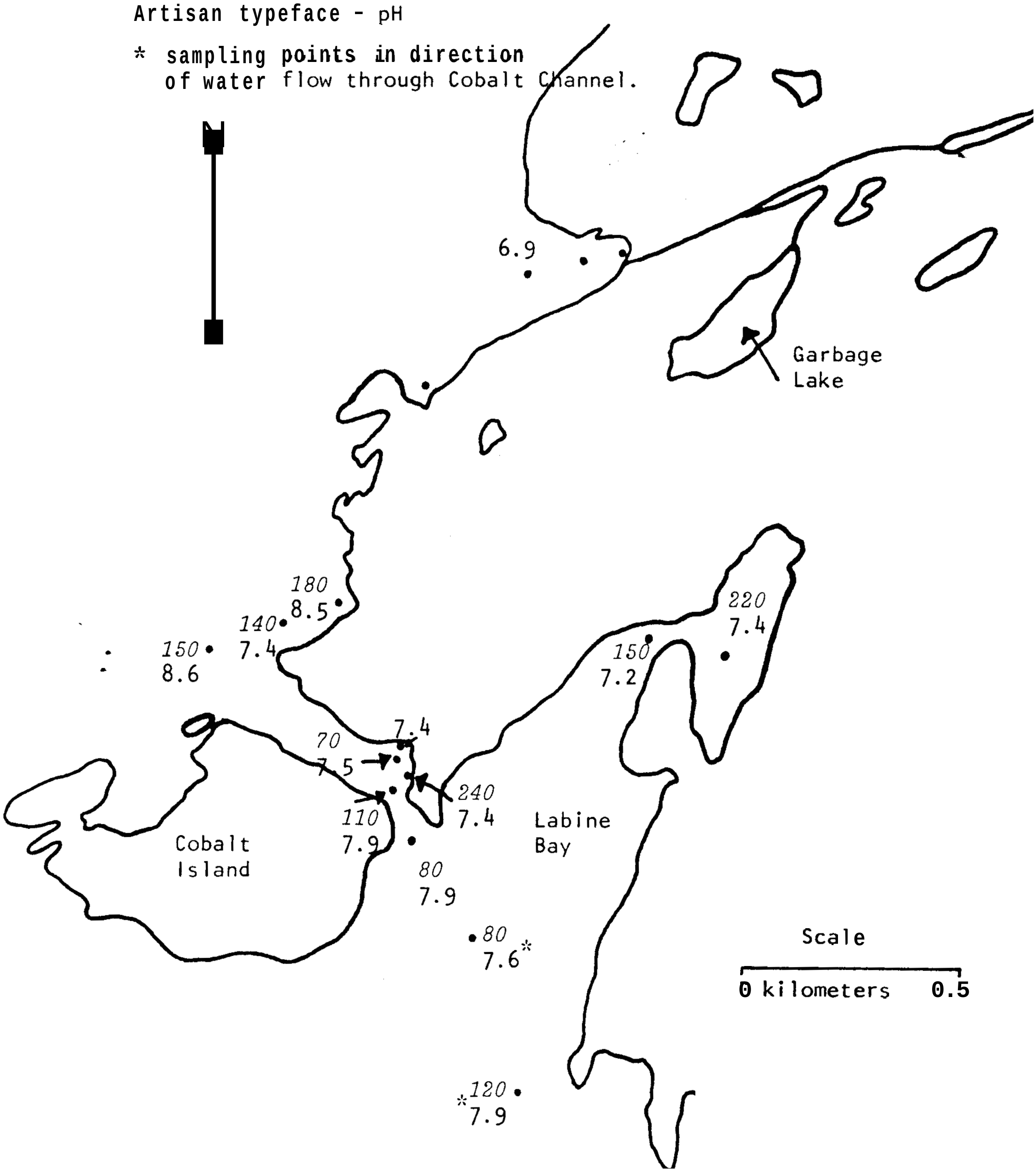
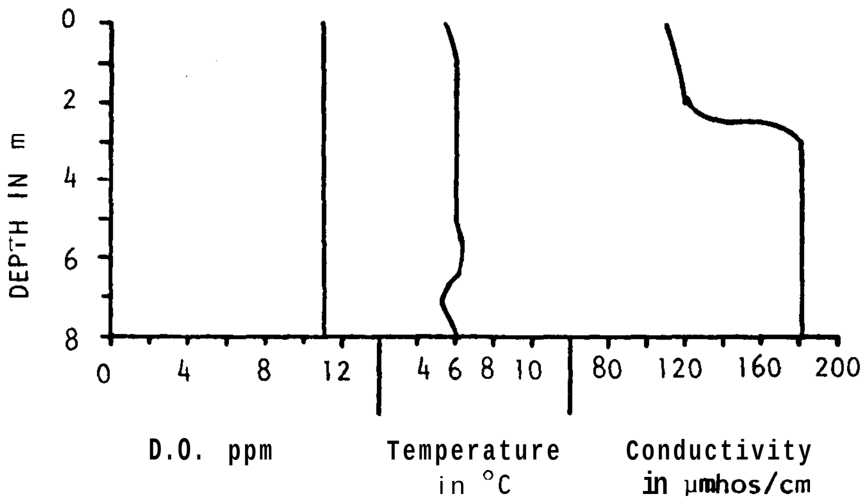


