Final Report

Former Navigational Aid and Weather Station, Radio Island, Nunavut

Environmental Site Delineation and Material Inventory

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Environmental Site Delineation and Material Inventory

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FORMER NAVIGATIONAL AID AND WEATHER STATION

RADIO ISLAND, NUNAVUT

ENVIRONMENTAL SITE DELINEATION AND MATERIAL INVENTORY

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FORMER NAVIGATIONAL AID AND WEATHER STATION

RADIO ISLAND, NUNAVUT

ENVIRONMENTAL SITE DELINEATION AND MATERIAL INVENTORY

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EXECUTIVE SUMMARY

The Radio Island navigational beacon site is located to the southwest of Resolution Island, which itself is located to the southeast of Baffin Island, Nunavut. The site was set up by the Canadian Department of Transport as a navigational aid and weather station and it was used until 1961. The environmental site issues at Radio Island include former landfills and buildings as well as abandoned hazardous materials (lead paint, asbestos), and barrels.

Indian and Northern Affairs Canada (INAC) retained Environmental Services, Public Works and Government Services Canada (PWGSC) to design a remediation plan for the site at Radio Island. In order to complete the design, information gaps in the previous site assessment work needed to be identified and additional site assessment work was required. Earth Tech completed the field investigation portion of the project September 3, 2001. The field program included an investigation to delineate soil contamination, completion of an inventory of materials abandoned on the property, and an investigation for potential landfill sites, and borrows pit locations.

The following conclusions can be drawn from the environmental assessment that has been completed during September 2001 at the former Navigational Aid and Weather Station at Radio Island, Nunavut.

- The Radio Island site is remote and difficult to access. In the current condition it poses a small health and safety risk, and a moderate to high ecological risk.
- Metals contamination exceeding CCME-1999 criteria exists in a number of areas at the station. Contaminated soil volumes have been estimated using the laboratory and survey/sample data. Due to difficult access and time constraints during the site visit, not all areas within the long and narrow ravines were delineated for heavy metals. The volume of contaminated soils was estimated based on field observations which identified the location of the soils in the ravines and the location of the delineating bedrock ravine faces.
- Hydrocarbon soil contamination exceeding criteria has an estimated volume of 312 m^3 in the vicinity of the former generator building and with a 25% contingency equates to approximately 400 m^3.
- Soil contaminated with heavy metals exceeding CCME-1999 criteria exists in a number of areas at the station and totals approximately 800 m^3. With a 25 % contingency applied this equates to approximately 1,100 m^3.
- Hazardous and non-hazardous material has been identified and quantified to allow for disposal planning. The crushed volume of non-hazardous material is approximately 320 m^3 and with a 25% contingency applied equates to 400 m^3. The volume of hazardous material is approximately 10 m^3 with a 25% contingency and rounded up equates to approximately 15 m^3.
- Some soil sample locations may be classified as leachable hazardous waste due to very high lead and zinc concentrations in the investigation and delineation

samples. The estimated volume of leachable hazardous waste is approximately 6 m^3 and with a 25 % contingency applied is approximately 8 m^3.

- Areas for the landfilling of non-hazardous debris have been identified and no sources of natural borrow material were identified.
- A map with elevations and key ravine locations has been surveyed and will prove very useful for remediation project planning.

1.0 INTRODUCTION

1.1 Background Information

The Radio Island navigational beacon site is located to the southeast of Resolution Island, which itself is located to the southeast of Baffin Island, Nunavut. The location of Radio Island is presented in Figure 1.1. The site was set up by the Canadian Department of Transport as a navigational aid and weather station and it was used until 1961. The site is remote and is only accessible by helicopter or by boat during summer months. Boat access is only possible through a cove on the north shore and is susceptible to 10 m high tidal fluctuations. The site is situated at Lat $61^0$18'N, and Long $64^0$52' W.

The environmental site issues at Radio Island include former landfills and buildings as well as abandoned hazardous materials (lead paint, asbestos), and barrels. There was very little PCB containing equipment used on site and previous studies did not reveal levels of PCB's above the applied criteria. The site was primarily powered by coal brought in by ship, which greatly reduced the amount of fuel and barrels required on site.

1.2 Scope of Work and Objectives

As a result of the Treasury Board Federal Contaminated Sites Assessment Initiative (FCSAI), Indian and Northern Affairs Canada (INAC) is undertaking an environmental site assessment and remedial action plan design for the Radio Island site. The purpose of this undertaking was threefold:

