

**PHASE I AND II  
ENVIRONMENTAL SITE ASSESSMENT**

**Britt Patrol Yard – Highway 526  
Township of Henvey  
Town of Britt, Ontario**

**Prepared for:**

**Ministry of Transportation (MTO)  
North Eastern Environmental Unit  
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## **EXECUTIVE SUMMARY**

DST Consulting Engineers Inc. (DST) was retained by the Ministry of Transportation of Ontario (MTO) to conduct a Phase I and a Phase II Environmental Site Assessment (ESA) on the property described as Lot 2, Concession A, located near the Town of Britt, in Henvey Township, Ontario. The subject property is known as the Britt Patrol Yard.

The ESA indicates that the subject property's use has been industrial and that the adjacent lands are residential and undeveloped forested land.

The Phase I ESA and associated EM survey identified the following potential sources of contamination at the Britt site:

- A review of the completed EM survey identified potential salt contamination west of the salt shed.
- One waste oil UST was reportedly removed from the site. No confirmatory soil or groundwater sampling was carried out during that excavation. As well the current AST waste oil tank is located within the same area and contains signs of surficial soil staining.
- An oil/water separator currently exists on site with discharge to the drainage ditches on-site.
- A salt/sand dome and a salt shed are located on site and have been there since the site was opened in 1977.
- Drainage ditches are located around the boundary of the site, as such surface and building drains discharge to these ditches.
- Based on observations made during the Phase I site investigation of the garage/office building, the presence of asbestos containing material is suspected.
- The building was built in 1976, and likely does contain PCB light ballasts.
- In that the office portion of the garage/office building has been recently painted and that the paint is in good condition, the exposure to lead paint is not suspected. However, the exterior of the salt shed and the storage shed may contain lead paint.

DST Consulting Engineers Inc. performed a Phase II ESA for the Britt Patrol Yard. The field program consisted of the drilling of five boreholes, the installation of a monitoring well, the installation of two

piezometers, the collection of two surface water samples, and a designated substance survey. The following is a summary of the findings:

- The scoped parameter DSS revealed no suspected ACMs, no lead containing paint exceeding criteria limits, and no potential PCB-laden materials in the garage/office building.
- The soil samples for boreholes BH1, BH2, BH3, BH4 and BH5 report chloride levels exceeding the MOE background soil concentrations. Elevated levels of aluminum, calcium, iron, magnesium, sodium and potassium are reported for all boreholes drilled across the site. Currently there are no MOE remediation criteria for these parameters
- The groundwater sample reports exceeding levels of sodium, chloride, iron, manganese and hardness. All other parameters for the samples are within current referenced guidelines.
- The surface water samples report elevated levels of sodium and chloride at B-SW1. There are no current MOE, Provincial Water Quality Objectives (PWQOs) for these parameters. The oil and grease concentration reported for B-SW1 and B-SW2 is elevated.
- Metal anomalies identified during the EM survey were investigated as best as possible considering the safety issues related to the drilling of these areas. No metal items were discovered during the drilling program.
- Borehole BH2/MW1 installed in the vicinity of the former UST tank nest and current waste oil tank, reported no petroleum contamination encountered in this borehole. BH5 drilled in the area of the current diesel ASTs reported only trace levels of xylene, and oil and grease, below MOE criteria.
- Borehole BH4 was drilled to investigate potential contamination associated with the manhole drain outlet. Results report trace amounts of oil and grease in the soils and elevated levels in the surface water in the area.
- No intrusive investigation was carried out at the rear of the garage/office building due to the location of locates in this area. As such, the oil/water separator was not investigated.
- In that the garage floor drain outlet could not be located, drilling was not completed to investigate this area.

## **1.0 INTRODUCTION**

DST Consulting Engineers Inc. (DST) was retained by the Ministry of Transportation of Ontario (MTO) to conduct a Phase I and a Phase II Environmental Site Assessment (ESA) on the property described as Lot 2, Concession A, located near the Town of Britt, in Henvey Township, Ontario. The subject property is known as the Britt Patrol Yard and is located on Highway 526, near the Town of Britt.

## **2.0 PURPOSE OF WORK**

The purpose of the Phase I ESA was to identify actual and potential contamination, which presents environmental risk on or adjacent to the subject property. The investigation was conducted through systematic non-intrusive and intrusive investigation techniques associated with a Phase I and II ESA. Upon completion of the Phase I ESA recommendations were made for additional investigative actions as part of an intrusive Phase II investigation.

The Phase I ESA is conducted to permit formulation of an opinion as to the potential for contamination to exist at the site at levels likely to warrant mitigation pursuant to applicable regulations. The Phase II ESA is conducted to confirm the presence/absence of potential contamination, as identified by the Phase I ESA.

## **3.0 SCOPE OF WORK**

### **3.1 Phase I ESA**

The Phase I ESA was conducted in general accordance with CSA Standard Z768-94, *Phase I Environmental Site Assessment* and ASTM, E 1527-93, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, standards as guidance tools. The Phase I ESA will only address the site from a point in time when the property commenced operation as a patrol yard to the present. The Phase I ESA involved the following:

- ▶ **records review of the site and adjacent properties**, including aerial photographs, property use records, previous site reports, company records of sites (site plans, building plans, permit records, production and maintenance records, spill reporting plans, etc.), geological maps, regulatory information;
- ▶ **site visit to observe the subject property and adjacent properties** for property use,

hazardous materials, unidentified substances, storage tanks, storage containers, odours, and potable water supply;

An interior assessment will specifically address possible PCBs, asbestos containing materials, lead, urea formaldehyde insulation, drains and sumps, heating and cooling systems, fuel sources and stains on floors, walls or ceilings;

An exterior assessment will specifically address possible exterior structures for potential contamination, topographic conditions, wells, sewage disposal, pit and lagoons, stained materials, stressed vegetation, fill, wastewater, watercourses, ditches, or standing water and observation of adjoining properties;

- ▶ **Interviews** pertain to current and past activities and events that may affect environmental conditions at the subject property. Interviews should involve site personnel, third parties (neighbours and former employees), and government officials. And;
- ▶ **evaluation of information and reporting.**

DST relied on information obtained from all parties as accurate, unless contradicted by field observations or written documentation. The following report summarizes the information gathered by DST during the Phase I ESA and identifies the presence or the likely presence of contamination at the site. This report is prepared for the sole use of the MTO and any use of the report, or any reliance on it by any other party, is the responsibility of such party.

### **3.2 Designated Substances Survey**

A limited parameter designated substances survey was carried out for the Britt Patrol Yard. The DSS consisted of inventorying three identified designated substances: asbestos; lead; and polychlorinated biphenyls (PCBs).

Asbestos containing materials (ACMs) were sampled and submitted to a laboratory certified by the National Voluntary Laboratory Accreditation Program (NVLAP) and tested using Polarized Light Microscopy (PLM).

Where practical, paint chips were collected and submitted for lead analysis. Where samples were not collected, a portable kit was used to screen for the presence of lead. Serial numbers from electrical equipment (i.e. fluorescent light ballasts) which may potentially contain PCBs were recorded and checked against manufacturer's records to confirm the presence/absence of PCBs. Ontario Hydro was solicited for information regarding the containment of PCBs in pole mounted transformers located on site, as well as any related leaking or spillage.

### **3.3 Electromagnetic Survey**

In concert with the Phase I ESA, Johnson Geophysics completed an electromagnetic survey of the patrol yard. Only those portions of the patrol yard that exhibited evidence of use or disturbance will have an EM survey completed. The purpose of the EM survey is to map soil conductivity anomalies, which may be present in the subsurface to depths of up to 6 meters. The primary focus of the investigations is to map contaminant plumes, which may exist from existing or historical stockpiles of materials and the historical existence of underground storage tanks.

### **3.4 Phase II ESA**

Prior to initiating the Phase II intrusive investigation, DST was responsible for utility clearances for each patrol yard, with the agreement that MTO would provide the necessary information for utility locates on MTO property.

The field program, consisting of boreholes, was proposed to specifically target potential concerns identified in the Phase I ESA and the previously conducted electromagnetic survey (EM). Field work on the subject property was carried out on November 10, 1999. Borehole locations are provided on the Site Plan, Figure 1 in Appendix B.

For the Britt Patrol Yard, five boreholes were completed at strategic locations with a truck mounted CME 45 drill rig utilizing split spoon sampling methods. Soil samples were collected from the split spoon and the auger flights and sealed in polyethylene bags and glass jars and kept cool until delivered to the lab. The sampling was completed in accordance with applicable MOE protocols and current industry practices. All boreholes were drilled to a depth of 2.9 m. For each borehole, logs were maintained and contain information pertaining to soil characterization such as hand texturing, colour, depth of soil and horizons,



and any visual or olfactory evidence of contamination.

All soil samples were screened using a Gastechtor model 1238ME Gas Detector. The Hydrocarbon Vapour Analyzer measures total hydrocarbon vapour concentrations (THVC), thereby providing a measure of relative vapour concentrations between samples due to hydrocarbon-based contaminants. Subsurface conditions and screening results are provided on the borehole logs, which are included in Appendix D.

Groundwater was encountered in all five of the boreholes, with one permanent monitoring well being installed. The well was established in accordance with accepted industry standards. The groundwater monitoring well was established outside a working area and consisted of a white PVC riser with approximately 1 metre stick-up above the ground with an unlocked cap. The permanent well is equipped with tubing and a dedicated waterra foot valve for sampling purposes. The well was developed and purged three well volumes plus sand pack, or until dry, prior to sampling. One groundwater sample was collected from the monitoring well. Samples were kept cool until delivery to the laboratory. A recovery test was carried out on the permanent groundwater monitoring well to aid in determining the hydraulic properties of the aquifer. In order to determine the direction of groundwater flow, if possible an additional two standpipes were installed at each site (within the drilled boreholes). Typically water samples are not collected from the standpipes and only water level readings are obtained. The standpipes are removed following the recording of the water level readings, and the boreholes backfilled with the cuttings.

DST collected two surface water samples at the Britt Patrol Yard site. The surface water samples were obtained, where possible, at or near the point of surface drainage discharge from the site. As well, if possible, a sample would be collected from a representative background source. No background surface water samples were collected from the Britt site. Surface water samples are collected as grab samples per MOE applicable guidelines.

Designated soil samples were submitted to TestMark Laboratory for analysis within approximately 24 hours of sampling. Soils samples were selected for analysis based on visual and olfactory observations combined with screening results. Five borehole soil samples were submitted for chemical analysis. The submitted samples were analyzed for parameters indicative of contamination due to likely past activities at the subject property, as identified by the Phase I ESA and the EM survey. These parameters included:

petroleum hydrocarbons in the gas/diesel range and petroleum hydrocarbons in the heavy oils range, which are sometimes referred to as total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene and xylene (BTEX), volatile organic compounds (VOCs), phenols; metals; and general chemistry. Regulation 347 parameters will be analyzed for if the site shows signs of contamination and requires clean-up.

A single representative groundwater sample was collected and submitted for analysis of metals, VOCs, chloride, conductivity, hardness, nitrate, iron, sodium, TPH (gas, diesel), BTEX, phenols, pH, organochlorine pesticides and PCBs.

Surface water samples were analyzed for chlorides, sodium, phenols, oils and greases.

#### **4.0 SITE DESCRIPTION**

##### **4.1 Property Description**

The patrol yard is an irregular shaped parcel of property comprised of 3.95 acres located on Highway 526, near the Town of Britt, Lot 2, Concession A, in the Township of Henvey. The Britt Patrol Yard is a sub yard where most activities are conducted during the winter. During the summer the staff report to the main yard in Rutter. The entire 3.95 acres is used at the Britt Patrol Yard.

##### **4.1.1 On-Site Buildings and Structures**

Structures observed on-site include a garage/office building, a salt/sand dome, a salt shed, and a storage shed. Buildings on site were constructed in 1977.

The garage/office consists of a concrete slab-on-grade floor, with steel framing, trusses and metal clad walls and roof. A wall separates the office area from a five (5) bay garage area. The office portion consists of an office, washroom, utility room, storage room and a lunch room. The garage portion contains five bays. Typically equipment maintenance and minor repairs are carried out in the garage area and generally include oil changes, lubrication, vehicle washing and minor maintenance.

The salt/sand dome is constructed on an asphalt pad with concrete walls approximately 0.5 m high, wooden framed walls and shingled roof. The salt shed is also constructed on an asphalt pad with concrete

walls approximately 0.5 m high with wooden frame walls and shingled roof. The storage shed on site is a wooden framed structure with a shingled roof, situated on wooden blocks over a gravel pad. Tools and signs are stored within this structure. None of the buildings on site have basements.

Other site features include an oil/water separator, above ground waste oil tank, an above ground propane tank, potable water well, septic tank and associated field bed, stock piles of gravel, sand and plow blades.

#### **4.1.2 Topography and Drainage**

The geomorphological features describe a relatively flat site with forested, undeveloped land west and residential properties located north and south of the site. The Still River is located east of the site on the east side of Highway 526. The site gently slopes towards the east. Overland flow, two on-site catchbasins and drainage ditches located north and south of the site generally direct surface water runoff from the paved areas of the site. All ditches eventually flow toward the eastern boundary into the ditch located along Highway 526 and through a culvert discharging to the Still River. During the site visit all ditches on-site were observed to be intermittent containing pooled and stagnant water with the exception of the north ditch containing sump pump discharge from the adjacent residence.

#### **4.2 Adjacent Properties**

The site is located within a residential setting with the areas surrounding the subject property including residential and undeveloped, see chart below:

Boundary		Adjacent Property Land Use
North	residential area.	
East	Highway 526 and east of the highway is Still River	
South	residential area.	
West	undeveloped forested land.	

Residential houses located north and south of the site are known to be using potable water wells for water

supply. A potable water well is also used by the patrol yard for drinking water.

## **5.0 PHASE I INVESTIGATION**

### **5.1 Records Review**

The Phase I ESA is only addressing the site from a point in time when the property commenced operation as a patrol yard to the present. As such, historical records were limited to MTO files of aerial photos, property use records, previous site reports, company records (MTO), geological maps and regulatory information.

Aerial photographs were reviewed for general documentation of the development of the site and properties in the vicinity and to identify fill material and on-site waste disposal areas. An aerial photograph of the site for the year 1987 was obtained. The site appears similar to today, with no change in buildings and fill material. Residential dwellings occupy properties to the north and south with undeveloped forested land to the west.

Historical file records indicate that waste oil and varsol has been routinely collected and disposed of by a registered hauler. The waste oil is collected in a steel, 2,273 L (500 gallon) UST. Records are kept of the amount of oil collected in the tank but the tank was never dipped to determine if leakage was occurring. The varsol was collected in 205 L (45 gallon) drums and disposed of when the drum was full. Records indicate that a total of 31 L had been collected over a 2 year period.

Empty paint cans are taken to a proper waste disposal site.

Catchbasin material is routinely shoveled out and taken to the waste disposal area, while the roadsweepings that are swept to the shoulder of the road. Ditching material is typically used as fill material by contractors and for washouts by the MTO. None are stockpiled on site.

Spills are cleaned up with an absorbant compound (speedy dry), and disposed of at a landfill.

Dead animal carcasses are typically disposed of at special pits designated by the Ministry of Natural Resources.

MTO patrol yards located in District 54, Sudbury (and listed in Schedule 'B' of the acknowledgment of Subject Waste Registration correspondence dated June 10, 1999), are covered by a blanket Generator Registration Number ON0124210. The sites are registered for the following wastes: acid waste - heavy metals(112C), acid waste - other metals(113C), alkaline wastes - other metals(122C), alkaline wastes - other metals(122L), neutralized wastes - other metals (132L), brines, chloro-alkali wastes (133L), paint/pigment/coating residues (145B), paint/pigment/coating residues (145H), paint/pigment/coating residues (145L), paint/pigment/coating residues (145N), paint/pigment/coating residues (145T), other specified inorganics (146L), other specified inorganics (146N), other specified inorganics (146T), inorganic laboratory chemicals (148A), aromatic solvents (211H), aliphatic solvents (212H), aliphatic solvents (212I), aliphatic solvents (212L), petroleum distillates (213I), light fuels (221I), light fuels (221L), heavy fuels (222I), heavy fuels (222L), polymeric resins (232H), halogenated solvents (241H), halogenated pesticides (242B), PCBs (243D), oil skimmings and sludges (251L), oil skimmings and sludges (251T), waste oils and lubricants (252T), detergents/soaps (262L), organic laboratory chemicals (263A), organic laboratory chemicals (263L). This does not guarantee that these wastes were generated on the Britt patrol site only that it was permitted under the Generator Registration Number.

A provisional Certificate of Approval (C.of A.) for a Waste Management System (transportation) covers the whole Ministry (i.e. all districts and all patrols within them), and allows for the transportation of wastes between highway locations to patrols and patrols to district yards.

The bedrock geology in the site area consists of regionally metamorphosed Precambrian rocks of the Grenville Structural Province. Predominant rock units include; metasediments, felsic igneous gneisses and migmatites. The surficial geology consists of unconsolidated material in the area of the site and is identified as Pleistocene glaciolacustrine deposits of silt and clay, minor sand, and basin and quiet water deposits. (Map 2556, Quaternary Geology of Ontario, Southern Sheet, MNDM, 1991).

