SITE INSPECTION REPORT

FOR

C & H TAMARACK OPERATIONS

HUBBELL, MICHIGAN 49934

U.S. EPA ID NO.: MIN000510835

MARCH 10, 2015

SIGNATURE PAGE

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1. EXECUTIVE SUMMARY

The United States Environmental Protection Agency (U.S. EPA) has been authorized to conduct assessments of sites of environmental concern under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (jointly referred to as CERCLA) and the federal Water Pollution Control Act, as amended through P.L. 107-303 of 2002 (commonly known as the Clean Water Act [CWA]). Details regarding the CERCLA site assessment process are found in the National Oil and Hazardous Substances Pollution Contingency Plan which is established pursuant to Section 105 of CERCLA and Section 311 of the CWA. CERCLA site assessment activities in the State of Michigan are conducted by the Michigan Department of Environmental Quality (MDEQ) under the authority of a cooperative agreement (CA) with the U.S. EPA. This report summarizes the results of a Site Inspection (SI) of the C & H Tamarack Operations site (Site) conducted by the MDEQ as part of the site assessment activities designated in the CA.

Approval was given to the MDEQ by the U.S. EPA to conduct an SI of the Site on March 26, 2012, the date when the CA grant was approved. Authority for conducting the SI is given under Section 104 of CERCLA. The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) identification number for the Site is MIN000510835.

The Site is located on M-26 in south Hubbell, Houghton County, Michigan. The location coordinates for the Site are 47.1638° north latitude and -088.4425° west longitude.

The Site was initially discovered into the CERCLA Pre-Remedial process on October 31, 2012. The MDEQ submitted a Pre-CERCLIS Screening report to the U.S. EPA on September 5, 2012. The U.S. EPA subsequently entered the Site into CERCLIS on October 31, 2012. The Site was initially evaluated in the form of a Preliminary Assessment (PA) that was submitted to the U.S. EPA, Region 5. The PA was prepared by John E. Spielberg of the MDEQ and was dated November 2, 2012.

The MDEQ prepared an SI work plan for the Site on November 2, 2012. The SI field work for the Site was conducted November 5, 6, and 8, 2012. The SI included: phone interviews with Site representatives; a reconnaissance inspection of the Site; x-ray fluorescence (XRF) screening of suspect materials for metals content; the installation of temporary groundwater monitoring wells; the collection of soil, groundwater, and blank samples; using a Global Positioning System (GPS) to obtain sample location coordinates; and the collection of photographs of samples, sample locations, and Site conditions.

The purposes of SIs have been developed by the U.S. EPA, Region 5 in response to U.S. EPA Administration Guidance outlining Pre-Remedial Program strategies. The program plan provides that all eligible sites will receive an SI to meet the investigative requirements of CERCLA Section 105 to provide sufficient data for National Priorities List (NPL) or No Further Remedial Action Planned (NFRAP) decisions and/or to support the need for time critical or non-time critical actions. If an NPL decision is made, the SI will: 1) collect additional data beyond the PA to enable a more refined preliminary Hazard

Ranking System (HRS) score, 2) establish priorities among sites most likely to qualify for the NPL, and 3) identify the most critical data requirements for NPL listing. Based on the refined preliminary HRS score, the SI, and other technical judgment factors, the Site will then either be designated as NFRAP or carried forward as an NPL listing candidate. A candidate NPL site will not automatically be placed on the NPL. First, the Site will go through a management evaluation to determine whether it can be addressed by another authority. Sites that are designated NFRAP or deferred to other statutes are not candidates for further investigation or action in the Superfund Program.

The scope and objectives of the SI are designed to address all the data requirements of the revised HRS using field screening and NPL-level data quality objectives. It may also provide needed data in a format to support remedial investigation work plan development.

The Site consists of waste and contaminated soils on about 11 acres of approximately 51 acres of land in the SI project area. The Site still contains the remains of several former stamp mills and a former reclamation plant. Lands surrounding the Site are mixed residential/commercial/industrial areas within Hubbell. The Site is located adjacent to the Torch Lake Superfund site but none of the Site is part of the Superfund site.