1. To document facility, contaminant and physical site characteristics;

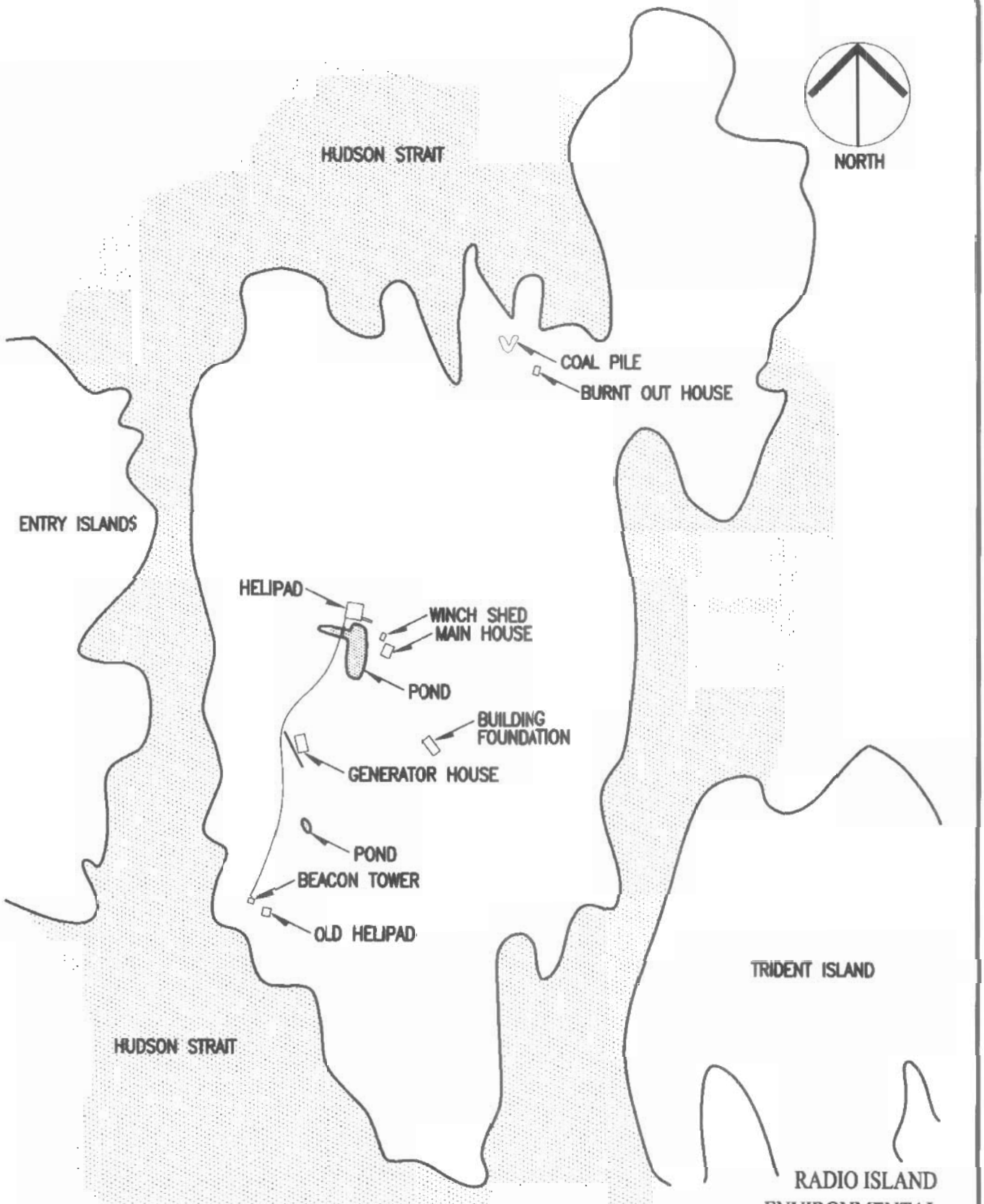
2. To finalize delineation of contamination (degree, nature, estimated extent and media affected) and site conditions (geological, hydrogeological and hydrological) so an effective remedial action plan can be developed; and

3. To develop a remedial design for the sites, complete with specifications, plans and a Class "D" cost estimate to undertake the work.

INAC has retained Environmental Services, Public Works and Government Services Canada (PWGSC) to design a remediation plan for the site at Radio Island. In order to complete the design, information gaps in the previous site assessment work needed to be identified and additional site assessment work was required. The Radio Island site was one of four sites completed on the site visit. The other three sites included in this project were, Padloping Island, Bear Island, and Cape Christian.

Earth Tech Canada Inc., formerly Reid Crowther, has prepared this report to complete the site assessment of the Radio Island abandoned military site in accordance with the Terms of Reference provided by PWGSC on August 2, 2001.

The scope of work that was proposed for this environmental assessment has been presented in Table 1.1 on the following page. The table is a brief overview of the detailed scope of work presented in the project Terms of Reference provided by PWGSC.



RADIO ISLAND
ENVIRONMENTAL
SITE ASSESSMENT

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

OCTOBER, 2001 FIGURE 1.2
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Table 1.1 Scope of Work Summary for Radio Island

Task	Scope of Work	Comments
1. Site Logistics	From Iqaluit travel to Radio Island by helicopter, return to Iqaluit.	Hire polar bear monitor from Iqaluit HTA.
2. Delineation of Impacted Areas	Areas in ESG report with analytical results showing exceedances to DCC I and DCC II criteria.	Areas are to be delineated for the specific parameter identified in the ESG report.
3. Quantify Non-Hazardous Debris	Quantify the volume of all non-hazardous debris with the view to on-site disposal. Includes remains of infrastructure, metal debris, empty barrels, equipment, and coal.	Due to lack of borrow material all debris may have to be removed from the island for disposal, possibly at Resolution Island.
4. Quantify Hazardous Debris	Quantify the volume of all hazardous debris with the view to removal and off-site disposal. Includes leachate toxic soil, batteries, panel containing asbestos.	Asbestos material can be bagged and landfilled on-site.
5. Site Drawings	Mark up existing available drawings and site plans to identify all features, buildings, equipment and areas.	Using a total station but not to produce detailed contour map.
6. Lab Analysis and Data Evaluation	Submit to CAEAL accredited laboratory the soil and liquid samples from Task 2 above. Data tabulation and evaluation.	
7. Prepare Draft Report	Prepare draft assessment report (two hard copies and two CD copies) for review by PWGSC and INAC.	Required by October 15, 2001.
8. Submit Final Report	Provide final report (5 hard copies and two CD copies) incorporating review comments.	Provide within two weeks of receipt of review comments from PWGSC and INAC.