## **5.2 Site Visit**

A site reconnaissance of the subject property was carried out on October 4th, 1999 by an Environmental Technologist from DST's Sudbury office. The objective of the site reconnaissance was to visually assess the surface conditions of the site, the nature of the surrounding area, the potential for designated

substances related to the buildings, and identify indicators of potential environmental risk such as above ground or underground storage tanks, visible staining of soil, discolored or stressed vegetation, on-site storage of hazardous materials, etc. Wherever possible, personnel on site were interviewed for further information regarding the subject site.

### **5.2.1 Utilities**

Below and above ground utilities service the Britt Patrol Yard.

#### **Sanitary System**

The site is serviced by a septic system. An on-site septic tank and associated field bed are located west of the garage/office building. The system was reportedly installed during the construction of the site in 1976 and has not been replaced since. Only the garage/office building is supplied with sanitary facilities.

#### **Water**

The site is not serviced by municipal water. A potable water well is located at an unknown location on site. Only the garage/office building is supplied with potable water. According to the interview with Noel Courchene, the well water was tested in the past and is not contaminated by sodium and chloride but does emit an organic odour. Records indicate the chloride level of the well water was 11 mg/L.

#### **Heat System**

The garage/office building has always been heated with a propane burning furnace and electric base boards. The site visit confirmed that the garage is heated with propane and the office with electric base boards. File reports indicate that the garage was heated with oil.

#### **Electricity**

Electricity is provided from above ground hydro lines running along Highway 526. The site is serviced with underground and above ground hydro lines, which run from the garage/office building to the sand and salt domes, yard lighting and outdoor plugs.

#### **Telephone Lines**

The site is serviced with above ground telephone wires.

### **5.2.2 Above Ground Storage Tanks (ASTs)**

Three AST storage tanks exist on site.

An old unused propane tank is located north of the salt shed, while a second tank is located west of the garage/office building.

The AST waste oil tank is located at the northwest corner of the garage/office building. The waste oil tank was installed approximately 4 years ago and is a 2,273 L (500 gallon) tank on metal legs, with no spill containment pad beneath it. The tank is emptied on an as needed basis. Surficial soil staining was observed on the ground in the area beneath the tank. There are no records of spills or leaks associated with the tank.

### **5.2.3 Underground Storage Tanks (USTs)**

Three UGTs have been removed from the site in the past five years.

According to MTO records, an UST diesel tank and an UST gasoline tank were installed on site in 1977 and removed from the site in 1997. Both tanks were 22,730 L steel tanks and were located at the northwest corner of the garage/office building. File reports indicate that confirmatory soil samples were collected during the removal of the tanks. Results show that no contamination was present within the soil surrounding the diesel tank or the gasoline tank. Groundwater was not encountered during the excavation and no groundwater samples were collected. There are no records concerning reports of spills or leaks. According to site personnel, no fuel USTs are currently existing on site.

According to MTO records, an UST waste oil was installed in 1977 and removed in approximately 1994 to be replaced with an AST waste oil tank. The 2,273 L steel tank was located at the northwest corner of the garage/office building within the same tank nest as the gasoline and diesel tank. There are no records associate with the removal of the tank or potential contamination surrounding soil and groundwater. There are no records concerning reports of spills or leaks. According to site personnel, no waste oil USTs are currently existing on site.

#### **5.2.4 Oil/water Separator**

An underground oil/water separator is currently located on site. Drainage is collected in garage drains and discharged to the oil/water separator. The oil/water separator is located west of the garage/office building, with piping discharging to the south drainage ditch. No oil staining was observed around the oil/water separator outlet at the drainage ditch. Oil staining was observed on the garage floor and in and around the floor drains.

#### **5.2.5 Surface Staining**

During the site reconnaissance of October 4th, 1999, surface staining was observed. Topical staining was observed on the ground below and around the waste oil AST. Surficial oil and grease staining was observed east of the garage/office patrol yard building at the edge of the grass and asphalt section.

Salt staining was observed east of the garage/office building along the edge of the grassed area.

#### **5.2.6 Building Investigation**

Within the garage/office building floor tiles are the originals installed in 1976 and appear to be in good condition. The ceiling tiles observed in the garage/office building lunchroom appear to be the original tiles installed in 1976. Located throughout the office, hallway, utility room and washroom, ceiling tiles appear to be more recent. Copper piping was observed throughout the building but was not wrapped with asbestos containing material. According to historical files and verified during the site investigation, the building is insulated with 2" styrofoam and R-Value-10 insulation. The walls throughout the office section of the building were recently painted and hence are in good condition. There was no evidence of peeling or flaking paint observed throughout the office, hallway, utility room, lunchroom and washroom. The storage room consists of a cement floor and unpainted cement brick walls. This room contains storage cabinets containing paint, solvents, oil and lubricants.

Within the garage, all light ballasts are the original fluorescent lights. Copper piping in this area contain no insulation wrapping. All the walls within the garage area are unpainted metal. A storage shed is located west of the salt shed. During the site investigation, tools and signs were being stored here. According to site personnel, this is typically what is stored in this building and that no hazardous material has or is stored here.



### **5.2.7 Miscellaneous Items**

An area of stressed vegetation was observed east of the garage/office building along the edge of the asphalt area. There were no obvious indicators of odour, discoloration or iridescence on surface drainage at the subject site. There was no wastewater or other liquid discharge at the subject property, other than the septic system and the oil/water separator. There was no indication of any pits, ponds or lagoons on site. Two stockpiles of granular material and sand were observed north of the site. Filling has occurred in the area where the USTs were removed.

### **5.3 INTERVIEWS**

Long time MTO employees at the subject property were approached to answer a series of questions regarding their workplace and past environmental occurrences in the area. In addition, the questionnaire inquired about the presence of any hazardous materials, conditions resulting in environmental risk and the availability of environmental documents.

**Mr. Noel Courchene** (patrol yard employee), was interviewed as part of the Phase I ESA. Mr. Courchene was an employee for the MTO for the past 26 years. He was unable to recall when the renovations had been completed within the office area.

He was aware of the removal of the underground storage tanks but did not know about any sampling carried out during the excavation. During his interview he noted that the waste oil tank had been located in the same tank nest as the diesel and gasoline USTs. He also indicated that the AST waste oil tank, the garage catchment basins and the oil/water separator are maintained on a regular basis. The patrol yard building is now considered to be a winter operations yard only. All routine maintenance is now going to be carried out at the Rutter patrol yard.

**Mr. Phil Lamothe** (acting services supervisor), stated that all PCB containing light ballasts and transformers were removed from MTO patrol yards during a clean-up in the early eighties. He also stated that he was unable to obtain water well records for the site.

**Carmen Besner** (former environmental waste management planner), was employed by MTO from 1988 to 1996, and during that time was responsible for the waste management activities. Carmen had completed a site visit and documentation of all the patrol yards located in District 54 regarding their activities and current practices involving hazardous materials and wastes. She indicated that sites were relatively clean with no major environmental concerns. She was not aware of the use or storage of pesticides at any sites.

#### **5.4 Phase I ESA Summary**

The ESA indicates that the subject property's use has been industrial and that the adjacent lands are residential and undeveloped forested land.

The following is a summary of the findings with corresponding recommendations:

1. A review of the completed EM survey identified potential salt contamination west of the salt shed. An intrusive investigation is required to fully assess the significance. Analysis of samples are to include sodium and chloride.
2. One waste oil UST was reportedly removed from the site. No confirmatory soil or groundwater sampling was carried out during that excavation. As well the current AST waste oil tank is located within the same area and contains signs of surficial soil staining. An intrusive investigation is required to fully assess their significance. Analysis of samples should include TPH heavy oils.
3. An oil/water separator currently exists on site with discharge to the drainage ditches on-site. An intrusive investigation is required to fully assess the significance. Analysis of samples should include TPH, BTEX, and VOCs.
4. A salt/sand dome and a salt shed are located on site and have been there since the site was opened in 1977. An intrusive investigation is required to fully assess their significance. Analysis of the samples should include sodium and chloride.
5. Drainage ditches are located around the boundary of the site, as such surface and building drains discharge to these ditches. An intrusive investigation is required to fully assess their significance. Analysis of the surface water samples should include chlorides, sodium, phenols, oils and greases.
6. Based on observations made during the Phase I site investigation of the garage/office building, the presence of asbestos containing material is suspected. As such, further sampling and analysis is recommended.
7. On a commercial/industrial property such as the Britt Patrol Yard, the most likely sources of PCBs

are from transformers and fluorescent light ballasts. The building was built in 1976, and likely does contain PCB light ballasts. A check of the identification numbers on the fluorescent light ballasts confirmed them as being non-PCB containing. No transformers are located on site. No further sampling or analysis for PCBs is recommended for the site.

8. In that the office portion of the garage/office building has been recently painted and that the paint is in good condition, the exposure to lead paint is not suspected. However, the exterior of the salt shed and the storage shed may contain lead paint, as such confirmatory sampling or analysis of the site is recommended.

## **6.0 DESIGNATED SUBSTANCES SURVEY (DSS)**

A scoped designated substances survey of the Britt Patrol Yard was carried out on October 4, 1999 by DST personnel. The DSS included limited sampling and analysis of suspected materials.

### **6.1 Polychlorinated Biphenyls (PCBs)**

PCBs are found in a variety of electrical equipment manufactured prior to approximately 1977. On a commercial/industrial property such as the Britt Patrol Yard, the most likely sources of PCBs are from transformers and fluorescent light ballasts. Since the garage/office building was constructed in approximately 1977, the age of the building indicates a potential for PCBs to be present in the electrical equipment.

Fluorescent lights are located in the garage/office building. A representative number of fluorescent light ballasts were checked for the verification of the identification numbers. Those lights situated in the office and garage sections of the building were verified as being non-PCB laden. A pole mounted transformer is located south of the garage/office building. Ontario Hydro owns the transformer and is responsible for potential risk. According to Ontario Hydro, all transformers have been cleared of any PCB containing oils. They are not aware of any PCB incidents of leakage on the subject property.

### **6.2 Asbestos Containing Materials (ACMs)**

Asbestos, as a designated substance, is commonly associated with thermal and electrical insulation, floor and ceiling tiles and plaster. ACMs can be divided into two groups: friable and non friable. Friable material means material that can crumble easily by hand pressure and readily releases fibres. Non friable

material will generally release fibres when they are cut or shaped. In 1973, new regulations in Ontario halted the spray application of asbestos insulation and the major Ontario suppliers of pipe and boiler insulation ceased using asbestos in their products. Both of these asbestos applications are prohibited by the new asbestos regulation which came into effect in 1986.

Based on the age of the garage/office building, the presence of ACMs was investigated. A visual inspection was made of all accessible areas of the building, and two samples were collected per applicable guidelines and submitted for analysis of asbestos. The building materials identified as potentially containing asbestos include: floor tiles and ceiling tiles located in the office area. Samples of these areas were collected and submitted for PLM analysis. The analysis reports each individual heterogeneous layer of each sample and the results are presented below:

Sample ID	Location of Suspected ACM	Results
B-AS1	Floor tile from office section	No Asbestos Detected
B-AS2	Hallway ceiling tile	No Asbestos Detected

No asbestos was detected in the floor tile, and ceiling tile samples submitted.

### 6.3 Lead Containing Materials

Lead as a designated substance is commonly associated with paint, old pipes and pipe solder. It has been used extensively in the past. In 1976, the Hazardous Product Act limited the amount of lead in interior paint to 0.5% by weight (5,000 ug/g).

Based on the age of the garage/office building, and that it has been recently painted, the exposure to lead paint is not suspected. However, the exterior of the salt shed and the storage shed likely contain lead

based paint. A portable lead screening kit was used within the garage/office building to confirm the presence/absence of lead based paint and did not detect any lead on the painted walls in this building. Samples of paint observed to be flaking on the storage shed and salt shed were submitted for analysis. Analytical results are presented below.

Sample ID	Location of Suspected Lead Paint	Results (µg/g)
B-LD1	Exterior of salt shed (white paint)	2736.1
B-LD2	Exterior of storage shed (two layers) (white paint/green paint)	1368.1 1305.5

Lead concentrations measured in the samples are below the acceptable guideline limits of 5000 ug/g..

#### **7.0 PHASE II ESA INVESTIGATION**

Detailed subsurface soil conditions are provided in the borehole logs, in Appendix D, and are discussed below.

The generalized surficial stratigraphy at the site is primarily asphalt, grass or gravel, overlying layers of sand. In general, surficial soils across the site consist of brown, medium textured sand over sandy silt. Bedrock refusal was not encountered in any of the five boreholes, however, groundwater was encountered in all five boreholes. A monitoring well was installed in BH2 located east of the former UST tank nest. Piezometers were installed in BH1 and BH4, and used to determine groundwater direction.

Soil samples were screened following MOE vapour testing (head space) protocols. THVCs ranged from 5 ppm to 30 ppm in the boreholes. There was olfactory evidence of petroleum contamination in BH2 and BH5.

Selected soil and groundwater samples were submitted for analytical analysis. The analytical parameters chosen for the specific samples were based on the Phase I ESA, the EM survey and the field screening program. All analytical results are presented below.

## 7.1 Soils

Five borehole soil samples were submitted for chemical analysis. Analytical parameters included TPH, BTEX, VOCs, oil and grease, phenols, chloride and metals. Analytical results are presented below in Table 7.1.1, along with the applicable guideline limits.

**Table 7.1.1**  
Analytical Results: Soil Samples from Boreholes

DESCRIPTION	SAMPLE LOCATION					CRITERIA MOE <sup>(b)</sup>
	BH1	BH2	BH3	BH4	BH5	
Benzene	-	ND	-	ND	ND	0.24
Bromodichloromethane	-	ND	-	ND	ND	0.12
Bromoform	-	ND	-	ND	ND	0.11
Bromomethane	-	ND	-	ND	ND	0.061
Carbon Tetrachloride	-	ND	-	ND	ND	0.10
Chlorobenzene	-	ND	-	ND	ND	2.4
Chloroethane	-	ND	-	ND	ND	ND
Chloroform	-	ND	-	ND	ND	0.13
Chloromethane	-	ND	-	ND	ND	ND
Dibromochloromethane	-	ND	-	ND	ND	0.09
1,2-Dibromomethane	-	ND	-	ND	ND	ND
p-Dichlorobenzene	-	ND	-	ND	ND	0.32
1,1-Dichloroethane	-	ND	-	ND	ND	3.0
1,2-Dichloroethane	-	ND	-	ND	ND	0.822
1,1-Dichloroethylene	-	ND	-	ND	ND	0.0024
1,2-Dichloroethylene	-	ND	-	ND	ND	4.1
1,2-Dichloropropane	-	ND	-	ND	ND	0.010
Ethylbenzene	-	ND	-	ND	ND	0.28
1,1,2,2-Tetrachloroethane	-	ND	-	ND	ND	0.01

**Table 7.1.1 (continued)**  
**Analytical Results: Soil Samples from Boreholes**

DESCRIPTION	SAMPLE LOCATION					CRITERIA MOE <sup>(1)</sup>
	BH1	BH2	BH3	BH4	BH6	
Tetrachloroethylene	-	ND	-	ND	ND	0.48
Toluene	-	ND	-	ND	ND	2.1
1,1,1-Trichloroethane	-	ND	-	ND	ND	28
1,1,2-Trichloroethane	-	ND	-	ND	ND	0.28
Trichloroethylene	-	ND	-	ND	ND	1.1
Trichlorofluoromethane	-	ND	-	ND	ND	NG
Vinyl Chloride	-	ND	-	ND	ND	0.003
o-Xylene	-	ND	-	ND	0.079	28
Petroleum Hydrocarbons (gasoline)	-	ND	-	-	ND	100
Petroleum Hydrocarbons (diesel)	-	ND	-	-	ND	Petroleum Hydrocarbons (gas/diesel)
Petroleum Hydrocarbons (heavy oils)	-	ND	-	-	ND	1000
Oil and Grease	-	-	-	-	2.1	NG
Phenols	-	ND	-	ND	ND	40
Aluminum	3463.3	3928.7	8448.8	6960.2	8338.3	NG
Antimony	ND	ND	ND	ND	ND	40
Barium	12.6	28.6	37.6	48.0	43.6	1600
Beryllium	ND	ND	ND	ND	ND	1.2
Cadmium	ND	ND	ND	ND	ND	12
Calcium	4810.6	4186.3	17016.6	3086.4	3596.7	NG
Chloride	1086	1003	3737	612	1282	330 <sup>(2)</sup>
Chromium	6.7	6.7	17.9	14.2	10.6	780
Cobalt	2.6	1.8	ND	2.8	ND	80
Copper	9.2	4.8	9.8	16.1	8.3	225
Iron	7678.9	7479.8	12701.0	13076.9	10424.1	NG
Lead	ND	ND	7.6	ND	ND	1000
Magnesium	2239.3	2141.8	3621.8	4021.0	3473.8	NG
Manganese	71.9	94	117.9	133.4	121	NG
Nickel	14.7	8.9	9.9	18.7	10.6	160
Sodium	2377.6	1068.6	7686.1	660.4	1386.4	NV
Potassium	272.4	228.3	464.6	646.1	442.9	NG
Thallium	ND	ND	ND	ND	ND	32

**Table 7.1.1 (continued)**  
**Analytical Results: Soil Samples from Boreholes**

DESCRIPTION	SAMPLE LOCATION					CRITERIA MOE <sup>(1)</sup>
	BH1	BH2	BH3	BH4	BH5	
Vanadium	9.2	9.3	12.0	19.3	13.0	200
Zinc	13.5	16.2	22.0	25.0	24.0	500

NA - Not Analyzed  
NV No Value

NG - No Guidelines

All units are µg/g

MOE<sup>(1)</sup> - Ontario Ministry of Environment "Guidelines for Use at Contaminated Sites in Ontario" 1998. Table A: Surface Soil Criteria for Industrial/Commercial Land Use for a Potable Groundwater Condition.