Mining-related operations at the Site, which included stamping copper-containing ores and reprocessing stamp sands, were originally conducted by several companies beginning about 1885. By 1917 or earlier, the Calumet & Hecla Mining Company (C & H) had taken over operations. Operations on the Site ceased at various times with final C & H operations ending in approximately 1969.

The findings of this SI include impacts to shallow soils and shallow groundwater, which can be attributable to past operations at the Site. Widespread shallow soil contamination, significantly above background and above state standards protective of direct contact risks in the southern part of the Site, is present. Shallow groundwater in the vicinity of a former reclamation plant in the southern part of the Site was also found to be significantly above background for several metals.

2. SITE BACKGROUND

2.1 Introduction

This section includes information obtained from the Site Inspection (SI) work plan preparation, file review, and Site representative interviews for the C & H Tamarack Operations site (Site). Individual subsections address the Site location, description, geology, operational history, previous investigations, and waste characteristics.

2.2 Site Location and Description

The Site is located along state highway M-26 on the western shore of Torch Lake in a mostly residential area within the unincorporated community of Hubbell, Osceola Township, Houghton County, Michigan (T.55 N., R.33 W., section 13). The Site location is shown in Figure 2-1. The location coordinates for the Site at a driveway entrance to the middle of the southern area of the Site, in decimal degrees, are latitude 47.1638° and longitude -088.4425°. This report has retained the division of the Site into three subareas - A, B, and C - as was the case in the Preliminary Assessment (PA) report. These divisions have no regulatory implication. The three subareas are shown in Figures 2-2 through 4-1.

The Site consists of waste and contaminated soils on about 11 acres of approximately 51 acres of land in the SI project area. The Site still contains the remains of several former stamp mills and a former reclamation plant. Two target distance limit (TDL) maps in the appendices show the extent of potential impacts from the Site being considered during this SI. To show potential groundwater impacts, the 4-Mile Radius Map of the Site is provided in Appendix A. To show potential surface water impacts, the 15-Mile Surface Water TDL map is provided in Appendix B.

Lands surrounding the Site are mixed residential/commercial/industrial areas within Hubbell. The Site is located adjacent to the Torch Lake Superfund site but none of the Site is part of the Superfund site.

The geology of the area within the 4-mile groundwater TDL consists of bedrock at the surface in places and shallow glacial deposits overlying bedrock [1-3][1]. The glacial deposits are relatively thin ground moraines typically consisting of coarse-textured glacial till, only 0 to 50 feet thick to the east and west of the Site. Some thicker lacustrine sand and gravel deposits are found to the north, up to 200 feet thick. The depth of these deposits in the general area of the Site is approximately 11 to 50 feet. The bedrock in the area of the Site consists of Jacobsville sandstone to the southeast and the Portage Lake Lava Series to the west and northwest. These glacial deposits and underlying bedrock are capable of producing limited supplies of groundwater.

[1] Numbers in brackets refer to numbered sources of information in the Bibliography section.

It appears that since the glacial deposits consist mainly of coarse and permeable materials, any aquifers in the glacial deposits are likely interconnected with the bedrock aquifer. Residents in the area are served by a combination of municipal systems and private water wells, both of which utilize groundwater for their drinking water.

2.3 Site Operational History

Mining-related operations at the Site, which included stamping copper-containing ores and reprocessing stamp sands, were originally conducted by several companies beginning about 1885 [4, 5]. The Osceola Consolidated Mining Company began operations on the Site in 1885 or earlier and continued to at least 1908, during which time it operated stamp mills throughout the Site. The Tamarack Mining Company operated from at least 1900 to 1908 or later, including stamp mills in Subarea C. By 1917 or earlier, the Calumet & Hecla Mining Company (1917 Sanborn) (C & H) had taken over operations. C & H did the same for the Ahmeek Stamp Mill in Subarea A by 1928 or earlier, after it had changed its name to Calumet & Hecla Consolidated Copper Company (1928 Sanborn). The 1928 Sanborn map is the first time the Tamarack Reclamation Plant appears in the northern part of Subarea C. See Figures 2-2, 2-3, and 2-4 for a 1928 Sanborn map, a 1946 topographic map, and a 1954 aerial photograph, respectively. Operations on the Site ceased at various times with final C & H operations ending in approximately 1969 [6]. No buildings remained at the former Tamarack Reclamation Plant by 1978 but only foundations, according to a 1978 aerial photograph from Michigan State University's Geographic Information Systems (GIS) & Remote Sensing archive.