1.3 Previous Environmental Investigations

The only previous environmental work completed on the site, was a 1996 report prepared by the Royal Military College, Environmental Sciences Group (ESG), "An Environmental Site Assessment of Radio Island, NWT".

This report was used as a template for gathering and compiling specific information on the Radio Island site. The ESG report provided the site history, sampling criteria, and background data needed to design the follow-up sampling program and site logistics.

The data in the ESG report indicated that samples and information were gathered during the field investigation program was not able to accurately delineate the extent of

contamination or provide a detailed inventory of materials on site. Hence, the need for an additional site visit for filling the information gaps and delineating the contamination that was identified in the ESG report.

1.4 Earth Tech Work Completed

Earth Tech completed the field investigation portion of the project September 3, 2001. The information gathered by Earth Tech will be used to prepare a remediation design and to prepare tender packages for the subsequent remediation of the site. An overall site plan showing site features is provided in Figure 1.2 and an elevation map prepared by Earth Tech is provided in pull-out format in Appendix A (Figure 1.3).

The field program included an investigation to delineate soil contamination, completion of an inventory of materials abandoned on the property, and an investigation for potential landfill sites and borrow pit locations.

1.5 Methodology

1.5.1 Soil Sampling

Soil sampling was completed by first reviewing the information in the ESG report and identifying the areas requiring delineation sampling. The team members responsible for delineation sampling identified and located the areas sampled by the ESG team in 1995 by conducting a short reconnaissance walk over of the site. This was somewhat of a challenge as the site plans were vague and not to scale. Most of the areas were found by looking for the identification tags and pegs installed by the ESG team. Many of the tags were still intact making locating the areas of concern a little easier. Tags that were missing had their respective areas located by matching descriptions in the report appendices to site features as well as site photographs.

Most of the soil sampling to be conducted on site involved delineation of heavy metals and hydrocarbon contamination. Heavy metals cannot readily be identified in soils by visual observation. The metals are usually carried or spread by oxidizing over time and being carried by surface or groundwater, or more commonly and rapidly, carried and spread by a solvent. At the Radio Island site many of the areas impacted with heavy metals were over grown with mosses and grasses within the narrow drainage pathways and any hydrocarbon staining associated with the heavy metal contamination could not be identified by visual observation.

Having identified/located the area to be sampled, a small shovel was used to retrieve the soil samples. This was particularly useful as many of the samples were beneath a thick blanket of arctic moss requiring removal much like cutting a household carpet and rolling it back. The sample shovel was cleaned with a small wire brush and wiped with a paper towel between sampling points to prevent cross contamination between sample locations.

The samples were placed in sealable plastic bags and labeled accordingly. Samples collected for hydrocarbons were placed in glass jars with Teflon-lined lids as soon as possible after retrieval to prevent volatilization of any light end hydrocarbons that may possibly remain in the sample. Upon departure from the island, samples from the site

were placed in ice pack filled coolers for preservation prior to transporting to the laboratory in Edmonton, Alberta. Prior to sealing the cooler for transport from Iqaluit to Edmonton, fresh ice packs replaced the original ice packs and a completed chain of custody/analytical request form was sealed in cooler for the courier south.

1.5.2 Product Sampling

No product was identified on the island and subsequently no liquid product samples were retrieved from the Radio Island site.

1.5.3 Asbestos Sampling

The Earth Tech team was equipped to sample asbestos with proper PPE and had a certified asbestos abatement person (Don Roy) on site should the need have arisen. No additional (or previously unidentified by ESG) asbestos containing material (ACM) was located and therefore no sampling was undertaken.

1.5.4 Paint Sampling

A single paint sample from the exterior of one of the buildings was retrieved while on site. A dedicated stainless steel putty knife/scraper was used to remove the flecks of paint and placed in a sealable plastic bag.

1.5.5 Landfill and Borrow Pit Identification

The landfill and borrow pit areas were identified with the aid of the ESG report, general site reconnaissance, and the examination of potential areas by the Earth Tech project team. The landfill sites were chosen based on their distance from the ocean and/or on site freshwater receptors, accessibility, distance from the site and major debris concentrations, topography and gradient for the prevention of leachate passing through the buried debris, and accessibility to fill cover.

Borrow sites were not easily identified, as the island is very rugged with very little soil.

1.5.6 Site Survey

Procedures undertaken for the site survey initially included all team members walking through the site to examine the lay of the land, identify important structures and significant features, and correlate potential sampling locations with the ESG reports. Based on these findings, survey control points were laid out in key positions across the site to establish the grounds for an efficient survey. The site survey was performed by an experienced surveyor (Greg Farion) using a TOPCON GTS-212 total station and was assisted by a rod person. Where possible, a second rod person (taken from the sampling crew) was utilized to increase productivity of the survey. The survey scope for each individual site was based on the requirements in the request for proposal from PWGSC, as well as, any information considered to be of use to PWGSC for the cleanup of the sites. Data collected during the survey had descriptor codes attached based on typical Earth Tech coding. A field book was also kept of the survey, which supplemented most survey points with additional information and descriptions to be used in the office once the points were downloaded. At the completion of each day, data collected for that day

was downloaded and stored onto a lap top computer and imported into EMXSAcad (AutoCAD based earthwork program) to check for erroneous data and to plan for the next day's survey. This data was backed up on 3 ½" floppy disk and protected in a waterproof bag. Upon return to the Edmonton Earth Tech office all four-site surveys were transferred from the laptop and site plans and supplemental drawings were created for the report.