<sup>(2)</sup> - Ontario Ministry of Environment "Guidelines for Use at Contaminated Sites in Ontario" 1998. Table F: Ontario Typical Range Soil Concentrations (Background) for All Land Uses Other than Agricultural.

**Bold and Shaded** - Sample concentration exceeds guideline limit.

Borehole BH1, BH2, BH3, BH4, and BH5 report chloride concentrations exceeding MOE typical background concentrations. All other parameters analyzed for in the borehole soil samples are within the referenced guideline limits.

## **7.2 Hydrogeology**

The water table was encountered in five boreholes and was recorded at depths ranging from 0.91 m to 1.06 m below the existing ground surface. The groundwater flow direction is primarily in an easterly direction. The hydraulic conductivity is calculated to aid in assessing the ability of the groundwater to transport potential contaminants. Based on the calculations, the hydraulic conductivity is estimated to be approximately  $1.9 \times 10^{-6}$  m/s for the subject soils.

One monitoring well was sampled, BH2/MW1. Analytical parameters included TPH (gas, diesel, heavy oils), phenols, VOCs, metals, chloride, PCBs, pesticides, and general chemistry. Analytical results are presented below in Table 7.2.1, along with the applicable guideline limits.



**Table 7.2.1**  
Analytical Results: Water Sample from Monitoring Well

DESCRIPTION	SAMPLE LOCATION	CRITERIA MCL <sup>(1)</sup>
	SH2RWH	
Chloride	1133.8	250
Conductivity	6020	NG
Hardness	130	80 - 100 <sup>(2)</sup>
Potassium	8.8	NG
Sodium	1125	200 <sup>(2)</sup>
Nitrate	ND	10
Aluminum	6.3	NG
Barium	0.27	1
Beryllium	ND	0.004
Calcium	47	NG
Cadmium	ND	0.006
Cobalt	ND	0.1
Chromium	0.02	0.06
Copper	ND	0.023
Iron	8.3	0.3 <sup>(2)</sup>
Magnesium	3.0	NG
Manganese	0.22	0.06 <sup>(2)</sup>
Nickel	ND	1.0
Lead	ND	0.01
Thallium	ND	0.002
Vanadium	ND	0.200
Zinc	0.06	1.100
pH	6.79	NG
PCBs Totals	ND	0.0002
Aldrin	ND	0.00001
Alpha-BHC	ND	NG
Beta-BHC	ND	NG
Chlordane	ND	0.00004
4,4' - DDD	ND	0.006
4,4' - DDE	ND	0.028
4,4' - DDT	ND	0.00006
Dieldrin	ND	0.00002

**Table 7.2.1 (continued)**

Analytical Results: Water Sample from Monitoring Well

DESCRIPTION	SAMPLE LOCATION	CRITERIA MOE <sup>(1)</sup>
	BH2/MW1	
Endrin aldehyde	ND	NO
Endosulfan I	ND	NO
Endosulfan II	ND	NO
Endosulfan sulfate	ND	NO
Endrin	ND	0.00005
Gamma - BHC	ND	NO
Heptachlor	ND	0.00004
Heptachlor epoxide	ND	0.003
Lindane	ND	NO
Methoxychlor	ND	0.0003
Toxaphene	ND	NO
Total Phenols	ND	4.2
1,1,1 - trichloroethane	ND	0.2
1,1,2,2 - tetrachloroethane	ND	0.001
1,1,2 - trichloroethane	ND	0.005
1,1 - dichloroethane	ND	0.070
1,1 - dichloroethylene	ND	0.00005
1,2 - dichlorobenzene	ND	0.003
1,2 dichloroethane	ND	0.005
1,2 - dichloropropane	ND	0.005
1,3 - dichlorobenzene	ND	0.530
1,4 - bromochloromethane	ND	NO
1,4 - dichlorobenzene	ND	0.001
Benzene	ND	0.005
Bromodichloromethane	ND	0.005
Bromomethane	ND	0.0037
Bromoform	ND	0.005
Cis - 1,3 - dichloropropylene	ND	NO
Chlorobenzene	ND	0.030
Chloroethane	ND	NO
Chloroform	ND	0.005
Chloromethane	ND	NO
Carbon tetrachloride	ND	0.005

**Table 7.2.1 (continued)**

Analytical Results: Water Sample from Monitoring Well

DESCRIPTION	SAMPLE LOCATION	CRITERIA
	BH2/MW1	MOE <sup>(1)</sup>
Dibromochloromethane	ND	0.006
Dichloromethane	ND	NG
Total xylenes	ND	0.3
tetrachloroethylene	ND	0.006
Toluenes	ND	0.024
Trans - 1,2 - dichloroethylene	ND	NG
Trichloroethylene	ND	0.06
Trichlorofluoromethane	ND	NG
Vinyl chloride	ND	0.0006
TPH gas/diesel	ND	1.0
TPH heavy oils	ND	1.0

NA - Not Analyzed

NG - No Guidelines

All units are mg/L (unless otherwise stated)

Exceedances are bolded and shaded

MOE<sup>(1)</sup> -

Ministry of the Environment Guideline For Use at Contaminated Sites in Ontario, Table A for a Potable Groundwater Condition, revised February 1997.

(2)

Ministry of the Environment "Ontario Drinking Water Objectives" 1994.

The groundwater sample collected from BH2/MW1 measured elevated concentrations for chloride, sodium and hardness. The chloride levels exceed the referenced guideline limit by a factor of 4.5 times, sodium exceeds by a factor of 5.6 times, while hardness exceeds the maximum amount by a factor of 1.3 times. As well, Iron and manganese concentrations exceed the drinking water objective for the subject site. All other parameters measured were within the referenced criteria guidelines.

### **7.3 Surface Water**

Surface water runoff from the paved areas of the site is generally directed by on site ditches to the low lying areas and eventually the surface water receivers. During the field survey the surface water ditches appear to be intermittent, and contained pooled, stagnant water with the exception of the north drainage ditch containing sump pump discharge from the adjacent residence. Surface water sample B-SW1 was

collected north of the salt shed. The water in this ditch was stagnant, no odour was noted and it was tea colour. No water was found in any other ditches on site. A representative background sample could not be obtained for the site. During the second field visit the culvert outlet (to the Still River), located north east of the patrol yard, was flowing and a sample was collected (B-SW2). Results of the surface water samples are presented in Table 7.3.1 below.

**Table 7.3.1**  
Analytical Results: Surface Water Samples

DESCRIPTION	SAMPLE LOCATION		GUIDELINES MOE <sup>(1)</sup>
	B - SW1 DRAINAGE DITCH	B-SW2 BACKGROUND	
Total Phenols	ND	ND	0.001
Sodium	2278	8.4	NG
Oil and Grease	77	137	NV
Chloride	1628.9	8.4	NG

ND - Not Detected

NG - No Guidelines

All units are mg/L (unless otherwise stated)

NV - No Value

Exceedances are bolded and shaded

MOE<sup>(1)</sup> -

Ministry of the Environment Provincial Water Quality Objectives, March 1995.

There are no surface water criteria concentrations for sodium or chloride, that aside, results for B-SW1 appear to be elevated, with no background sample for comparison purposes. Salt staining was observed on site during the field visits. Oil and grease concentrations should not be present in concentrations that; can be detected as a visible film, sheen, or discolouration on the surface; can be detected by odour; can cause tainting of edible aquatic organisms; can form deposits on shorelines and bottom sediments that are detectable by sight or odour, or are deleterious to resident aquatic organisms. B-SW1 and B-SW2, show a concentration of oil and grease of 77 and 137 mg/L, respectively. There were no visible signs or olfactory evidence in the samples. The manhole drain outlet that collects surface runoff from much of the paved areas on site discharges just upstream of the B-SW1 location. As well, oil staining was observed in various areas around the site. The garage/office building floor drain outlet discharges to the south east drainage ditch (somewhere), upstream from B-SW2 sampling point. No obvious oil staining was observed in the

area. All other parameters are within applicable criteria.

#### **7.4 Phase II ESA Summary**

DST Consulting Engineers Inc. has performed a Phase II ESA for the Britt Patrol Yard. The field program consisted of the drilling of five boreholes, the installation of a monitoring well, the installation of two piezometers, the collection of two surface water samples, and a designated substance survey. The following is a summary of the findings:

1. The scoped parameter DSS revealed no suspected ACMs, no lead containing paint exceeding criteria limits, and no potential PCB-laden materials in the garage/office building.
2. The soil samples for boreholes BH1, BH2, BH3, BH4 and BH5 report chloride levels exceeding the MOE background soil concentrations. Elevated levels of aluminum, calcium, iron, magnesium, sodium and potassium are reported for all boreholes drilled across the site. Currently there are no MOE remediation criteria for these parameters
3. The groundwater sample reports exceeding levels of sodium, chloride, iron, manganese and hardness. All other parameters for the samples are within current referenced guidelines.
4. The surface water samples report elevated levels of sodium and chloride at B-SW1. There are no current MOE, Provincial Water Quality Objectives (PWQOs) for these parameters. The oil and grease concentration reported for B-SW1 and B-SW2 is elevated.
5. Metal anomalies identified during the EM survey were investigated as best as possible considering the safety issues related to the drilling of these areas. No metal items were discovered during the drilling program.
6. Borehole BH2/MW1 installed in the vicinity of the former UST tank nest and current waste oil tank, reported no petroleum contamination encountered in this borehole. BH5 drilled in the area of the current diesel ASTs reported only trace levels of xylene, and oil and grease, below MOE criteria.
7. Borehole BH4 was drilled to investigate potential contamination associated with the manhole drain outlet. Results report trace amounts of oil and grease in the soils and elevated levels in the surface water in the area.
8. No intrusive investigation was carried out at the rear of the garage/office building due to the location of locates in this area. As such, the oil/water separator was not investigated.

9. In that the garage floor drain outlet could not be located, drilling was not completed to investigate this area.

## **8.0 RISK CLASSIFICATION**

<b>Potential Environmental Hazard</b>	<b>Level of Risk</b>	<b>Potential Environmental Concerns</b>
Salt Storage	HIGH	Salt storage facilities on site – suspected salt impacted soils and groundwater. Chloride concentrations exceeding the MOE potable groundwater remediation criteria were reported in boreholes BH1, BH2, BH3, BH4 and BH5 with an elevated level of chloride and sodium in groundwater monitoring well BH2/MW1. Chloride and sodium concentrations in the surface water samples B-SW1 was also elevated. The potential for contamination and migration off site exists. Refer to screening level risk assessment below.
Petroleum Hydrocarbon Contaminated Soils	LOW	Borehole BH2/MW1 drilled in the former tank nest area reported concentrations of petroleum constituents of non-detect, for a potable water situation. Borehole BH5 drilled in the area of the current ASTs reported trace levels of xylenes, below MOE criteria.
ACMs	LOW	All samples submitted for potential ACMs were negative and do not contain asbestos.
LEAD	LOW	All samples field screened and those submitted for laboratory analysis were not lead containing and were less than the criteria limit respectively. Lead based paint does not pose a health hazard unless disturbed through renovations.
PCBs	LOW	Verification of fluorescent light ballasts indicated that they are not PCB containing in the garage/office area.
Elevated Levels of aluminum, calcium, iron, magnesium, sodium and potassium in soils.	LOW	Elevated aluminum, calcium, iron, magnesium, sodium and potassium were reported in all BHs established across the site. Refer to discussions below.
Exceeding levels of sodium, chloride, iron, manganese and hardness, in groundwater	MODERATE	Elevated sodium, chloride was reported in the groundwater, likely a result of the salt contamination present in the soils. Elevated levels of hardness was measured in the groundwater, along with iron and manganese. Refer to discussion below.
Elevated levels of conductivity, in groundwater	LOW	Elevated conductivity is typically associated with a contamination source, likely salt contamination at the subject site.

Potential Environmental Hazard	Level of Risk	Potential Environmental Concerns
Floor Drain Outlet	MODERATE	Elevated levels of oil and grease and sodium and chloride were reported for the surface water. The floor drain may be a potential source of oil and grease.
Suspected Buried Metal Objects	LOW	Metal anomalies indicating suspected buried metal objects were detected during the EM survey. Most of these identified appear to be buried scrap metal (culverts, sign posts, etc.) or cables
Adjacent Property Land Use	NONE	Adjacent lands are used for residential and undeveloped forested land

It is common for concentrations of aluminum, calcium, iron, magnesium, and potassium elevated levels to be naturally present in Ontario soils. These cations are readily exchangeable as plants move nutrient ions, the resulting changes in the soil solution are partly counteracted by the cation exchange reactions. Acidic soils (as found at this site) would tend to reduce this exchange capacity and cause the accumulation of aluminum. The concentrations measured appear to be consistent and represent typical concentrations across the site. Low potential risk is associated with the elevated concentrations of these elements to humans during the use of this site for industrial purposes.

Hardness is considered an aesthetic parameter, and is a common characteristic of groundwater in Ontario. As groundwater moves through carbonate rich overburden, calcium and magnesium compounds are dissolved causing hardness. Hardness is not health related and instead is a nuisance resulting in scale formations on kettles and prevents soap from lathering.

Iron and manganese are frequently present in groundwater. Iron content is a concern because small amounts may affect the water's usefulness for some domestic and industrial purposes. Concentrations of iron in excess of 0.3 mg/L causes staining of plumbing fixtures, staining of cloths during laundering, incrustation of well screens and plugging of pipes. Some industrial plants cannot tolerate more than 0.1 mg/L before processes are affected. When iron solutions come in contact with oxygen, the iron

precipitates out. Iron bearing waters also favor the growth of iron bacteria. They are not health related but are considered a nuisance organism that can cause plugging of water mains, recirculating systems, etc. Manganese in excess of 0.05 mg/L is a concern for aesthetic reasons. It tends to precipitate out of solution when the water comes in contact with oxygen, resulting in the staining of fixtures and clothing during laundering. Manganese stains are typically blacker brown in colour than iron stains.

Conductivity is typically elevated as a result of point or non-point source contamination in the area. The conductivity at this site is likely the result of salt contamination.

Sodium chloride is considered to be of low health risk, however excessive levels in soil results in reduced soil fertility and vegetation stress. Soil samples analyzed from the various boreholes report elevated sodium levels at subsurface depths, therefore, stressed vegetation would not necessarily be visible. Other concerns include metal corrosion and concrete scaling. Sodium was present at a concentration of 1125 mg/L in the monitoring well at the subject site. Sodium is an important element for the regulation and maintenance of bodily processes and the minimum daily requirement is 50 mg for the average adult. The body has very effective methods for controlling sodium levels and thus sodium is not acutely toxic in the normal range of environmental or dietary concentrations. However, at extremely high doses, toxic effects include muscle twitching, cerebral and pulmonary edema and death. The average sodium intake from water is a small fraction of that consumed in a normal diet (about 5 g/day), however, sodium intake from drinking water could become significant for persons suffering from hypertension or congestive heart failure who may require a sodium restricted diet (about 500 mg/day). For these individuals, drinking water concentrations would have to be less than 20 mg/L. If sodium levels exceed this health-related limit, MOE recommends that the local Medical Officer of Health be notified so that persons with relevant medical conditions can be alerted. With respect to aesthetics, the taste of drinking water is offensive at sodium levels of 175 to 185 mg/L and the aesthetic objective for sodium in drinking water is set at 200 mg/L. According to the MOE, levels of sodium above the limit are not considered to be reasonably treatable.

Chloride was present at concentrations between 612 and 3727 ug/g in the soil on the subject site and at a



concentration of 1139.6 mg/L in the monitoring well at the subject site. The MOE soil background concentration for chloride is 330 ug/g and the aesthetic objective for chloride in drinking water is set at 250 mg/L. According to the MOE, levels of chloride above the limit (for drinking water) are not considered to be treatable. In general, chloride is found at low concentrations in natural surface waters in Canada, however higher concentrations may be found in drinking water derived from groundwater sources due to naturally high chloride levels in soils or contamination by road salt. Chloride levels in the body are well regulated and the chloride balance is maintained, even after the intake of large quantities of chloride in food and water. Recently evidence has been found which suggests that chloride ingestion is harmful to humans. Correspondence through media in the recent past has discussed the linkage of organochlorides and bladder cancer in 18 communities in eastern Canada. As well, chloride is objectionable in water supplies, in that it imparts undesirable tastes to water and beverages prepared from water.