Figure 7: Water column characteristics in the middle of Cobalt Channel.

Site 4 - Cobalt Channel:



D. Vegetation on the Port Radium Peninsula

The aim of the decommissioning or 'cleaning up' a mine site may often be to leave the area in a condition which minimizes environmental degradation and optimizes natural recovery of the site. In order to facilitate such aims, parameters which may result in environmental degradation have to be identified and conditions for a natural recovery have to be described. Potential contamination of the foodchain leading to fish should be considered. Clearly the algal bloom on Bear Bay could potentially present an undesirable food source for fish as the algae may accumulate metals and radionuclides. Indeed, from discussions with personnel on Site, it became evident that Bear Bay has always had many fish. i.e., good fishing hole! Thus, material of the algal bloom has been collected and will be analyzed for radionuclides and heavy metals. The periphyton was tentatively identified as algae consisting mainly of members from the order of Ulotrichales.

On the peninsula vascular plants, mosses and lichens were collected and the waste types on which they were found noted The colonization of waste material by indigenous vegetation

Table 4: Vascular and non-vascular plants in tailings discharge areas.

OVERBURDEN - OUTSIDE LABORATORY

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Gramineae	Poa cf alpigena (E. Freis.) Lindm.	Bluegrass
Leguminosae	Oxytropis varians (Rydb.) Holt.	Locoweed
Cruciferae	Arabis hirsuta var. pycnocarpa	Hirsute rock cress
	A. alpina L.	Alpine rock cress
	Rorippa hispida (Desv.) Britt. var. hispida	Hispid yellow cress
Saxifragaceae	Androsace septentrionalis L.	Pygmyflower

CROSS FAULT LAKE

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Side of waste rock:		
Bryophyta	Aulacomnium turgidum	
Equisitaceae	Equisetum arvense L.	Common horsetail
Gramineae	Calamagrostis canadensis (Michx.) Beauv.	Marsh reed grass
	C. neglecta (Ehrh.) Gaertn., Mey & Schreb.	Narrow reed grass
Salicaceae	Salix cf. athabascensis Raup.	Athabasca willow
Onagraceae	Epilobium angustifolium L.	Narrow-leaved fireweed
Cruciferae	Descureania sophoides (Fisch.) Schultz	Northern flixweed
Shore of Cross Fault Lake (moist areas):		
Equisetaceae	Equisetum hyemale L.	Common scouring rush
Cyperaceae	Carex aquatilis Wahlenb.	Water sedge
	Eriophorum cf. angustifolium Hanek.	Tall cotton grass

'Table 4: Vascular and non-vascular plants in tailings discharge areas cont'd.

CROSS FAULT LAKE CONT'D

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Waste rock:		
Betulaceae	Betula papyrifera Marsh.	White birch
Lichens	Cetraria nivalis	
	Stereocaulon cf. tomentosa	
	Cladonia cf. pyxidata	
Mosses	cf. Dicranella spp.	
	cf. Trichocolea tornentella	

BEAR CREEK

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Juncaceae	Luzula confusa Lindb.	Northern wood rush
Onagraceae	Epilobium angustifolium L.	Narrow-leaved fireweed
Gramineae	Poa pratensis L.	Kentucky blue-grass
Equisetaceae	Equisetum arvense L.	Common horsetail

MURPHY CREEK

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Pinaceae	Picea glauca (Moench.) Voss.	White spruce
Cupressaceae	Juniperus horizontalis Moench.	Creeping juniper
Equisitaceae	Equisetum arvense L.	Common horsetail
Gramineae	Poa cf. alpigena (E. Freis.) Lindm.	Bluegrass
Betulaceae	Betula papyrifera Marsh.	White birch
	B. glandulosa Michx. (B. glandulifera)	Shrub birch
Salicaceae	Salix cf. bebbiana Sarg.	Beaked willow

Table 4: Vascular and non-vascular plants in tailings discharge areas cont'd.