1.5.7 EM Survey

Due to the rugged terrain of the island and most of the debris being trapped in low areas within drainage patterns, it was not practical to conduct and EM survey and subsequently was not included in the terms of reference for this project.

1.5.8 Petroflag and Enviroguard Field Tests

Due to time constraints, remoteness, and lack of available cargo space in the only available helicopter to transport the field crew to the site, the Petroflag and Enviroguard tests kits were not used to aid in the on site delineation.

1.5.9 Soil Volumes

Due to the lack of soil on site, volumes of impacted soil were determined based on the depth to granite bedrock. Soil samples for delineation were collected in areas identified in the ESG report and submitted for analytical testing. Once the laboratory data was reviewed, exceedances to he applied criteria were plotted on the site plan and a surface area was calculated. The average depth to bedrock then multiplied by the surface area to obtain a volume. Although the volume calculation itself is simple, several assumptions for the depth of contaminant needed to be made.

Several other extensive studies conducted in Arctic have shown that vertical subgrade mobility of hydrocarbons is somewhat limited by the active layer of permafrost and/or bedrock. There were only a few areas that appeared to be impacted by hydrocarbon contamination and it should be noted that hydrocarbons are typically the most common carrier of heavy metal contamination; some finite assumptions can be made as to the depth of heavy metals being limited by the same factors. The investigation at the Radio Island site was carried out near the time of year when the thickest layer of thawed soil is present. In most cases this provides an opportunity to investigate the depth of actual penetration in the soil, however due to the lack of soil at Radio Island, the depth of penetration is assumed to be bedrock.

The standard used for calculating depth of contaminants at Radio Island depended on the setting of the area being investigated. Very few impacted areas were broad or flat and most were consisted of drainage channels leading to lower elevations on the island. The pitch or sides of the drainage channels were also inconsistent in angle and width. This type of setting provided for typical impacted areas to be broader at the source, narrowing within the drainage pathways (sometimes to as little as 300 mm in width), and broadening again in low flat ponded areas. The soil volume for each area (described in detail in Section 2 of this report) is presented in brief below:

- Main Station Area, heavy metals and petroleum hydrocarbons were investigated in the areas around the buildings, former buildings, dumpsites, helipads, and mostly in drainage patterns and low areas. Soil was scarce in all locations. The assumed depth to bedrock is 0.5 m (maximum).

- Beach Area and Coal Off Loading Site, heavy metals and petroleum hydrocarbons were investigated in soil around these areas. There was a little more soil here at this elevation on the island (likely sedimentary accumulations due to erosion). The assumed depth to bedrock is 0.5 m.

It should be noted that sampling in the drainage channels was often treacherous as the inclination in the channels can be very steep. This limited and even restricted further sampling down gradient in some areas of the drainage channels. Due to no safe access, some delineation areas were calculated based on the length and width of the channel.

2.0 CONTAMINANT INVESTIGATION

2.1 Main Station Area

The area surrounding the main station area had the most samples collected by ESG in 1996. The majority of the samples were retrieved in small drainage ravines around the main house, winch shed, former powerhouse, and in areas where debris was discarded on the ground surface. The ravines and drainage patterns are typically low areas were debris was deposited. The ESG report determined that contaminated soils (typically heavy metals) were present in the waste filled ravines and was likely migrating through the local drainage patterns.