Based on the sodium and chloride levels in the monitoring well, it appears as though salt contamination is a potential problem on the site. The direction of the groundwater flow is primarily towards the east direction. Surface water samples collected from the drainage ditch located north of the salt storage areas reports an elevated chloride concentration of 1625.9 mg/L and a sodium concentration of 2270 mg/L, respectively. A potable water well is located on site but is not thought to be salt contaminated. Potable water wells are located on the adjacent properties, south and north of the site

The following formula from "Incorporation of the Reasonable Use Concept into MOE Groundwater Management Activities" (MOE, 1994) was used to calculate the maximum concentrations (Cm) of chloride that would be acceptable in the groundwater beneath the adjacent property:

$$C_m = C_b + x(C_r - C_b)$$

The terms are defined as follows:

- Cb     The background concentration of the particular contaminant in the groundwater before it has been affected by human activity. (for this site 11 mg/L was assumed, from on site potable well analysis)
- Cr     The maximum concentration of the particular contaminant that should, in accordance with the Province's water management guideline, be present in the groundwater.

x        A constant that reduces the contamination to a level that is considered by the Ministry to have only a negligible effect on the use of the water (for drinking water, x is 0.5 for non-health related parameters or 0.25 for health related parameters).

Considering the assumed background concentrations of chloride, the maximum calculated concentrations of chloride that would be acceptable in the groundwater on the adjacent property is 130.5 mg/L. Overall, the elevated chloride concentrations on the site pose a potential risk for off-site migration. Results of the salt concentration measured in the surface waters indicates that there does exist a moderate risk to the surface water receiver adjacent the property due to these elevated salts on the subject site. Results of the sample collected at B-SW2 reported reduced sodium and chloride levels (compared to B-SW1), of the surface water prior to it discharging to the Still River.

Those boreholes analyzed for petroleum contamination confirmed that those areas associated with borehole BH2/MW1, and BH5 appear not to be contaminated. Based on the results, petroleum contamination currently does not pose a risk for off site contamination through groundwater transport. However, in that fuel is currently being stored and used on site and no spill containment pads are present beneath the tanks there is the possibility of contamination of the soils and groundwater through the refueling of vehicles and the filling of the tanks. Currently trace levels of xylenes do exist in the soils located downgradient in BH5.

## **9.0 CONCLUSIONS AND RECOMMENDATIONS**

Based on the findings of the Phase I ESA, as well as the results of the Phase II investigation, environmental concern was associated with several issues at the subject property. DST's conclusions and recommendations are summarized in Table 9.1.

**Table 9.1**  
Conclusions and Recommendations

Potential Environmental Hazard	Level of Risk	Potential Environmental Concerns	Recommendations
Salt Storage	MODERATE – HIGH	Salt storage facilities on site - suspected salt impacted soils, surface water and groundwater. Elevated sodium and chloride concentrations were reported in BH2/MW1, while chloride levels in the soils of BH1, BH2, BH3, BH4, and BH5 exceed MOE criteria. Elevated levels of sodium and chloride were reported in the surface water locations onsite. The potential for contamination and migration off site exists. Groundwater is used in the area.	Refer to screening level risk assessment and discussion. Maintain proper housekeeping practices to minimize the potential of current salt contamination due to surface drainage. Salt should not be stored or handled outside a properly enclosed area. All salt stock piles should be stored inside covered structures.
Petroleum Hydrocarbon Contaminated Soils	LOW	Borehole BH2.MW1 drilled in the former tank nest area reported concentrations of petroleum constituents of non-detect, for a potable water situation. Borehole BH5 is located in the vicinity of the existing fuel storage tanks and report no contamination in these areas.	No further intrusive investigation is required at this time. Trace levels of xylenes reported in BH5 are likely a result of spillage associated with the existing diesel ASTs. Spill pads beneath the tanks and in the area where refueling is carried out is recommended.
Waste Management	LOW	A few oil cans were observed stored in the garage area. No contamination was found in association with the area. Garage floor staining was limited.	Properly dispose of waste materials regularly to an approved disposal/recycling facility. Temporary storage on-site should only be in specified, controlled areas.
Exceeding levels of iron and manganese in groundwater	LOW	Concentrations of iron and manganese exceed the MOE drinking water objectives.	Iron and manganese frequently exceed criteria limits. They are not health related parameters, but are considered a nuisance. Refer to screening level risk assessment. No further action is required.
Elevated Levels of aluminum, calcium, iron, magnesium, and potassium in soils.	LOW	Elevated aluminum, calcium, iron, magnesium, and potassium were reported in all BHs established across the site.	Refer to screening level risk assessment. No further action is required since no provincial criteria currently exist for these parameters. Levels appear to naturally occurring across the site.
PCBs	LOW	Verification of light ballast numbers reports non-PCB laden.	No further action is recommended.
Lead	LOW	Low levels of lead was detected in the paint from the salt shed and storage shed.	Further action is not be required at this time. Caution is to be used during any renovations. Ministry regulations addressing lead paint are to be applied.

**Table 9.1 (continued)**  
Conclusions and Recommendations

Potential Environmental Hazard	Level of Risk	Potential Environmental Concerns	Recommendations
Garage Floor Drain Outlet Manhole Drain Outlet	MODERATE	Elevated levels of oil and grease and sodium and chloride were reported for the surface water samples collected in the drainage ditches.	Use best management practices(BMP), in the garage (i.e. the use of absorbant materials on spills). No washing of spills into the floor drains Regular maintenance of the oil/water separator and confirmatory documentation is recommended.
Suspected Buried Metal Objects	LOW	Although metal anomalies indicating suspected buried metal objects were detected during the EM survey, most is suspected to be buried scrap metal such as culverts, sign posts, etc.	No further action is recommended at this time.

## **10.0 QUALIFICATIONS OF ASSESSOR**

**Manon Giroux**, is the project field supervisor. She has over five years of relevant experience in the environmental industry. Mrs. Giroux has completed over 21 Phase I and II ESAs on MTO Patrol Yards within the Province of Ontario, while acting as field supervisor during the completion of 11 of these sites. Manon is currently an environmental technologist and project supervisor with DST Consulting Engineers Inc. Her responsibilities include the management, coordination and supervision of environmental projects, including Phase I and Phase II Environmental Site Assessments, site remediation, and impact assessments. She has also completed chemical/bacteriological and hydrogeological monitoring at landfill sites.

**Janet Lowe, B.Sc.** is the project manager. She has over ten years of environmental consulting experience. Mrs. Lowe is currently the Sudbury manager for DST Consulting Engineers Inc. Her responsibilities include project management, supervision of all the environmental services, and environmental engineering, site investigations, biological studies, plans review and reporting reviews. Janet has participated in various capacities (field coordinator, field supervisor, report preparation, and budgeting) in approximately 24, Phase I and II ESAs of Patrol Yards for MTO. She has provided senior

review and project management for a number of other Phase I and II ESAs.

## 11.0 REFERENCES AND SUPPORTING DOCUMENTATION

Source	Document(s)
Johnston Geophysics (Completed as part of the contract)	Electromagnetic Survey – Britt Patrol Yard, Highway 526, Town of Britt, Ontario (September 1999)
Ministry of Transportation of Ontario (MTO) – North Eastern Environmental Unit	Patrol Yard Records and Original Site Plan(s)
Ministry of Northern Development and Mines (MNDM) - Sudbury Office	Bedrock Geology of Ontario, Geological Maps of Southern Ontario
N. Irving Sax	Industrial Pollution, 1974
Canadian Council of Ministers of the Environment (CCME)	A Framework for Ecological Risk Assessment: General Guidance (March 1996) A Framework for Ecological Risk Assessment: Technical Appendices (March 1997) Interim Canadian Environmental Quality Criteria for Contaminated Sites (September 1991)
Ontario Ministry of Environment and Energy (MOEE)	Ontario Drinking Water Objectives (1993) Guideline for Use at Contaminated Sites in Ontario (February 1997) Guidance on Site Specific Risk Assessment for Use at Contaminated Sites in Ontario (May 1996) Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities (April 1994) Technical Guideline for Private Wells: Water Supply Assessment (October 1994)
Robert C. Terry	Road Salt, Drinking Water, and Safety – Improving Public Policy and Practice (1974)
Environment Canada	Sodium Chloride - Environmental and Technical Information for Problem Spills (March 1984)
R. Allan Freeze and John A. Cherry	Groundwater (1979)

Source	Document(s)
Health Canada	Guidelines for Canadian Drinking Water Quality (Sixth Edition, 1996)
	Guidelines for Canadian Drinking Water Quality - Supporting Documentation - Iron (November 1987), Manganese (November 1987), Sodium (December 1992)
(Prepared by the Federal-Provincial Subcommittee on Drinking Water)	Aluminum in Drinking Water - Document for Public Comment (December 1996)

## 12.0 GLOSSARY OF MEASUREMENT TERMS

Term	Definition
g/day	gram/day
km	Kilometre
L	Litre
m	Metre
m <sup>3</sup>	Metre cubed
m/m	Metre/metre
m/s	Metre/second
m <sup>2</sup>	Metre squared
m/year	Metre/year
µg/g	Microgram/gram
µS/cm	Microsiemens/centimetre

Term	Definition
mg	Milligram
mg/day	Milligram/day
mg/L	Milligram/litre
ppm	part per million

### **13.0 LIMITATIONS OF REPORT**

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix A and this forms an integral part of this report.

For DST CONSULTING ENGINEERS INC.

Prepared by:



Janet Lowe, B.Sc  
Senior Environmental Scientist

Reviewed by:



Ron deGagne  
Senior Earth Scientist

**APPENDIX A  
LIMITATIONS OF REPORTS**

**DST CONSULTING ENGINEERS INC.**



## APPENDIX 'A'

### LIMITATIONS OF REPORT ENVIRONMENTAL INVESTIGATIONS

The information, conclusions and recommendations given herein are specifically for this project and this client only, and the scope of work described herein. It may not be sufficient for other uses.

The conclusions and recommendations regarding environmental conditions which are presented in this report are based on a scope of work authorized by the Client. Note, however, that virtually no scope of work, no matter how exhaustive, can identify all contaminants or all conditions above and below ground. For example, conditions between test holes may differ from those encountered in the investigation and conditions may change with time. This report therefore cannot warranty that all conditions on or off the site are represented by those identified at specific locations.

Note also that standards, guidelines and practices related to environmental investigations may change with time. Those which were applied at the time of this investigation may be obsolete or unacceptable at a later date.

Any topographic benchmarks and elevations used in this report are primarily to establish relative elevation differences between test locations and should not be used for other purposes such as grading, excavation, planning, development, etc.










The comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to determine all of the factors that may affect construction or clean-up methods and costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

Any results from an analytical laboratory reported herein have been carried out by others, and DST Consulting Engineers Inc. does not warranty their accuracy.

**APPENDIX B  
SITE PLAN AND PHOTOS**

**DST CONSULTING ENGINEERS INC.**

# LEGEND

	wetland		borehole + monitoring well location (BH/MW)
	surface water flow		borehole location (BH)
	ditch		monitoring well location (MW)
UST	underground storage tank		benchmark location (BM) 100.00 meters
AST	aboveground storage tank		groundwater flow direction (GWFD)
*W-SW	surface water sample	98.76	water level in meters
	fence		
RAP	recycled asphalt pile		

Note:  
1. Benchmark is found on south side of salt shed.

MTO  
BRITT PATROL YARD

FIGURE 1

PROJECT NO:  
SE99103

DATE:  
Oct. 4/1999

SCALE:  
Not to scale

**DST**  
CONSULTING ENGINEERS

Unit 6, 1351-D Kelly Lake Road  
SUDBURY, ONTARIO, P3E 5P5  
TEL (705) 523-6680  
FAX (705) 523-6690

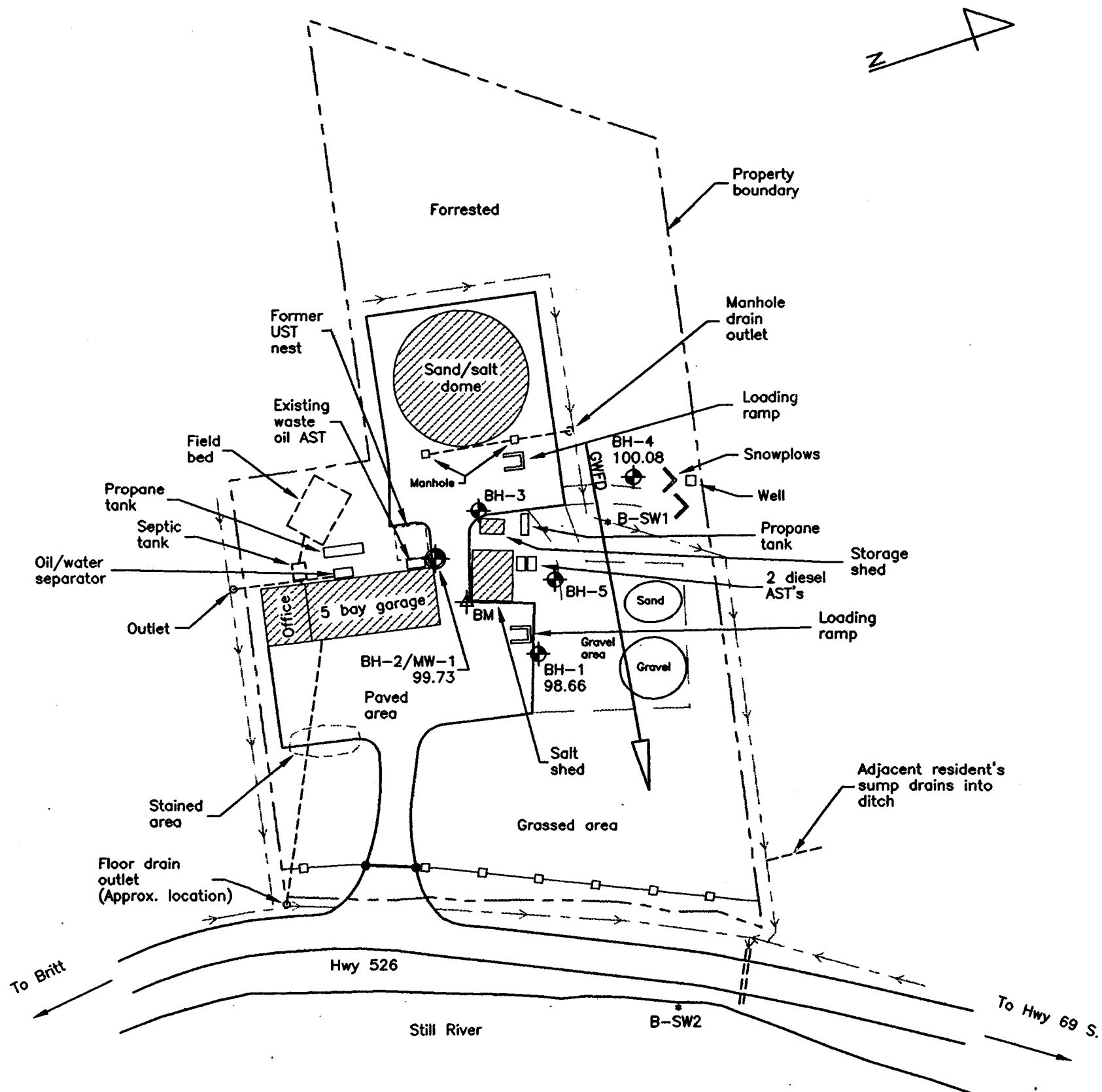




Plate 1: Patrol yard garage looking west.

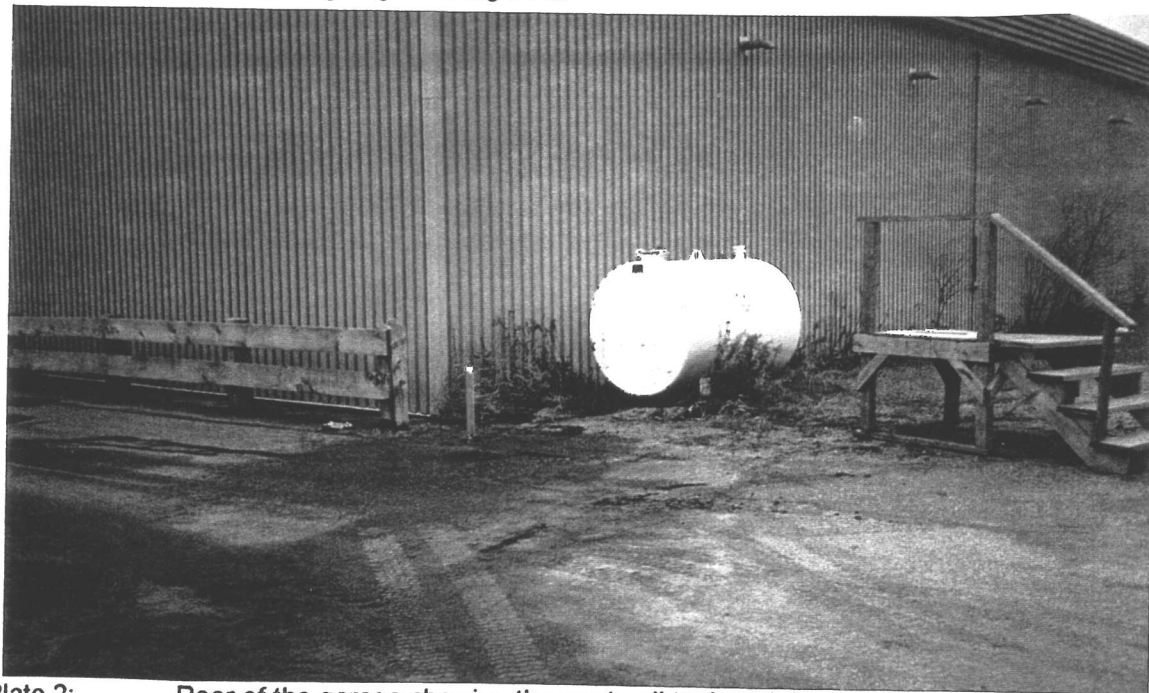


Plate 2: Rear of the garage showing the waste oil tank and the monitoring well installed adjacent the tank.