MURPHY CREEK CONT'D

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Eleagnaceae	Shepherdia canadensis (L.) Nutt.	Buffaloberry
Rosaceae	Rosa acicularis Lindl.	Prickly rose
Leguminosae	Hedysarum alpinum L. var. americanum Michx.	American hedysarum (yellow broom)
	Oxytropis varians (Rydb.) Holt.	Locoweed
Ericaceae	cf. Vaccinium uliginosum L.	Alpine blueberry
Compositae	Aster cf. sibiricus L.	Siberian aster
Mosses	Bryum cf. capillare	

WEST AUDIT TAILINGS

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Mosses	cf. Pohlia/Mielichhoferia spp.	
	Bryum argenteum	Silver bryurn
Equisetaceae	Equisetum scirpoides Michx.	Dwarf scouring rush
Salicaceae	Salix bebbiana Sarg.	Beaked willow
	S. cf lanata L. spp. richardsonii (Hook.) Skvortz.	Richardson's willow
Betulaceae	Betula glandulosa Michx. (B. glandulifera)	Shrub birch
Gramineae	Poa pratensis L.	Kentucky blue-grass
	Calamagrostis canadensis (Michx.) Beauv.	Marsh reed grass
Ericaceae	Ledum groenlandicum Oeder.	Labrador tea
	Phyllodoce coerulea (L.) Bab.	Mountain heather
	cf. Vaccinium uliginosum L.	Alpine blueberry

Table 4: Vascular and non-vascular plants in tailings discharge areas cont'd.

CONTROL BAY

FAMILY NAME	GENUS/SPECIES/VARIETY	COMMON NAME
Mosses (control 2)	Thuidium abietinum	
	Dicranum cf. majus	
Entrance #2	Pohlia cf. annotina	
Lichens (control 2)	Cetraria nivalis	
	C. cucullata	
Gramineae	Agropyron cf. violaceum (Hornem.) Lange	Wheat grass
	Poa cf. alpigena (E. Freis.) Lindm.	Bluegrass
Salicaceae	Salix bebbiana Sarg.	Beaked willow
Ericaceae	Pyrola asarifolia Michx. v. purpurea (Bunge) Fern.	Purple winter-green
Onagraceae	Epilobium latifolium L.	Broad-leaved fireweed
Saxifragaceae	Saxifraga tricuspidata Rottb.	Three toothed saxifrage
Leguminosae	Hedysarum alpinum L. var. americanum Michx.	American hedysarum (yellow broom)

is indicative of the mechanisms which operate in colonization process. Waste rock produced by Echo Bay Mines Limited or earlier by Eldorado Nuclear Limited has no vegeation. If waste rock has been mixed somewhat with overburden some vegetation has become established Overburden is understood to be any kind of unconsolidated material which can be found on the peninsula. It is important to recognize that it does not require soil type material that some plants grow. If overburden is mixed with tailings, as a result of tailings discharge through creeks (e.g., Murphy Creek and Bear Creek) some vegetation has also been established.

In Table 4 a list of plants is given, with reference to the locations in which they were collected. The collections made are a representative sample of plants occurring on the different waste materials surveyed.

The rocky nature of the Port Radium peninsula, the exposure on the shores of Great Bear Lake provides conditions, under which only sparse vegetation cover develop naturally. More protected areas, for example, around Cross Fault Lake, have a denser vegetation cover between many barren rock outcrops. The potential of using vegetation to mitigate any potential effects of the wastes based on these observations, appears unpractical.

CONCLUDING REMARKS

An identification of various waste materials, plants, water and sediment characteristics is necessary to evaluate potential environmental problems which am arise after the area is abandoned. This brief inventory presented for the Port Radium site can be summarized as follows

On land, uranium mill tailings are we. Silver tailings are abundant, but well confined. Waste rock from uranium and silver mining is found in large quantities Uranium mill tailings and silver tailings are on the bottom of Cobalt Channel and have been carried along with the water flow southward. Knowledge of location of waste materials along with the determination of chemical characteristics of the material will facilitate an assessment of any potential environmental degradation from these wastes This report was intented to provide an overview of the environmental conditions on the Port Radium site.