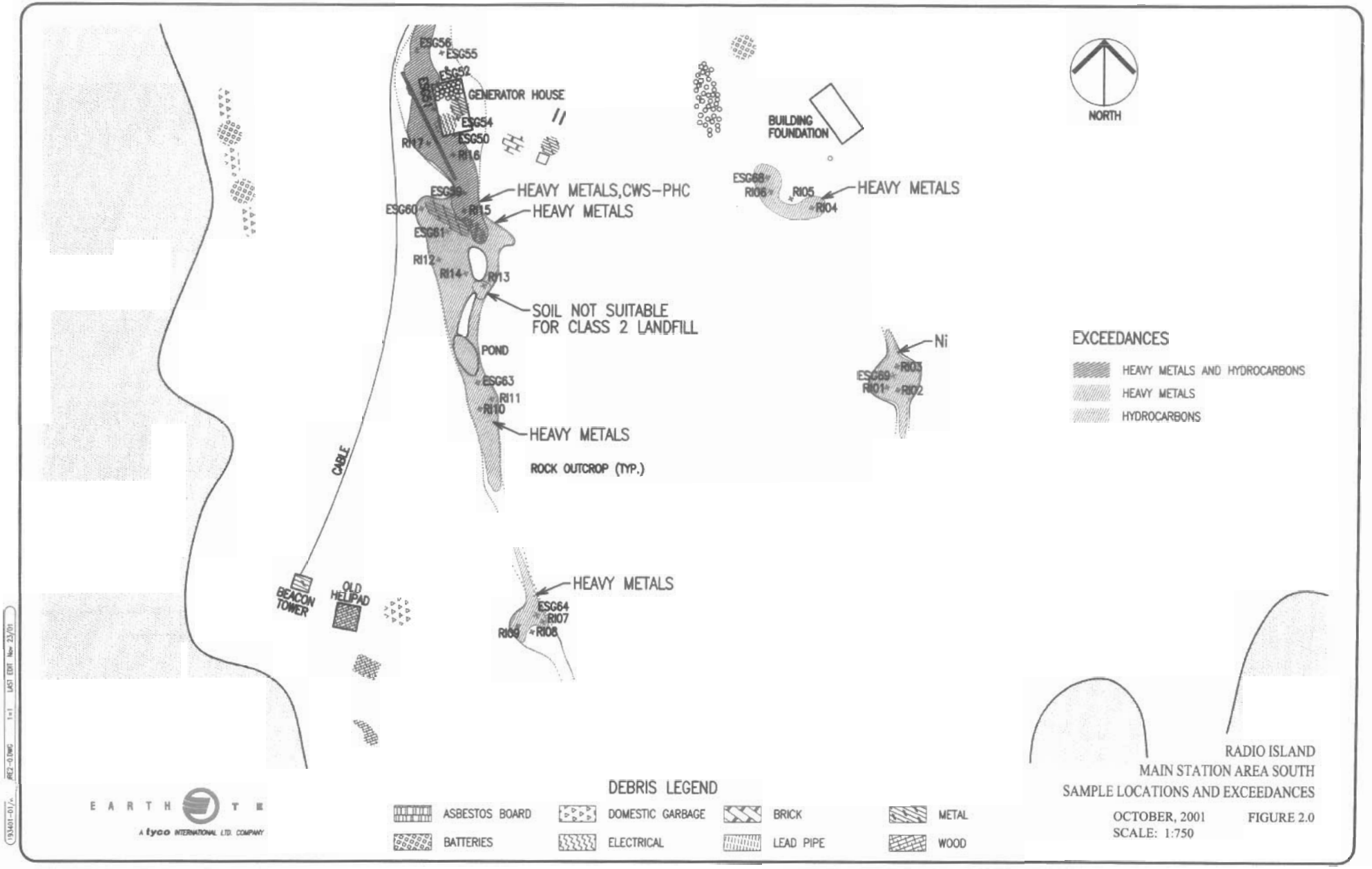
The ESG sample locations were assigned a four-digit number with a letter prefix and the sample point(s) for the location were identified with an ESG tag number. (i.e. G7508, Tag #9) Where possible, the ESG tags were located in the field and correlated to the site/location description in the report. Where the tags could not be located or there was no tag, the description provided in Appendix C of the ESG report was used to locate the sample area. The location of identified areas having exceedances and requiring delineation in the vicinity of the main station area is presented in Figure 2.0 (south half of site), and Figure 2.1 (north half of site).

Table 2.1.1 identifies the locations having exceedances in the ESG report and presents the subsequent delineation sampling results for these areas. Appendix B provides site and sample location photographs, and Appendix C presents a copy of the lab reports.

The data in Table 2.1.1 uses the same criteria presented in the in ESG report however, since the ESG report was published, two new sets of relevant criteria have been published by the CCME. The first is the Canadian Environmental Soil Quality Guidelines, 1999, which presents updated scientifically defensible soil chemistry derived from the CCME 1991 Interim Canadian Environmental Quality Criteria for Contaminated Sites. The second set of newly published criteria is the Canada Wide Standards for Petroleum Hydrocarbons in Soil January 2001, (CWS-PHC). The CWS is a 3-tiered, risk-based, remedial standard developed for four generic land uses – agriculture, residential /parkland, commercial, and industrial. The CWS criteria applied to the Radio Island site is Residential/Parkland for course-grained soils between 0 and 1.5 m in depth.

The data presented in Table 2.1.1 indicates that there are exceedances outside of the ESG sampled areas and that delineation as been achieved in some areas. Table 2.1.2 briefly describes each site in the vicinity of the station area, and presents the results of the investigations conducted. Table 2.1.2 also provides and estimate as to the volume of impacted soil at each location. The sites are identified for location and delineation on Figures 2.0 and 2.1.

It should be noted that several sample locations across the site that were shown as exceedances in the ESG report did not exhibit exceedances in the Earth Tech 2001 sampling program when compared to the most recent CCME criteria. This indicates the impacted area identified in the ESG report has been delineated or is no longer an exceedance. These areas should be confirmed again for the presence of contamination exceeding the applicable criteria prior to undertaking costly remedial activities such as excavation.