Plate 3: Photo looking north showing salt shed, and storage shed.



Plate 4: Photo looking west showing salt/sand dome.



Plate 5: AST diesel tanks adjacent the salt shed.



Plate 6: Salt shed and gravel stockpiles.

**APPENDIX C  
ELECTROMAGNETIC SURVEY**

**DST CONSULTING ENGINEERS INC.**

**REPORT ON ELECTROMAGNETIC SURVEYS**  
**AT MTO PATROL YARDS - SUDBURY REGION**  
**BRITT, CARTIER, ELLIOT LAKE, GORE BAY, KILLARNEY,**  
**LITTLE CURRENT, MCKERROW, MINDEMOYA, PRIDDLE ROCK,**  
**RUTTER, WALDEN, WALFORD, WAHNAPITAE**

February, 2000  
Timmins, Ontario

Matthew Johnston  
Consulting Geophysicist



## TABLE OF CONTENTS

1.0	Summary.....	1
2.0	Location and Access.....	1
3.0	Summary of Geophysical Investigations.....	1
3.1	Discussion of Results.....	3
4.0	Conclusions.....	8

Statement of Qualifications

## Appendix A

### Survey Equipment Specifications

### List of Maps Accompanying Report

Map	Scale		Scale
Britt - Conductivity	1:1000	Mindemoya - Conductivity	1:1000
Britt - In Phase Data	1:1000	Mindemoya - In Phase Data	1:1000
Cartier - Conductivity	1:1000	Priddle Rock - Conductivity	1:1000
Cartier - In Phase Data	1:1000	Priddle Rock - In Phase Data	1:1000
Elliot Lake - Conductivity	1:1000	Rutter - Conductivity	1:1000
Elliot Lake - In Phase Data	1:1000	Rutter - In Phase	1:1000
Gore Bay - Conductivity	1:1000	Walden - Conductivity	1:1000
Gore Bay - In Phase Data	1:1000	Walden - In Phase	1:1000
Killarney - Conductivity	1:1000	Walford - Conductivity	1:1000
Killarney - In Phase Data	1:1000	Walford - In Phase Data	1:1000
Little Current - Conductivity	1:1000	Wahnapitae - Conductivity	1:1000
Little Current - In Phase Data	1:1000	Wahnapitae - In Phase	1:1000
McKerrow - Conductivity	1:1000		
McKerrow - In Phase Data	1:1000		

## **1.0 Summary**

During September and October of 1999, ground geophysical investigations consisting of Electromagnetic surveys were carried out at 13 MTO highway patrol yards in the Sudbury region. The surveys were performed under sub-contract to DST Consulting Engineers Inc. of Sudbury, Ontario. The patrol yards surveyed were Britt, Cartier, Elliot Lake, Gore Bay, Killarney, Little Current, McKerrow, Priddle Rock, Rutter, Walden, Walford, and Wahnapiatae. The purpose of these surveys was to map the distribution of potentially contaminated groundwater plumes arising mainly from leaching of road salt stockpiles. This was achieved by measuring and recording the conductivity of the ground. Soil conductivity measurements are an excellent method to detect contaminated groundwater and soil. In particular, soil, which has been subject to salt-water intrusion displays a distinct high conductivity contrast with non-contaminated soils. In addition, other soil anomalies were investigated at the sites.

## **2.0 Location and Access**

All of the sites were located in the Sudbury region. Elliot Lake was the furthest east, Cartier was the furthest north and Britt was the furthest south. All of the sites were easily accessed via the highway system within north central Ontario. The site locations are shown in figure 1.

## **3.0 Summary of Geophysical Investigations**

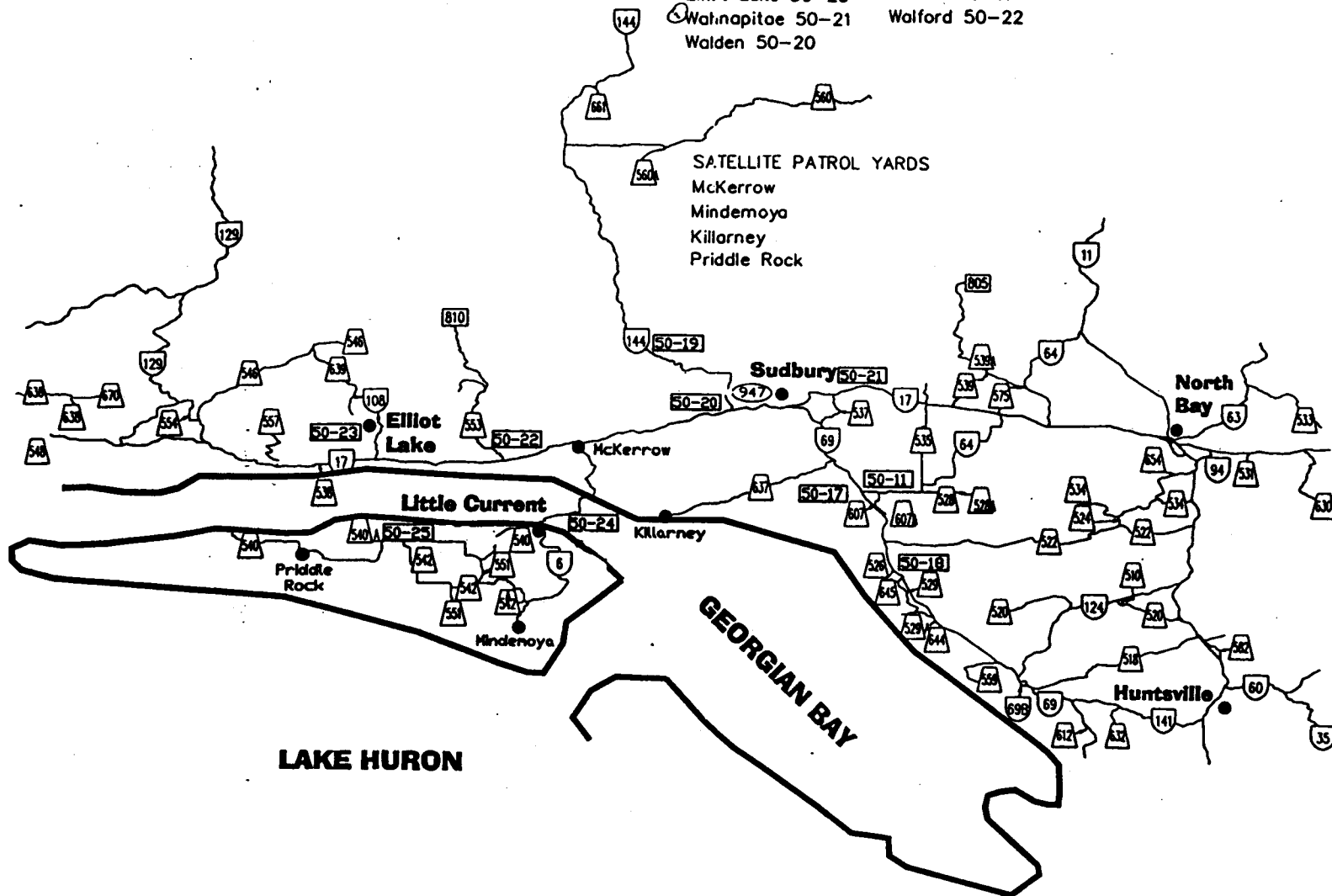
The geophysical program consisted of measuring both conductivity and in-phase response of the ground at all sites utilizing a GEM-300 electromagnetic instrument. The electromagnetic surveys were conducted on survey lines spaced 10 meters apart with a reading along all lines at 5-meter intervals. Both the conductivity and in phase measurements at 3990 Hz. were recorded and stored.

PATROL YARDS  
SUDBURY DISTRICT

Britt 50-18	Gore Bay 50-25
Cartier 50-19	Little Current 50-24
Elliot Lake 50-23	Rutter 50-17
Wahnapitoc 50-21	Walford 50-22
Walden 50-20	

SATELLITE PATROL YARDS

McKerrow  
Mindemoya  
Killarney  
Priddle Rock



This frequency was chosen in order to achieve a depth of investigation of approximately 6 meters while also allowing good resolution of near surface soil anomalies and buried metallic objects.

The Gem-300 instrument is a soil conductivity instrument capable of measuring a wide range of frequencies in both the horizontal and vertical dipole configurations. In this survey the vertical dipole method was chosen in order to achieve maximum depth of penetration while also allowing good vertical resolution of near surface anomalies. A description of the instrument as well as technical specifications can be found in appendix A.

The results of the survey have all been plotted at a scale of 1:1000 as both black and white contour maps of conductivity and in phase responses. In addition, colour images of the contoured conductivity and in phase responses have been produced. These images are a very good method of presenting this type of data as the anomalies are clearly identified by the higher (red) values, while background values are represented as 'cooler' colours of yellow, green and blue.

### **3.1 Discussion of Results**

All of the sites surveyed displayed anomalous responses, primarily within the conductivity data. In many cases the in phase data correlated directly with conductivity responses. This is interpreted to reflect the generally high strength of the conductivity responses found within the ground at the sites. At a few sites in phase anomalies were detected which did not correlate directly with either soil conductivity anomalies or visible surface metallic objects. A brief interpretation of each site will be discussed below.

#### **Britt Patrol Yard**

Significant conductivity anomalies were discovered east and west of the sand dome centered at 90W/45N and 95W/35N as well as at 40W/50N and

35W/40N. Another conductivity anomaly was located 15W/60N, which may indicate the source of another plume. An in phase metallic response was located at 50N/40W which may reflect a loading ramp in the vicinity.

#### **Cartier Patrol Yard**

An interesting N-S trending linear conductivity anomaly occurs along line 30W between 40N and 90N in front of the garage. The most significant conductivity occurs to the south/southeast of the dome and salt shed centered at 90W between 10N and 30 N. The other significant conductivity anomaly occurs behind the garage trending between L90W/90N and L70W/65N. Several in phase anomalies were also detected at the Cartier site. A linear in phase response occurs between 100W/115N and 60W/80N towards the garage area, possibly reflecting and underground service corridor. Other anomalous in phase responses occur behind the garage area at 60W/65N and 70W/60N, which may reflect buried metallic objects. Another in phase anomaly occurs near the helicopter pad at 50W/115N.

#### **Elliot Lake Patrol Yard**

Soil conductivity anomalies were located around and south of the sand/salt domes as well the salt shed. These anomalies were most intense at 170W/105S, 160W/110S, 160W/65S and 150W/70S. A linear soil conductivity anomaly was found to occur between 120W/72.5S and 80W/72.5S. Other soil conductivity plumes were centered L90W/105S and 50W/110S.

A linear in phase anomaly was mapped between 120W/72.5S and 80W/72.5S, which may reflect a service corridor or culvert or possibly a buried pipe. A significant in phase anomaly also occurs at 160W/105S. Other in phase anomalies are located at 120W/90S, 110W/100S and 80W/115S. The north east corner of the patrol yard also shows some in phase responses between 40W/15S and 10W/15S as well as along line 10W between 0 and 20S.

### **Gore Bay Patrol Yard**

Terrain conductivity anomalies were mapped both to the north and south of the sand/salt dome and in the vicinity of the storage sheds. The anomaly is located between 190S and 120S along the axis defined by the 150E coordinate. The immediate vicinity of the garage area also displays higher terrain conductivity. Significant in phase anomalies was also mapped at 140S/180E, 40S/155E, and 40S/190E.

### **Killarney Patrol Yard**

A significant terrain conductivity anomaly surrounding the sand dome exhibiting a strong N-S trend is centered between lines 30W and 10W, extending from 125N to 65N. This anomaly has maximum amplitude at 10W/115N and 20W/90N. A moderate conductivity anomaly also occurs between 30W/35N and 20W/25N. In phase anomalies possibly related to buried metallic objects occur at 70W/80N, 80W/50N and 50W/45N.

### **Little Current Patrol Yard**

Terrain conductivity anomalies were very strong north of the sand/salt domes and east of the salt shed. It is a linear east-west trending anomaly trending from 40E/55S to 100E/80S, with peak conductivity located at 70E/80S. Other terrain conductivity anomalies are located at 110E/100S, and between 60S and 80S along line 130E.

### **McKerrow Patrol Yard**

The strongest terrain conductivity anomalies occur to the south and west of the sand/salt dome between lines 70E and 90E from 95N to 55N. A moderate strength terrain conductivity anomaly occurs just south of the above anomaly at 90E/25N. The other significant conductivity anomaly trends between 130E/70N and

150E/65N. An in phase anomaly also occurs between 0/40N and 40E/40N, with a peak response at 20E/35N.

#### **Mindemoya Patrol Yard**

A strong north-south trending conductivity anomaly is located just west of the sand/salt dome trending between 140N/130W and 90N/120W. In addition, this anomaly also displays an east west trend between 140W/90N and 50W/90N. Isolated conductivity anomalies were also mapped at 30N/160W and 70N/150W. A significant in phase anomaly was mapped 80N/20W; possibly reflecting a near surface buried metallic object.

#### **Priddle Rock Patrol Yard**

Moderate strength terrain conductivity anomalies were mapped south and east of the sand stockpile between 60W and 20W from 60S to 30S, with peak conductivity at 30W/50S. Surface metallic objects, such as the fence, garage, and equipment likely cause higher conductivity mapped in the vicinity of the garage area.

#### **Rutter Patrol Yard**

Significant terrain conductivity anomalies were detected north of the sand/salt domes between lines 50S and 80S from 110W to 60W, with a peak response located at 60S/100W. Another conductivity anomaly was also detected in the vicinity of the dome at 70S/125W and 80S/130W.

A linear trending terrain conductivity anomaly was also mapped between 10S/15W and 60S/25W with peak responses occurring at 30S/15W and 40S/25W. A very strong in phase anomaly was also mapped 20S/27W possibly reflecting buried metallic objects.

#### **Walden Patrol Yard**

A significant conductivity anomaly was mapped to the south of the sand domes. This linear trending anomaly is located between 0/55S and 70E/55S. It is strongest at 20E/55S and 40E/55. In addition to the primary conductivity anomaly, a number of in phase anomalies were also mapped on line 50E along its entire length.

#### **Walford Patrol Yard**

Significant terrain conductivity anomalies were mapped south of the sand/salt dome and north of the salt shed at the Walford patrol yard. South of the sand/salt dome a linear conductivity anomaly occurs between lines 20W and 30W from 90S to 115S. North of the salt shed a conductivity anomaly centered between lines 60W and 80W occurs from 50S to 70S. South of the salt shed a conductivity anomaly occurs on line 70W between 95S and 100S. In phase anomalies were mapped at 120W/90S, 90W/105S, and 70E/75S.

#### **Wahnapiatae Patrol Yard**

Terrain conductivity anomalies were mapped in the area outside the large sand/salt dome between lines 70W and 40W from 100S to 140S, with peak values measured at 60W/130S and 70W/105S. An additional conductivity anomaly was mapped north of the sand dome between lines 90W and 60W centered at 45S, with peak values mapped at 80W/45S. Another conductivity anomaly also occurs at 120W/60S. Another significant conductivity anomaly was mapped in front of the garage area between 40W/10S and 20W/40S, with maximum conductivity located at 30W/25S.



#### 4.0 Summary and Conclusions

The electromagnetic terrain conductivity surveys conducted at the 13 MTO patrol yards were very successful in mapping numerous terrain conductivity anomalies within the area of the patrol yards. The majority of the conductivity anomalies were clearly associated and found within the immediate area of the various sand and salt storage domes as well as the salt sheds which are located at all of the sites. The likely source of these anomalies is the salt contamination within the ground and ground water as a result of storage and leaching of the winter road salt in to the groundwater. High concentrations of salt within the ground provide a very good target for terrain conductivity mapping as the salt will be mapped as conductivity high.