ESG56
ESG55
ESG52
GENERATOR HOUSE
ESG54
ESG50
RI16
RI17
BUILDING FOUNDATION
NORTH
ESG68
RI06
RI05
RI04
HEAVY METALS
ESG59
HEAVY METALS,CWS-PHC
ESG60
RI15
HEAVY METALS
ESG61
RI12
RI14
RI13
SOIL NOT SUITABLE FOR CLASS 2 LANDFILL
POND
ESG63
RI11
RI10
HEAVY METALS
ROCK OUTCROP (TYP.)
CABLE
Ni
ESG69
RI01
RI03
RI02
EXCEEDANCES
HEAVY METALS AND HYDROCARBONS
HEAVY METALS
HYDROCARBONS
BEACON TOWER
OLD HELIPAD
HEAVY METALS
ESG64
RI07
RI09
RI08
DEBRIS LEGEND
ASBESTOS BOARD
DOMESTIC GARBAGE
BRICK
METAL
BATTERIES
ELECTRICAL
LEAD PIPE
WOOD
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
RADIO ISLAND
MAIN STATION AREA SOUTH
SAMPLE LOCATIONS AND EXCEEDANCES
OCTOBER, 2001
FIGURE 2.0
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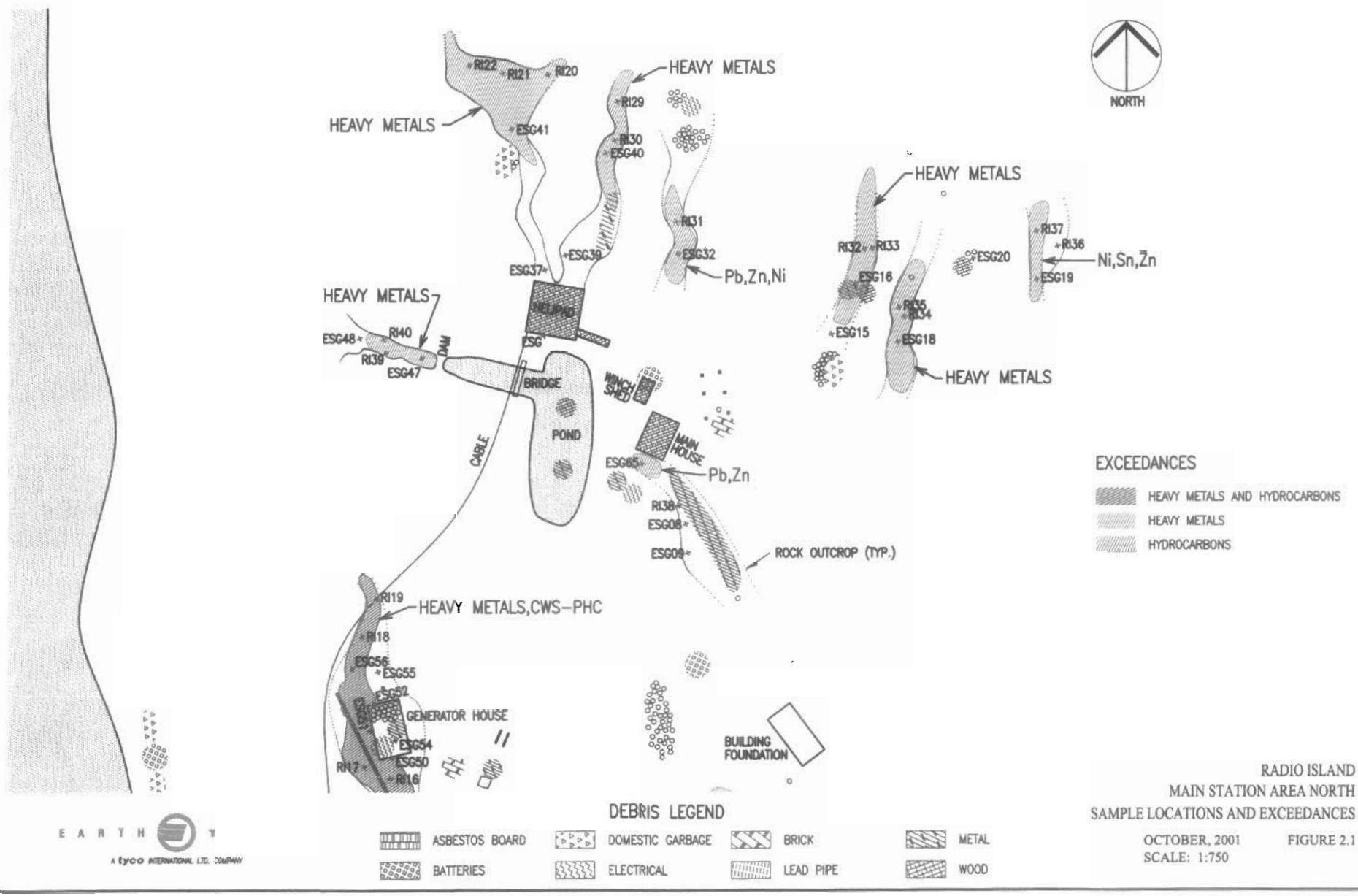
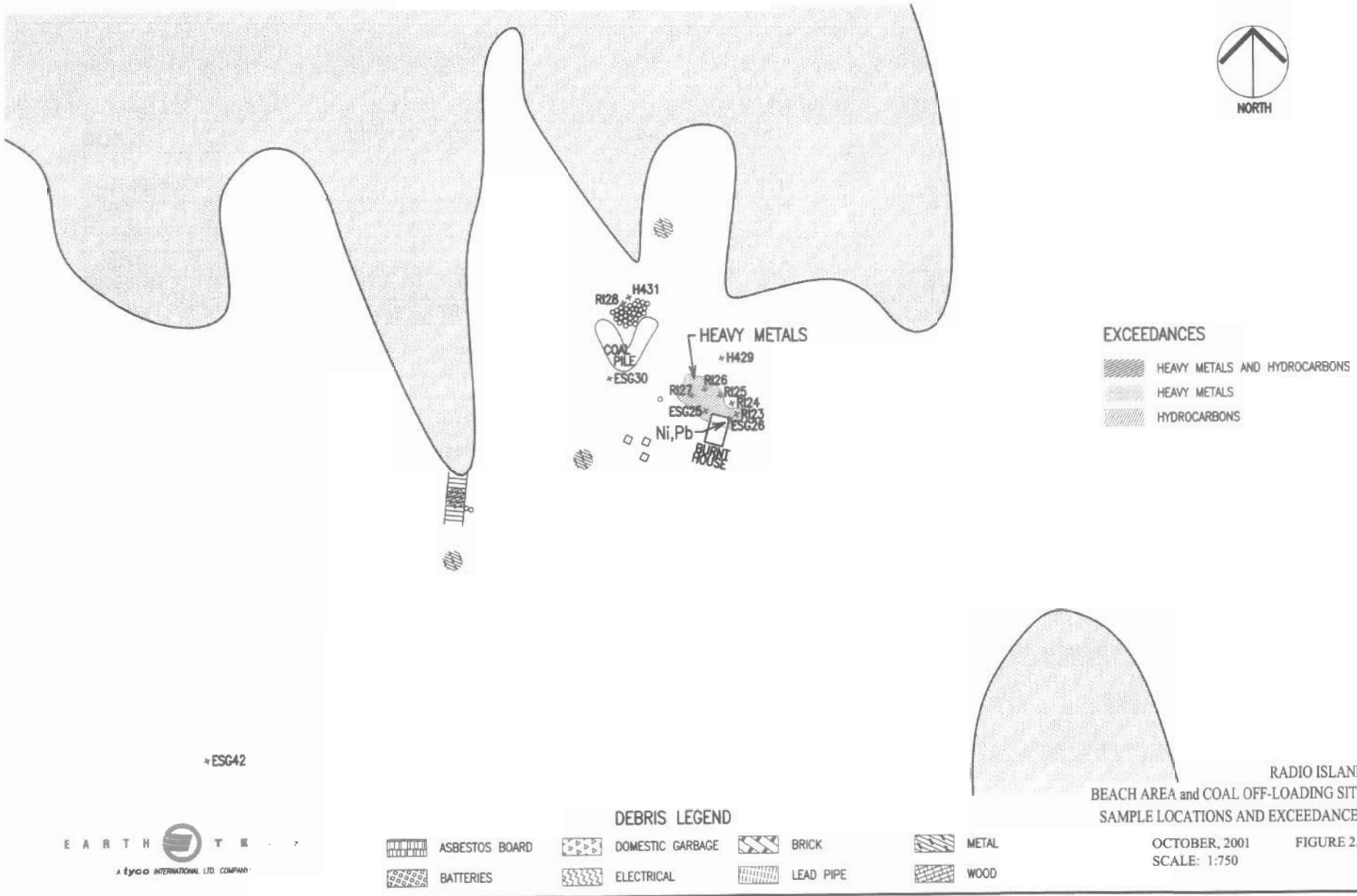

HEAVY METALS
HEAVY METALS
HEAVY METALS
HEAVY METALS
HEAVY METALS
Pb,Zn,Ni
Ni,Sn,Zn
Pb,Zn
HEAVY METALS,CWS-PHC
ROCK OUTCROP (TYP.)
BUILDING FOUNDATION
GENERATOR HOUSE
BRIDGE
POND
CABLE
MAIN HOUSE
WINCH SHED
DAM
NORTH
EXCEEDANCES
HEAVY METALS AND HYDROCARBONS
HEAVY METALS
HYDROCARBONS
DEBRIS LEGEND
ASBESTOS BOARD
DOMESTIC GARBAGE
BRICK
METAL
BATTERIES
ELECTRICAL
LEAD PIPE
WOOD
EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY
RADIO ISLAND
MAIN STATION AREA NORTH
SAMPLE LOCATIONS AND EXCEEDANCES
OCTOBER, 2001
FIGURE 2.1
SCALE: 1:750



EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

RADIO ISLAND
BEACH AREA and COAL OFF-LOADING SITE
SAMPLE LOCATIONS AND EXCEEDANCES

OCTOBER, 2001 FIGURE 2.2
SCALE: 1:750

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Table 2.1.1 Soil Samples
Summary of Laboratory Results
Radio Island, Main Station Area

	Remediation Criteria	Gully South of Building Foundation				Southwest of Building Foundation				Gully East of Old Heli Pad			
Parameter	1999 CCME Residential Parkland mg/kg	**ESG - 69**				ESG - 68				**ESG – 64**			
		8474	RI-01	RI-02	RI-03	8473	RI-04	RI-05	RI-06	8469	RI-07	RI-08	RI-09
Metals													
Antimony	20						<2.0	<2.0	<2.0		<2.0	<2.0	3.2
Arsenic	12	1.5				6.1	6.7	2.9	4.5	1.4	<0.7	3.6	<0.7
Barium	500						39.4	48.9	147		58.2	31.8	120
Beryllium	4						0.3	0.2	0.3		0.6	0.2	1.5
Cadmium	10	<1.0				5.4	0.4	<0.2	1.4	<1.0	<0.2	<0.2	1.5
Chromium	64	<20				**<20**	22.5	10.9	20.7	**34**	21.6	9.6	28.2
Cobalt	50	18.8				**90**	11.3	7.4	**87.6**	**116**	**60.5**	8.7	**107**
Copper	63	43				**137**	**101**	18.8	**112**	**660**	**253**	27.2	**685**
Lead	140	14				**620**	42.6	4.5	**150**	84	8.8	3.4	**1120**
Mercury	6.6						0.15	<0.05	0.76		<0.05	<0.05	2.59
Molybdenum	10						3.3	<0.4	2.3		0.5	<0.4	1.5
Nickel	50	**105**	**120**	**167**	**231**	**84**	**70**	27.1	**99.3**	**840**	**382**	43.5	**801**
Selenium	3						1.3	<1.0	**6.2**		1.0	<1.0	2.7
Silver	20						<1.0	<1.0	<1.0		<1.0	<1.0	<1.0
Thallium	1						<1.0	<1.0	<1		<1.0	<1.0	<1.0
Tin	50						**93.2**	<2.0	6.1		<2.0	<2.0	5.9
Vanadium	130						27.0	16.6	33.7		27.6	15.1	32.5
Zinc	200	189				**1500**	179	26	**447**	**237**	76.8	23.9	**478**

BOLD Indicates exceedances to CCME Residential/Parkland Criteria.