In addition to the numerous terrain conductivity anomalies, a number of in phase electromagnetic anomalies were also mapped. These anomalies generally reflect stronger conductors within the ground, and may represent buried metallic objects or possibly very strong ground conductivity anomalies.

All pre-existing data for the patrol yards regarding previous storage of salt or other materials, which may cause conductivity anomalies within the ground, should be examined in order to fully assess the anomalies, which were mapped during this program.

Respectively Submitted,

A handwritten signature in cursive script, appearing to read "Matthew Johnston".

Matthew Johnston, B.Sc.  
Geophysicist

## Statement of Qualifications

This is to certify that: MATTHEW JOHNSTON

I am a resident of Timmins; province of Ontario since June 1, 1995.

I am self employed as an Consulting Geophysicist, based in Timmins, Ontario.

I have received a B.Sc. in geophysics from the University of Saskatchewan; Saskatoon, Saskatchewan in 1986.

I have been employed as a professional geophysicist in mining exploration and other consulting geophysical techniques since 1986.

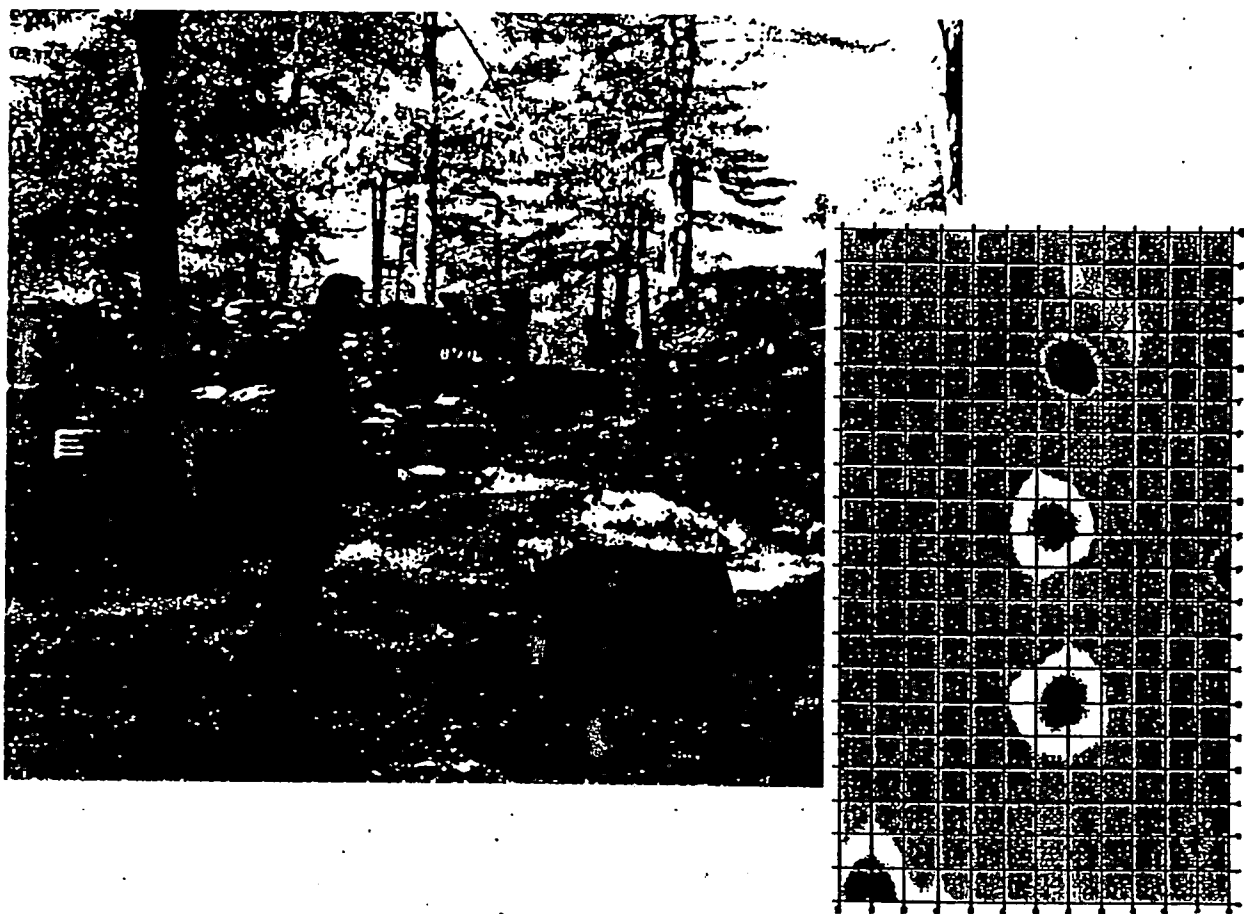
Signed in Timmins, Ontario, this February 15, 2000

A handwritten signature in black ink, reading "Matthew Johnston". The signature is written in a cursive style with a large, stylized 'M' and 'J'.

## **Appendix A**

GEM<sup>®</sup>-300

## Multifrequency Electromagnetic Profiler



Operating System Version 1.10

MN37-097A

April, 1998

## 10.0 Specifications

Frequency Range:	325 Hz. to 19975 Hz.
Maximum # of survey frequencies:	16
Memory :	240,000 locations (In-phase, Q-phase, Time Stamp)
Measurement Units:	In-phase response in PPM Quadrature phase response in PPM and mS/m
Dynamic Range:	-1M PPM to 1M PPM (In-phase)
Relative Accuracy:	+/- 0.1% full scale
Noise Levels:	+/- .01% full scale (rms)
Depth of Penetration:	4 meters for conductive half-spaces 8 meters (targets)
Battery Duration:	10 hours at 1 frequency and period=1 Sec
Environmental:	
Weight (Field Configuration)	8 Kg (18 lbs.)
Size:	L: 190cm(74 in) W: 20cm (7.9 in) H: 15 cm (5.9 in)
Operating Temperature Range:	0-40 Degrees C (32-104 Degrees F)
Weatherproofing:	Watertight
Calibration Modes:	Local zero Absolute null (factory only)
Markers:	End of Line Mark, User Mark
Data Stretching:	Rubber sheeting based on marks
Data Editing:	Delete Last Point, Edit any point, Skip any point

Recommended calibration period is 1 year. Calibration is only recommended if a change is apparent in the instrument performance. Calibration can be performed without sending the unit back to GSSI, however you must contact GSSI Customer Service for details.

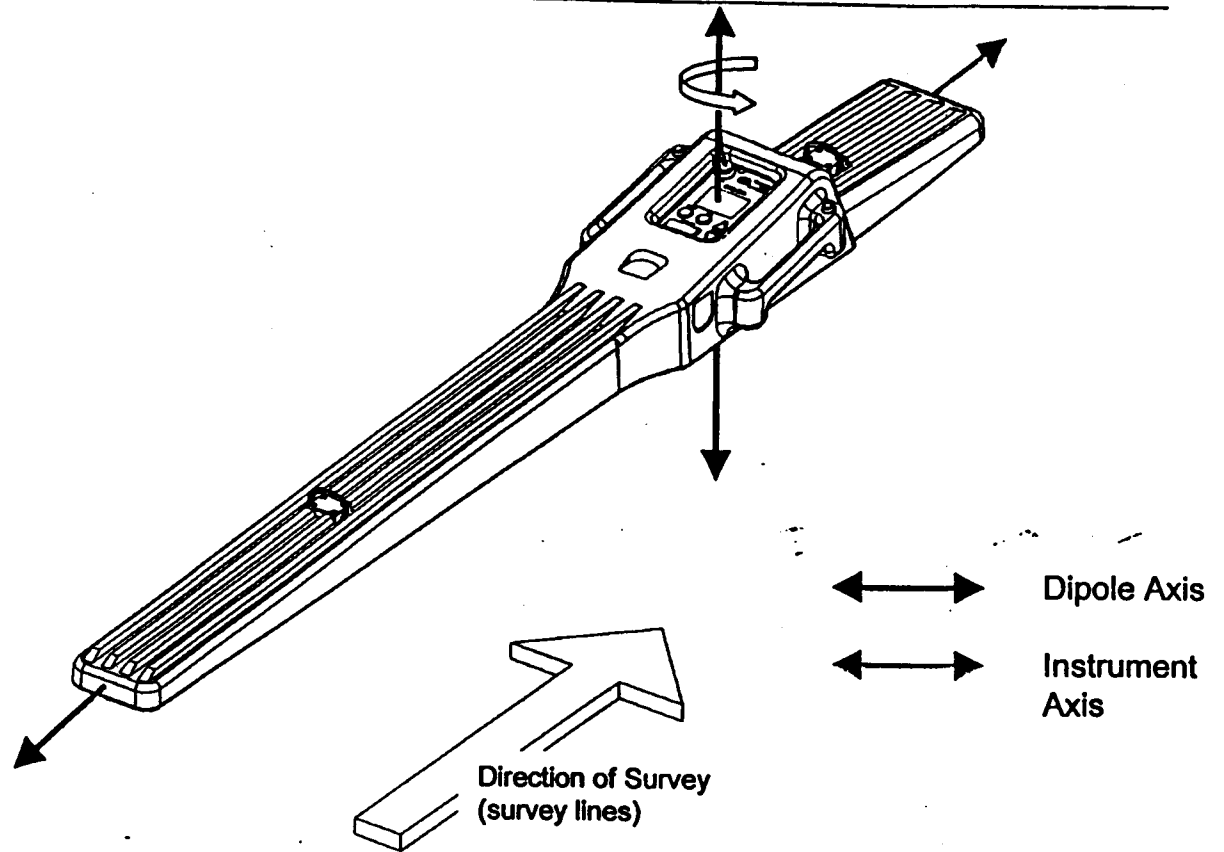


Figure 27: Vertical Magnetic Dipole, In-line survey

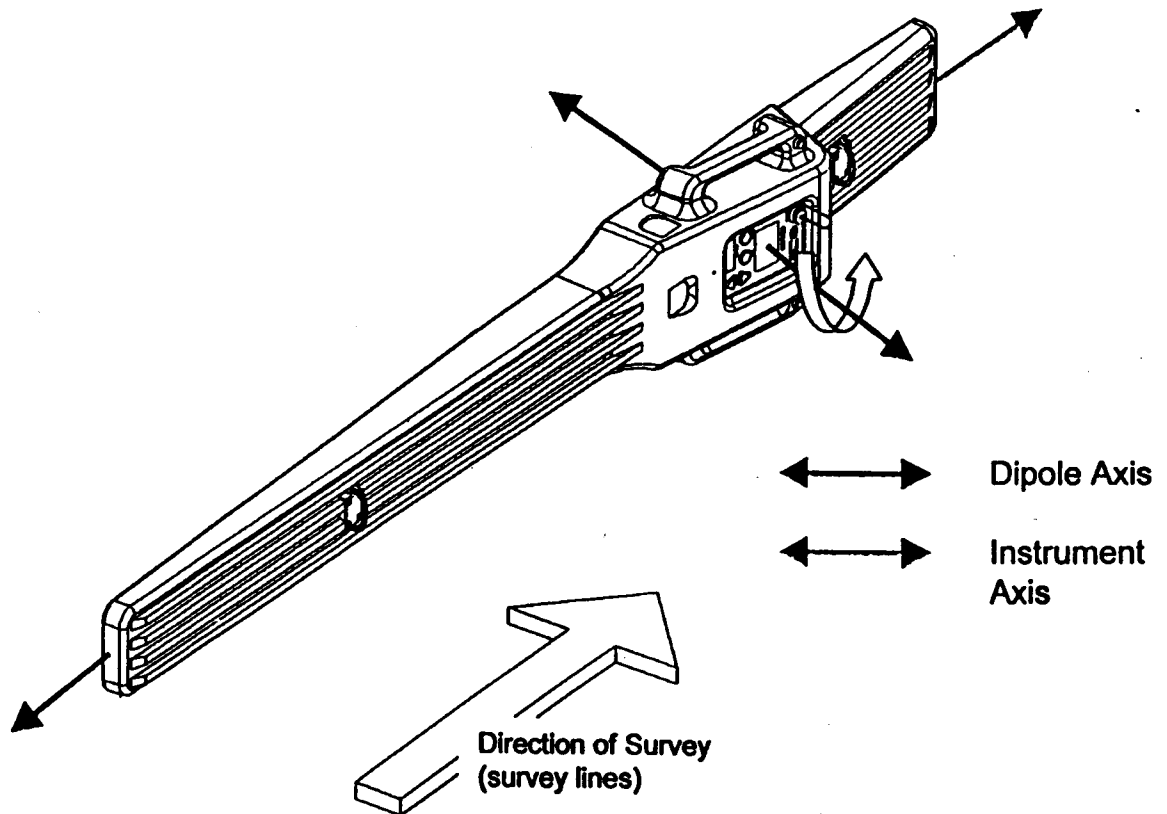


Figure 28: Horizontal Magnetic Dipole, In-line survey

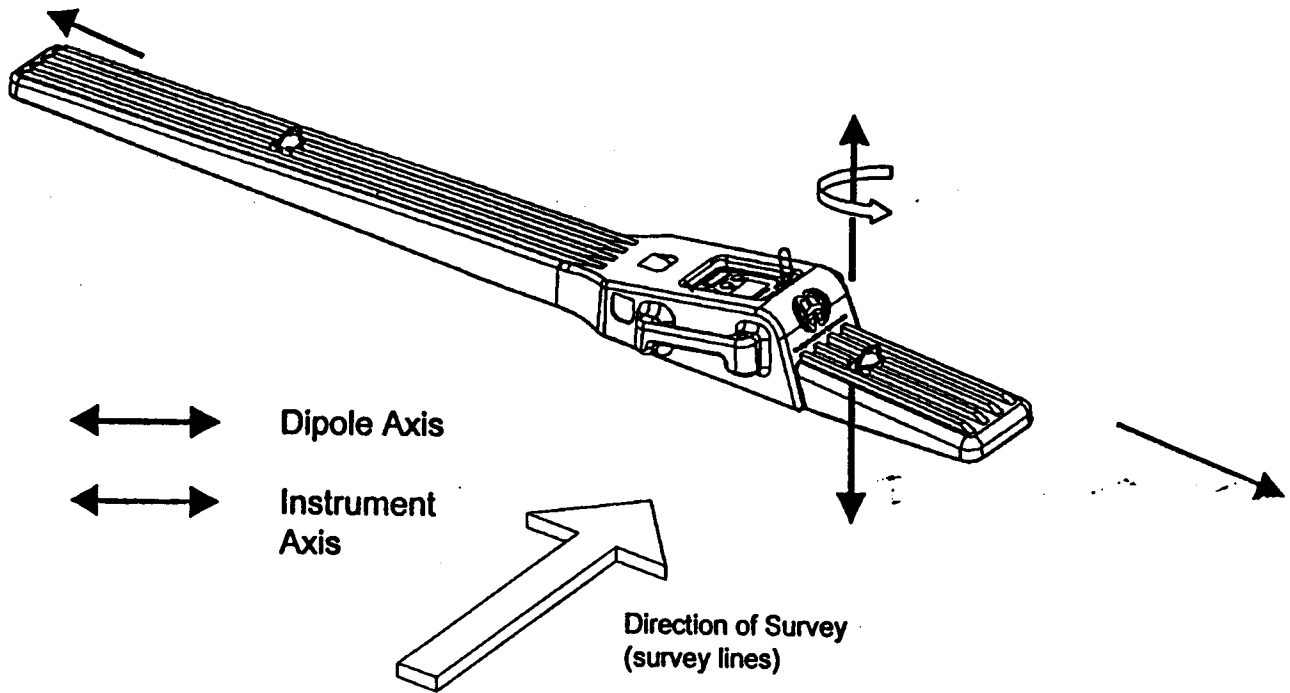


Figure 29: Vertical Magnetic Dipole, Broadside

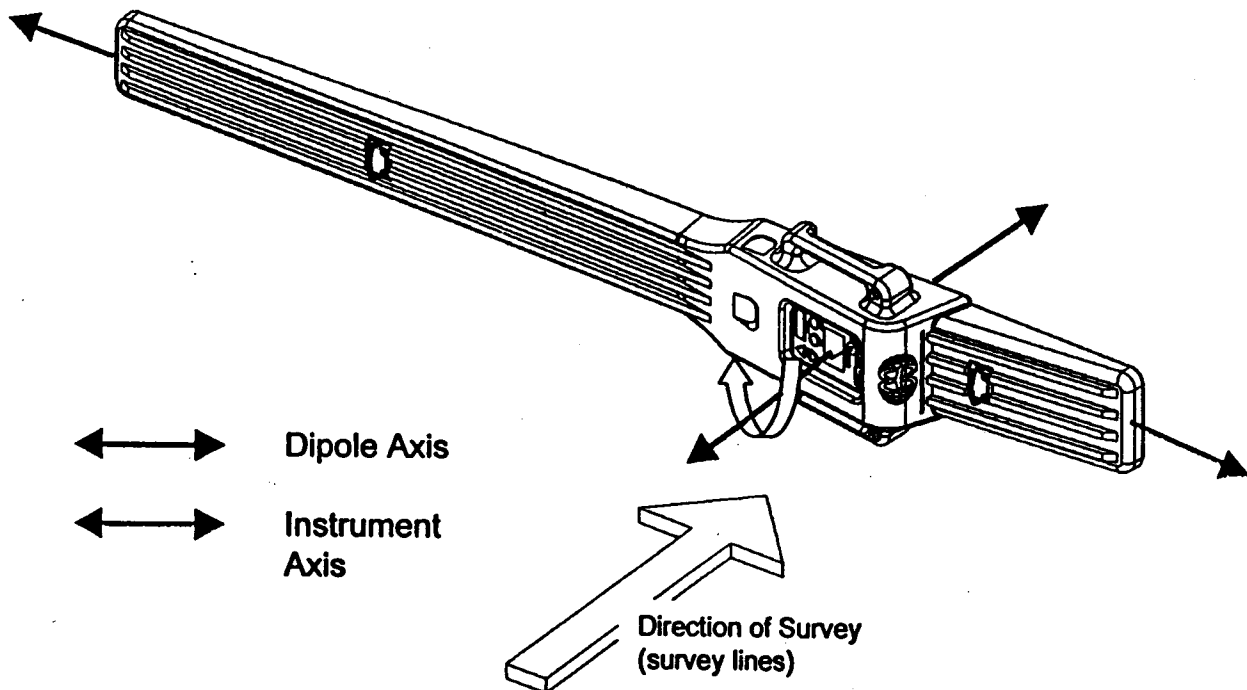


Figure 30: Horizontal Magnetic Dipole, Broadside

A discussion of the differences between different instrument orientations can be found in several geophysics references. A standard starting point is the author F. C. Frischknecht (for example, see *Electromagnetic Methods in Applied Geophysics – Applications Part A and Part B* Edited by Misac Nabighian and published by Society of Exploration Geophysicists 1991) and I.J. Won (see for example *JEEG* Sept, 1997, Vol 2 Issue 2 (a reprint of this article begins on page 38)).

### **Depth of Investigation**

There are many parameters that govern the survey depth. Among these are soil conductivity, frequency, target conductivity and target orientation. At this time, the best gauge of target detectability is Table 2 showing the spectrum of actual targets detected so far. A general measure of the relative difference between investigation depths at different frequencies is shown in the skin depth nomogram (Figure 27). It is important to note that this nomogram gives a relative comparison of skin depths for a given host material at different frequencies. It is simply the depth at which the power in the original signal drops to a pre-determined percentage (usually  $1/e=36\%$ ) of the power at the surface. It is assumed that the host material is a uniform "half-space" and does not take any layering or target characteristics into account.

The general conclusion from this nomogram is that low frequencies penetrate further into a given medium than high frequencies. For a given set of frequencies, and a known conductivity for the host medium, the specific range of skin depths may be determined. For example, if the system is set up to generate 9990 Hz and 5970 Hz, and the host material is clay with a conductivity of 2.0 s/m, the skin depths will be 3.5 m (for 9990 Hz) and 5 m (for 5970 Hz).



Table 2

Target	Top of Target Depth (m)	Target Diameter (m)	Earth Medium	Best Frequency (Hz) Shown Target Detected	Magnetic Dipole Orientation	Target Shape
Steel reinforced concrete septic tank <sup>1</sup>	0.5	1.25	glacial till			cylinder
Salt water intrusion zone <sup>2</sup>	1.5		sand			inclined half space
Concrete pipe <sup>3</sup>	0.5	0.9	glacial till			cylinder
Metal plate in salt water <sup>1</sup>	3	1	salt water			square
Quonset hut wood with steel <sup>4</sup>	4.3	10	volcanic and clastic rocks	12150		half cylinder
Stainless steel pipe <sup>4</sup>	8.5	0.4	volcanic and clastic rocks	7290		cylinder
Subway tunnels <sup>5</sup>	11.5	4.5	marshy	9810		rectangle
Drum containing concrete <sup>6</sup>	2*	0.6	unknown	12150	VMD	cylinder
Plastic drum with salt water <sup>6</sup>	2*	0.4	unknown	12150	VMD	cylinder
Drum containing foam <sup>6</sup>	2*	0.4	unknown	12150	VMD	cylinder
Wood box containing wood and paper <sup>6</sup>	2*	1.2	unknown	12150	VMD	box
Wood box containing wood and paper	2*	1.2	unknown	12150	VMD	box
Wood box containing ferrous metals <sup>6</sup>	2*	1.2	unknown	12150	VMD	box
Wood box containing mixed metals <sup>6</sup>	2*	1.2	unknown	12150	VMD	box
Wood box containing nonferrous metals <sup>6</sup>	2*	1.2	unknown	12150	VMD	box

Wood box containing dense packed metals <sup>6</sup>	2*	1.2	unknown	12150	VMD	box
5 drawer metal file cabinet <sup>6</sup>	2*	0.7	unknown	12150	VMD	rectangle
Metal plate <sup>7</sup>	0.3	0**	unknown	1350	HMD	square
Vertical metal drum <sup>7</sup>	2	0.6	unknown	1350		cylinder
Metal plate <sup>7</sup>	0.6	0**	unknown	1350		square
Trenches with radioactive waste <sup>8</sup>	2*	10	Unknown			rectangle

## Notes:

- \* Depth unknown, assumed to be at least 2m
- \*\* Targets with zero diameter had unknown diameter

## References:

- 1 GSSI field trials, Kingston, NH, USA
- 2 GSSI field trials, Portsmouth, NH, USA
- 3 GSSI field trials, North Salem, NH, USA
- 4 Keiswetter, D. and Won, I.J., JEEG, vol. 2, issue 2, September 1997, pp. 99-103
- 5 Witten, A., Won, I.J. and Norton, S., JEEG, vol. 2, issue 2, September 1997, pp. 105-114
- 6 Keiswetter, D. and Won, I.J., JEEG, vol. 2, issue 2, September 1997, pp. 115-125
- 7 Won, I.J., Keiswetter, D., Fields, G.A., and Sutton, L.C., JEEG, vol. 1, issue 2, August 1996, pp. 129-137
- 8 GSSI testpit

Table 2: Sampling of targets detected by GEM-300 instruments

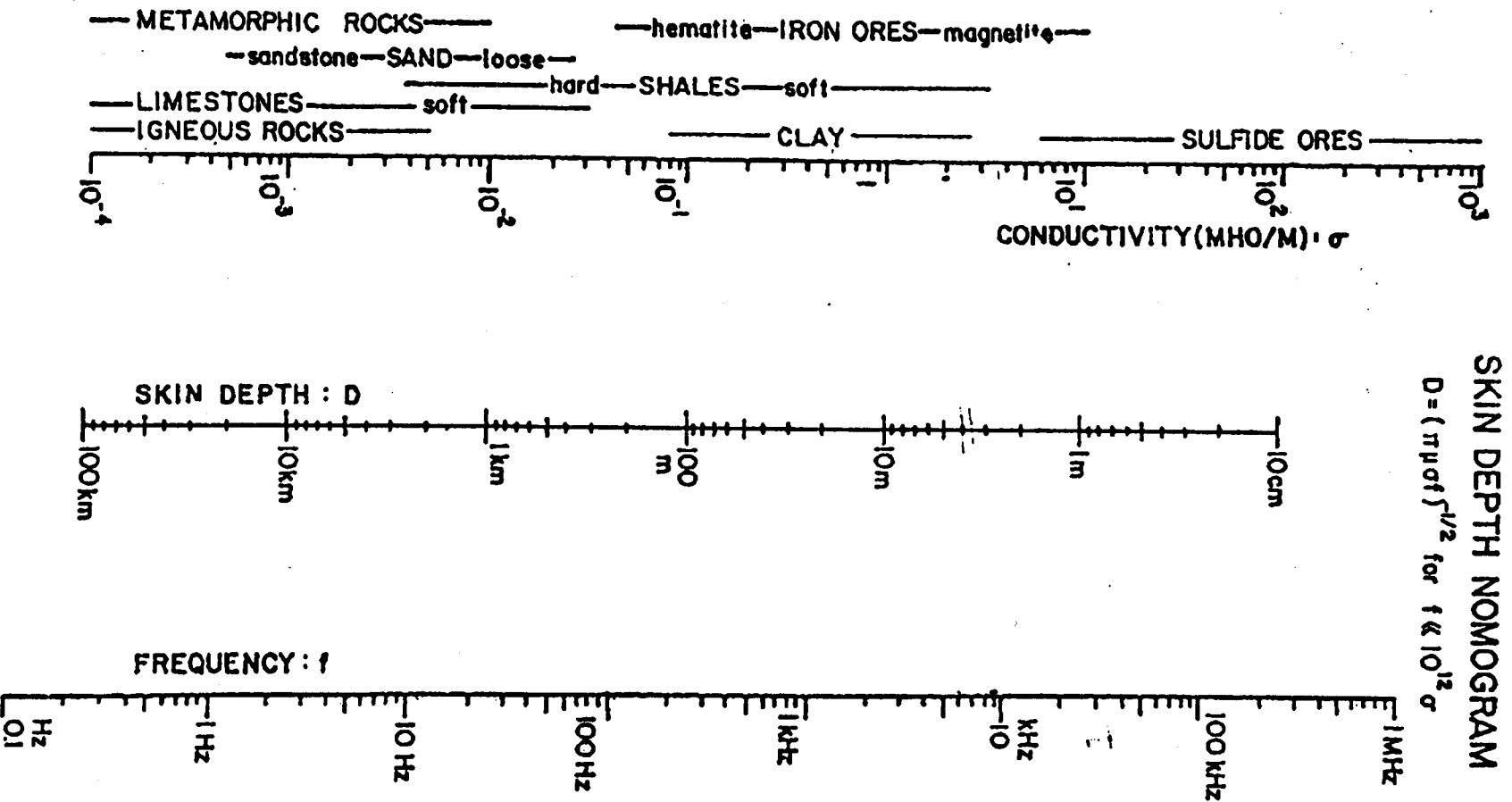
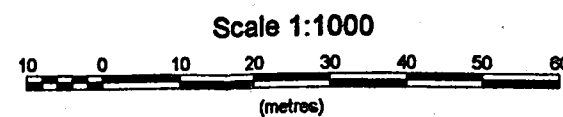
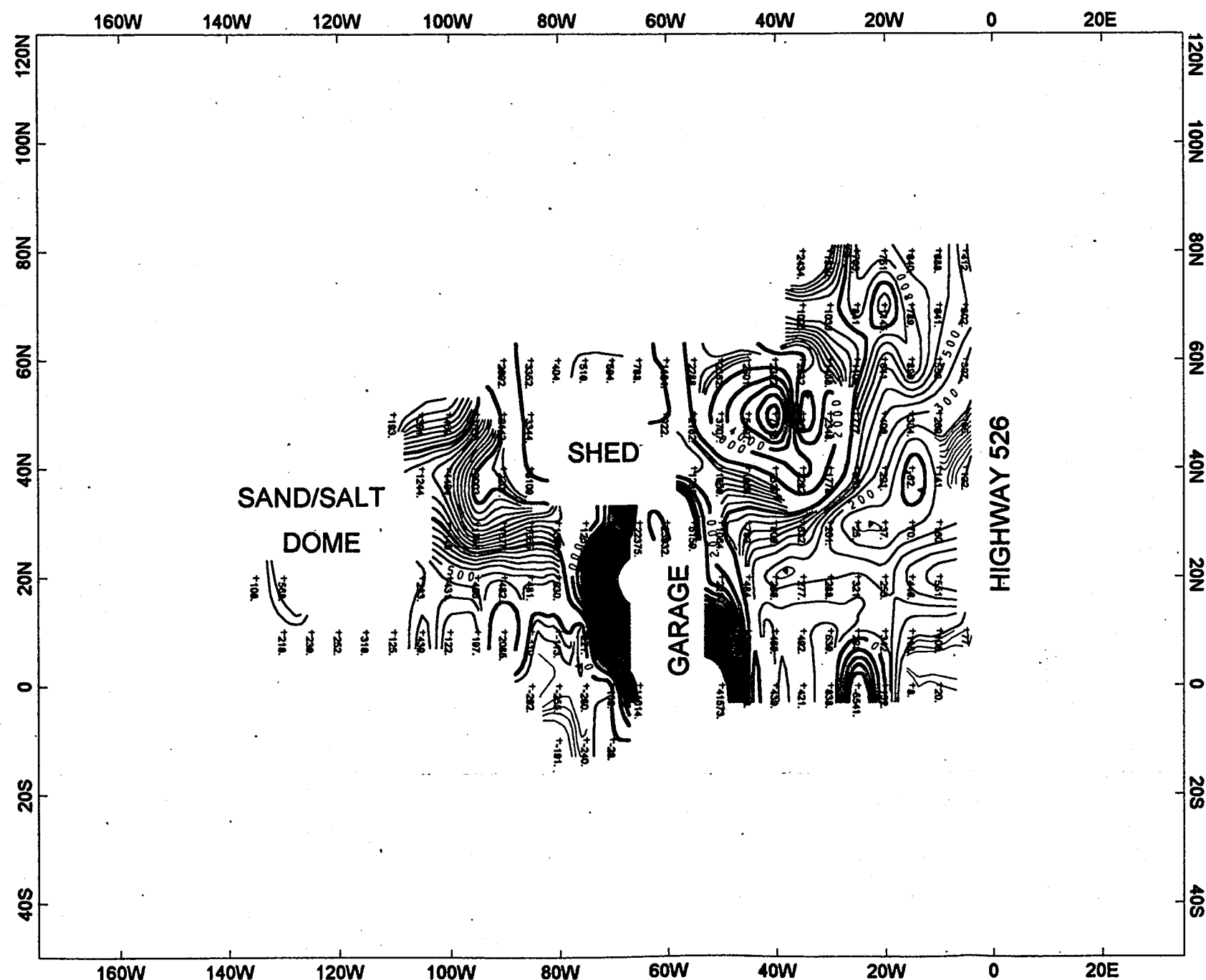
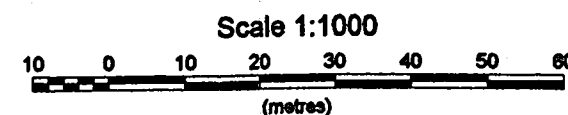
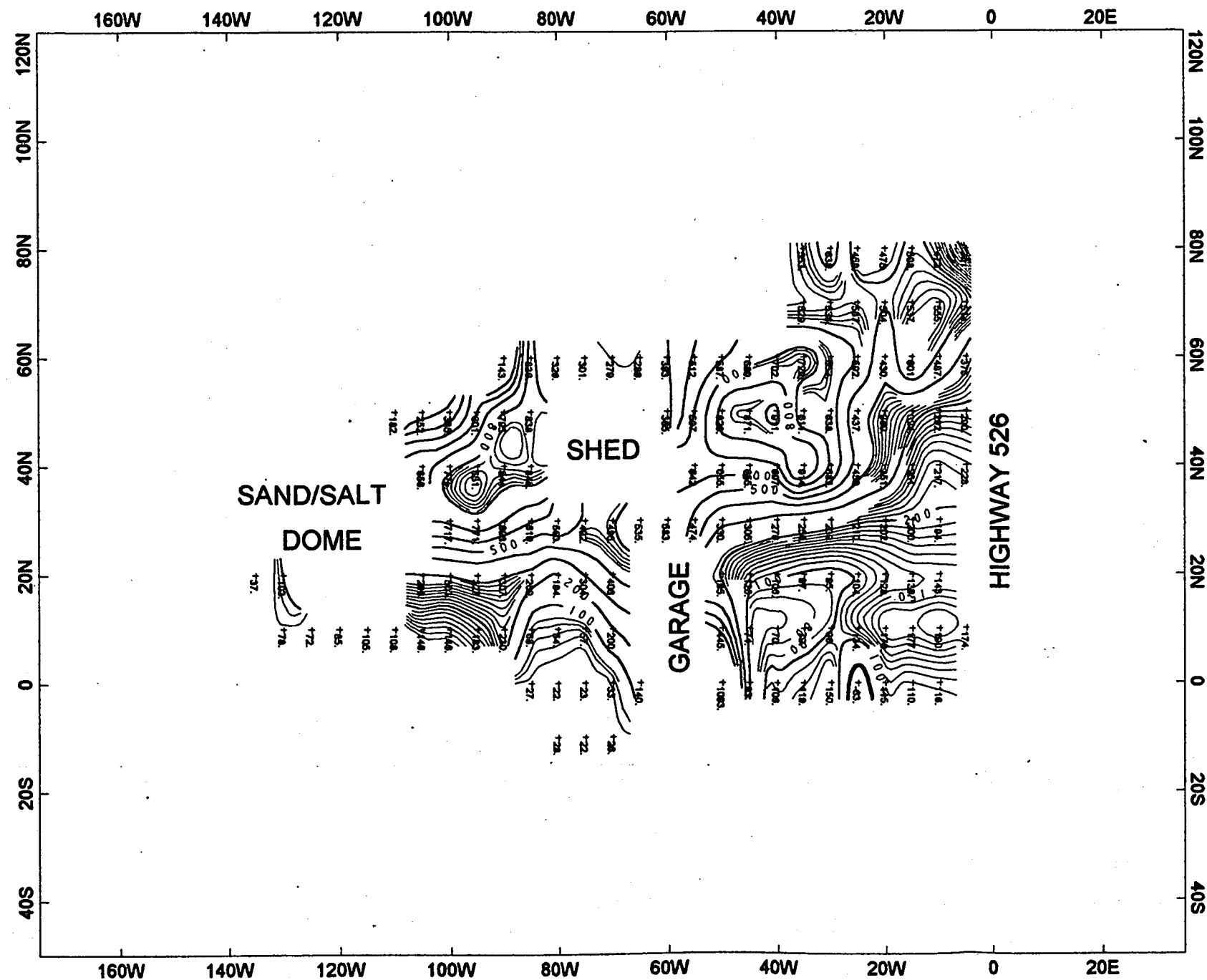