Table 2.1.1 Soil Samples (Continued)
Summary of Laboratory Results
Radio Island, Main Station Area

	Remediation Criteria	**Ravine South of Generator House**						
Parameter	1999 CCME Residential Parkland mg/kg	**ESG – 63**			**ESG - 61**			
		8469	RI-10	RI-11	8466	RI-12	RI-13	RI-14
Metals								
Antimony	20		11.1	9.7		<2.0	**254**	**56.6**
Arsenic	12	1.4	7.5	3.5	7.4	2.6	4.9	6.5
Barium	500		215	110		168	85.4	244
Beryllium	4		0.2	0.2		0.3	0.1	0.3
Cadmium	10	<1.0	8.6	**11.1**	**28**	1	0.2	**115**
Chromium	64	**3.4**	9.6	14.1	<20	20.1	15.0	11.4
Cobalt	50	**116**	44.7	**73.1**	7.2	19.2	4.1	**116**
Copper	63	**660**	**280**	**335**	**348**	**177**	57.6	**623**
Lead	140	84	**4030**	**2110**	**4100**	**527**	**115000**	**21200**
Mercury	6.6		**10.3**	3.72		0.42	0.42	**13.8**
Molybdenum	10		4.5	3.9		0.9	1.3	4.4
Nickel	50	**840**	**120**	**206**	19.9	28.2	21.4	**115**
Selenium	3		**7.6**	**6.9**		2.7	2.0	**9.6**
Silver	20		<1.0	<1.0		<1.0	<1.0	<1.0
Thallium	1		<1.0	<1.0		<1.0	<1.0	<1.0
Tin	50		9.3	6.7		7.7	38.4	22.8
Vanadium	130		24.1	17.5		26.4	18.1	51.4
Zinc	200	**237**	**1270**	**1450**	**3160**	**316**	36.7	**19500**

BOLD Indicates exceedances to CCME Residential/Parkland Criteria.

Table 2.1.1 Soil Samples (Continued)
Summary of Laboratory Results
Radio Island, Main Station Area

	Remediation Criteria		Generator House				Generator House		Generator House			
Parameter	1999 CCME Residential Parkland mg/kg	CWS Res. Course-Grain Eco Soil Contact	ESG-59		ESG – 50		ESG-51		ESG - 52 & 56			
			8463	RI-15	8454	RI-16	8455	RI-17	8456	8460	RI-18	RI-19
Metals												
Antimony	20			148		3.7		4.0			10.2	<2.0
Arsenic	12		10.8	8.1	7.3	5.2	3.6	2.8	4.9	1.1	0.8	1.7
Barium	500			381		1120		**679**			138	175
Beryllium	4			0.4		0.5		0.2			0.3	0.3
Cadmium	10		3.1	7.2	**10.2**	1.2	3.9	4.4	**8.4**	1.0	0.9	1.7
Chromium (total)	64		29	8.1	26	8.0	63	21.5	45	28	27.3	27.1
Cobalt	50		14.7	6.0	11.4	4.6	8.9	4.6	11.2	9.3	9.1	21.0
Copper	63		**354**	**141**	**920**	**148**	**880**	**407**	**560**	**67**	48.4	**71.5**
Lead	140		**18860**	**14000**	**11760**	**2880**	**5380**	**2220**	**8300**	**247**	**793**	**196**
Mercury	6.6			4.72		**31.0**		**14.1**			0.72	1.70
Molybdenum	10			3.5		1.0		0.5			0.6	1.2
Nickel	50		36	14.4	27	15.5	30	22.6	28	24	30.4	37.7
Selenium	3			2.4		<1.0		<1.0			<1.0	1.2
Silver	20			<1.0		<1.0		<1.0			<1.0	<1.0
Thallium	1			<1.0		<1.0		<1.0			<1.0	<1.0
Tin	50			44.3		**102**		43			2.6	2.1
Vanadium	130			27.2		15.8		13.5			34.9	34.6
Zinc	200		**2720**	**1720**	**14560**	**3980**	**3100**	**1240**	**6340**	**640**	**584**	**733**
Hydrocarbons												
Benzene	0.5			<0.04		<0.04		<0.04			<0.04	<0.04
Toluene	3			<0.10		<0.15		<0.10			<0.10	<0.10
Ethylbenzene	5			<0.10		<0.10		<0.10			<0.10	<0.10
Xylenes	5			<0.20		<0.79		<0.20			<0.20	<0.20
F1, (C6-C10),		130		<10		<10		<10			<10	50
F2, (C10-C16)		450		<10		**4100**		**3800**			34	**29000**
F3,(C16-C34)		400		**3500**		**30000**		**10000**			**590**	**20000**
F4,(>C34)		2800		**3500**		**15000**		**1700**			120	**1300**

BOLD Indicates exceedances to CCME Residential/Parkland Criteria.