Figure 31: Skin depth nomogram



<b>DST CONSULTING ENGINEERS INC.</b>
<b>TERRAIN CONDUCTIVITY SURVEY BRITT PATROL YARD 3990 Hz. - IN PHASE DATA</b>
INSTRUMENT: GEM-300 OCTOBER 1999 MEASUREMENT UNITS: ppm CONTOUR INTERVALS: 10, 100, & 1000
<b>JOHNSTON GEOPHYSICS</b>



<b>DST CONSULTING ENGINEERS INC.</b>
<b>TERRAIN CONDUCTIVITY SURVEY BRITT PATROL YARD 3990 Hz. CONDUCTIVITY</b>
INSTRUMENT: GEM-300 OCTOBER 1999 MEASUREMENT UNITS: mS/m CONTOUR INTERVALS: 10, 100, & 1000
<b>JOHNSTON GEOPHYSICS</b>

**APPENDIX D  
BOREHOLE LOGS**

**DST CONSULTING ENGINEERS INC.**

# LOG OF BOREHOLE BR-1

REF. No.: SE99103	DST CONSULTING ENGINEERS INC.
CLIENT: MTO	DRILLING DATA
PROJECT: Britt Patrol Yard	METHOD: CME45
LOCATION: Britt, Ontario	DIAMETER: 100 mm
SURFACE ELEVATION: meters	DATE: 10 November 1999

THVC *				SAMPLES		SUBSURFACE PROFILE				REMARKS			
o	PPM			No.	Type	N-Value	SPT	SYMBL	MATERIAL DESCRIPTION		DPTH m	ELEV m	WATER DATA
■	% LEL												
200	400	600	800										
20	40	60	80										
SURFACE													
				1					SAND - medium, medium brown, no odour				
				2					SAND - medium to fine, medium grey, organic odour, soils are saturated	1			
				3					SANDY SILT - medium grey and brown, organic odour, soils are saturated				
				4					SANDY SILT - medium grey, organic odour, soils are saturated	2			
									End of borehole				

GASTECBH BRITT2.GPJ DST\_MNH.GOT 21/12/99

- ☐ Auger Sample
- ☒ Split Spoon
- ☐ 70mm Thin Wall Tube

\* - Total Hydrocarbon Vapour Concentration

# LOG OF BOREHOLE BR-2

REF. No.: SE99103	DST CONSULTING ENGINEERS INC.
CLIENT: MTO	DRILLING DATA
PROJECT: Britt Patrol Yard	METHOD: CME45
LOCATION: Britt, Ontario	DIAMETER: 100 mm
SURFACE ELEVATION: 100.2 meters	DATE: 11 October 1999

THVC *				SAMPLES		SUBSURFACE PROFILE				REMARKS			
PPM				No.	Type	SPT N- Value	SYMBL	MATERIAL DESCRIPTION	DPTH m		ELEV m	WATER DATA	
PPM													
PPM													
PPM				SURFACE									
○	PPM												
200	400	600	800										
■	% LEL												
20	40	60	80										
SURFACE													
				10	1			SAND - medium, medium brown, some dark staining, slight petroleum odour, soils are damp			100		some dark staining, slight petroleum odour
				10	2			SAND- medium, medium brown, slight petroleum odour, soils are saturated	1		99		slight petroleum odour
				10	3			SANDY SILT - fine, medium grey, no odour, soils are saturated	2		98		
				5	4			SANDY SILT - fine, medium grey, no odour, soils are saturated	3		97		
								End of borehole					

- Auger Sample
- Split Spoon
- 70mm Thin Wall Tube

\* - Total Hydrocarbon Vapour Concentration

GASTECBH BRITT1.GPJ DST\_MIN.GOT 21/12/99

GASTECTOR MODEL 1238

Sheet 1 of 1

Enclosure No. 1



REF. No.: SE99103	DST CONSULTING ENGINEERS INC.
CLIENT: MTO	DRILLING DATA
PROJECT: Britt Patrol Yard	METHOD: CME45
LOCATION: Britt, Ontario	DIAMETER: 100 mm
SURFACE ELEVATION: meters	DATE: 10 November 1999

GASTECBH BRITTS.QPJ DST\_MIN.GDT 21/12/99

**Enclosure No. 1**

# LOG OF BOREHOLE BH-4

REF. No.: SE99103	DST CONSULTING ENGINEERS INC.
CLIENT: MTO	DRILLING DATA
PROJECT: Britt Patrol Yard	METHOD: CME45
LOCATION: Britt, Ontario	DIAMETER: 100 mm
SURFACE ELEVATION: meters	DATE: 10 November 1999

THVC *					SAMPLES		SUBSURFACE PROFILE					REMARKS			
○ PPM	200	400	600	800	PPM	No.	Type	N-Value	SPT Value	SYMBL	MATERIAL DESCRIPTION		DEPTH m	ELEV m	WATER DATA
■ % LEL	20	40	60	80											
SURFACE															
					15	1					SAND - medium brown, no odour, soils are damp				Water table @ 1 m
					10	2					SANDY SILT - dark grey, organic odour, soils are saturated	1			
					30	3					SANDY SILT - medium grey, mottles are present, organic odour, soils are saturated	2			
					15	4					SANDY SILT - medium grey, mottles present, organic odour, soils are saturated				
											End of borehole				
<div><div><div>Auger Sample</div><div>Split Spoon</div><div>70mm Thin Wall Tube</div></div><div>* - Total Hydrocarbon Vapour Concentration</div><div>GASTECTOR MODEL 1238</div><div>Sheet 1 of 1</div><div>Enclosure No. 1</div></div>															

- ☐ Auger Sample
- ☒ Split Spoon
- ☐ 70mm Thin Wall Tube

\* - Total Hydrocarbon Vapour Concentration

# LOG OF BOREHOLE BH-5

REF. No.: SE99103	DST CONSULTING ENGINEERS INC.
CLIENT: MTO	DRILLING DATA
PROJECT: Britt Patrol Yard	METHOD: CME45
LOCATION: Britt, Ontario	DIAMETER: 100 mm
SURFACE ELEVATION: meters	DATE: 10 November 1999

THVC *				SAMPLES		SUBSURFACE PROFILE				REMARKS				
○ PPM	■ % LEL	200	400	600	800	No.	Type	SPT Value	SYMBOL		MATERIAL DESCRIPTION	DEPTH m	ELEV m	WATER DATA
20	40	60	80											
SURFACE														
						15	1			SANDY SILT - medium brown, dark staining observed, petroleum odour, soils are damp				dark staining, petroleum odour
						10	2			SANDY SILT - medium brown, no odour, soils are saturated	1			Water table @ 0.91 m
						20	3			SANDY SILT - medium grey, no odour, soils are saturated	2			
						16	4			SANDY SILT - medium grey, no odour, soils are saturated				
										End of borehole				

☐ Auger Sample

☒ Split Spoon

☐ 70mm Thin Wall Tube

\* - Total Hydrocarbon Vapour Concentration

GASTECTOR BH BRITTS.GPJ DST\_MIN.GDT 21/12/99

## Piasecik, Anna (MTO)

---

**From:** Dorval, Gary (MTO)  
**Sent:** December 18, 2002 11:41 AM  
**To:** Piasecik, Anna (MTO)  
**Subject:** Sub Patrol Yard Salt Dome Foundation

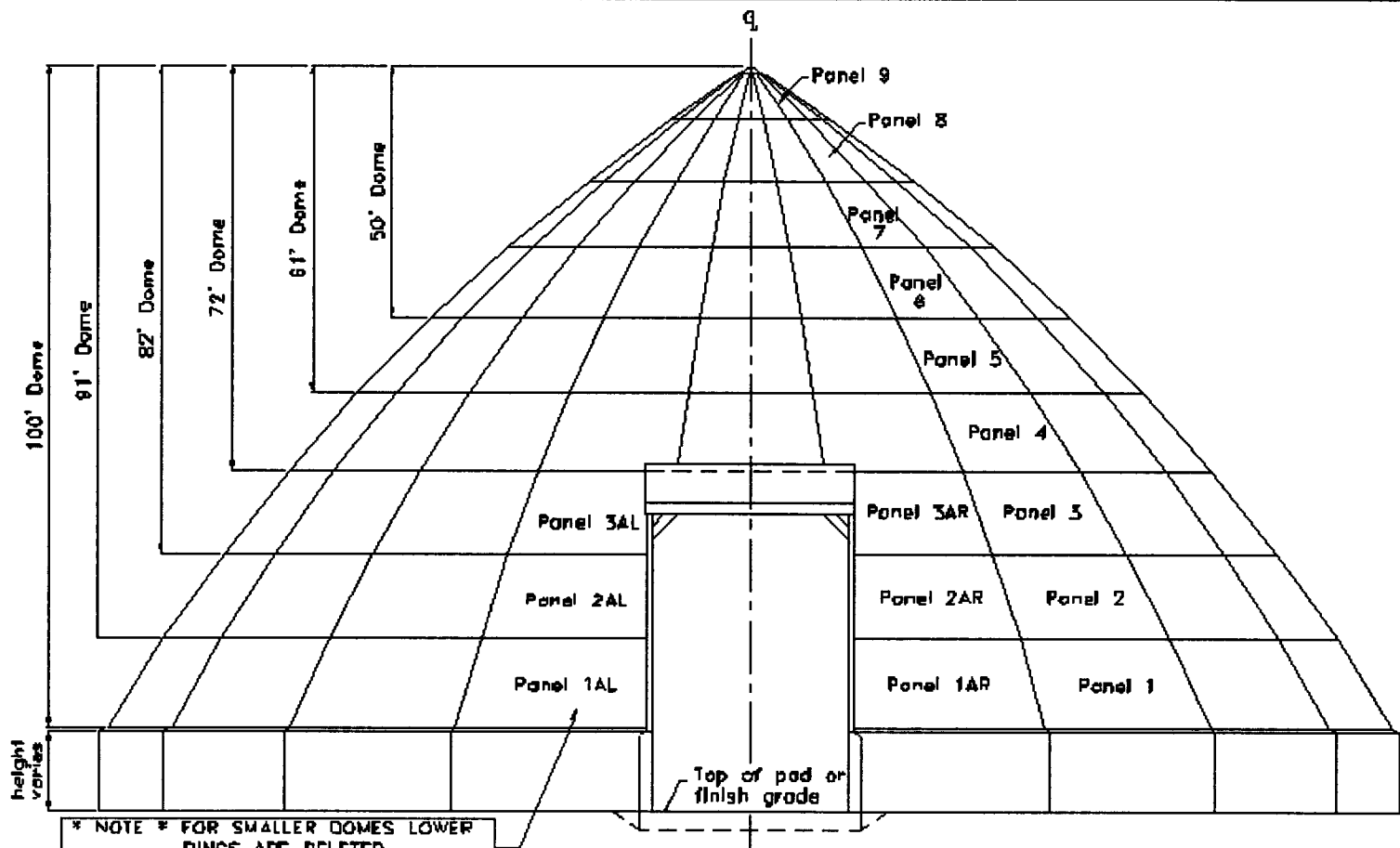
Hi Anna

I'm in the process of writing a Pavement Design Report for a Sub-Patrol yard in the Sault Ste Marie area. The work will include the installation of a 30 m salt dome over an asphalt pad. (see attachment). Apparently, building the concrete walls (300mm x 1.8) on an asphalt pad is common practice in the Northwest for these types of facilities. The underlying soil is primarily a silty-sand. The dome will be constructed in a shallow cut area of the site (0.5-1.0 m). D. Shaw's preliminary recommendations for the asphalt pad calls for 450 mm of Granular B and 150 mm of Granular A in cuts with 50 mm of hot mix pavement. Drawings for a similar sized dome built in Emo called for a foundation designed for a minimum permissible soil bearing pressure of 150 kPa. Any concerns?

Gary



dome.gif



\* NOTE \* FOR SMALLER DOMES LOWER RINGS ARE DELETED

### ELEVATION

#### **ATTENTION:**

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**BULK-STORE STRUCTURES INC.**  
MANUFACTURERS OF PRECASTED BULK STORAGE SYSTEMS

General Information  
100' family

Scale: 3/4" = 1'

Date

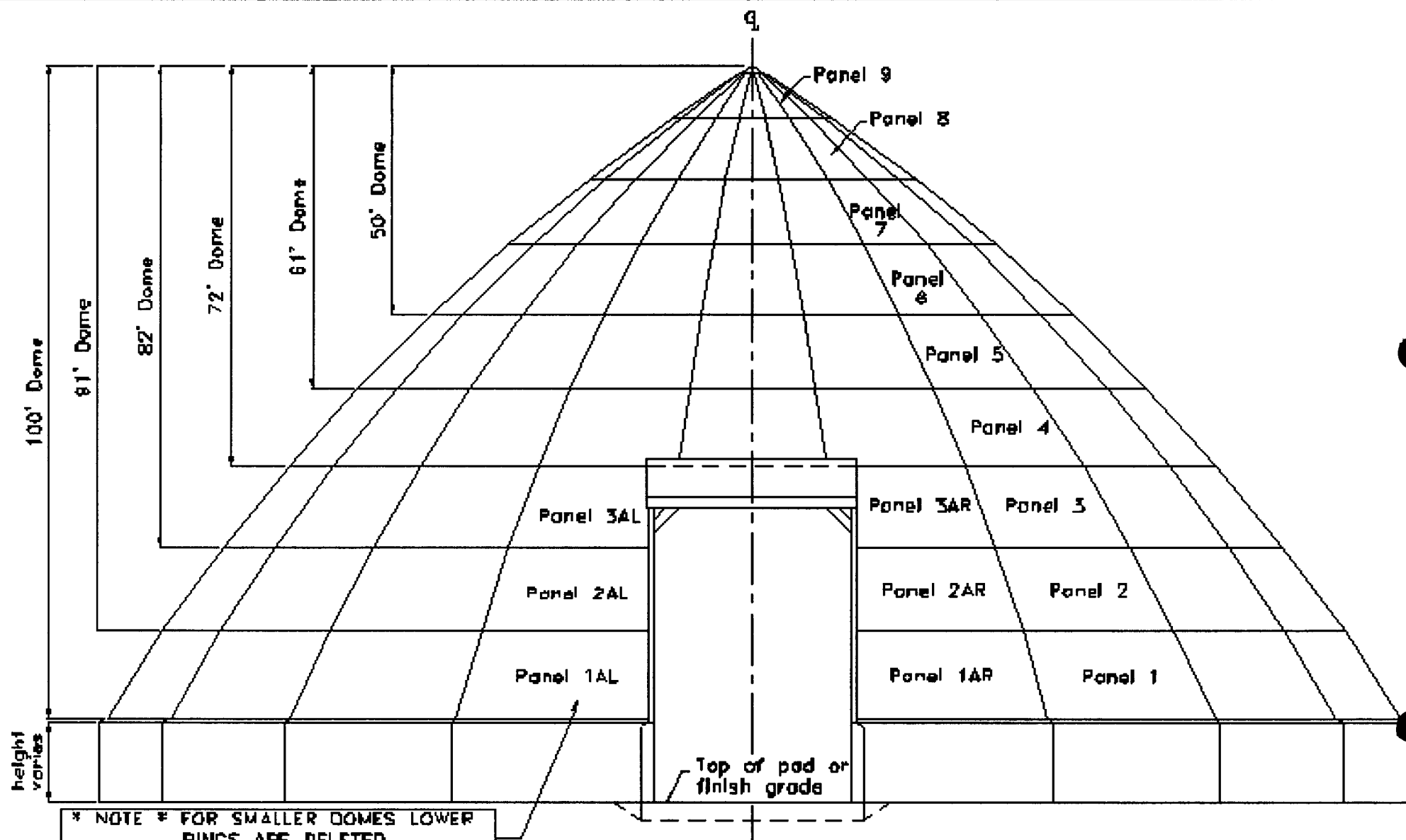
Designed: D.J.

Drawn: J.E.H.

Project Engineer: D.J.

Contract No.

Drawing No.: SK 1



### ELEVATION

#### **ATTENTION:**

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**BULK-STORE STRUCTURES INC.**  
MANUFACTURERS OF PRESTANDARD BULK STORAGE SYSTEMS

General Information  
100' family

Scale: N.T.S.

Date

Designed: D.J.

Drawn: J.E.H.

Project Engineer: D.J.

Contract No.

Drawing No. Sk 1