2.4 Summary of Previous Investigations

The following environmental investigations were completed at the Site:

- In the fall of 2001, a consultant conducted a Baseline Environmental Assessment (BEA) [7] on behalf of Osceola Township for the former Ahmeek Stamp Mill [6, 8]. That BEA included the collection of five shallow soil samples.
- In June of 2002, the Michigan Department of Environmental Quality (MDEQ) conducted a Brownfield Redevelopment Assessment (BFRA) of the former Ahmeek Stamp Mill. The results were summarized in a December 2002 report [9].
- In 2005, Weston Solutions, Inc. (Weston) conducted a review of the BEA and BFRA to evaluate conditions at the former Ahmeek Stamp Mill, according to the report below [6], which states their results were reported in 2005 [10].
- In September 2007, U.S. EPA contractor, Weston, undertook field activities to assess various areas of concern around Torch Lake identified by the U.S. EPA and the MDEQ. Two of their areas of investigation (AOIs) were within the Site: the Tamarack City Stamp Mill (Ahmeek Stamp Mill) (AOI #20) and the former Tamarack Reclamation Plant (part of

AOI #19). Weston summarized existing data from MDEQ sources for both AOIs. Results are summarized in a December 2007 report [6].

The above investigations provide documentation that source areas exist at the Site and releases to the environment have occurred at the Site. See Figure 2-5 for a summary of locations where these investigations occurred and the overall results, which demonstrate soil and groundwater contamination that poses a risk to the surface waters of Torch Lake. The table below summarizes what each investigation found:

Investigation	Results
2001 BEA	All five soil samples exceeded state Groundwater Surface Water Interface (GSI) Protection Criteria (GSIPC) for nine metals and three semi-volatile organic compounds. The highest concentrations were significantly above the GSIPC. Arsenic was found up to 470 parts per million (ppm) (5.8 ppm GSIPC), copper up to 240,000 ppm (32 ppm GSIPC), and mercury up to 1.1 ppm (0.13 ppm GSIPC). The semi-volatiles carbazole, fluoranthene, and phenanthrene also exceeded GSIPC.
2002 MDEQ BFRA	MDEQ collected shallow and subsurface soil samples and groundwater samples, and conducted x-ray fluorescence (XRF) screening of surficial materials. The primary exposure pathway of concern seems to be surface water due to potential impacts from contaminated groundwater venting into Torch Lake (mostly copper, but also barium, beryllium, lead, manganese, mercury, and vanadium). Mercury, a bioaccumulative metal in surface water, was found up to 0.65 ppm in surficial soil samples, up to 250 ppm in XRF screenings, and up to 0.25 ppm in soil boring samples (0.13 ppm GSIPC). In groundwater samples, five metals including mercury were found to be significantly above background levels and all exceeded GSI levels, which are protective of surface water impacts. In addition, 23 out of 25 shallow soil samples revealed concentrations of semi-volatile or inorganic contaminants significantly above background. Ten of these samples also exceeded direct contact standards.
2005 Weston	Surface soils and standing structures were the main concern, based on contaminant concentrations at the surface above Residential Direct Contact Criteria and Particulate Soil Inhalation Criteria.
2007 Weston	The report reviewed data from the BEA, BFRA, and 2007 MDEQ sampling. Based on XRF screening results and one waste sample submitted to the MDEQ Environmental Laboratory, the former leach plant was found to contain surface soils with antimony, arsenic, copper, lead, and mercury at concentrations exceeding GSIPC. Mercury was detected at 340 ppm (0.13 ppm GSIPC).

2.5 Waste Characteristics

Documented sources include contaminated soils or waste.

Contaminated Soils at the Former Ahmeek Plant (2001 and 2002 sampling):

Inorganic and semi-volatile releases were documented in a 2001 BEA and a 2002 BFRA. Contaminated soils were found to be widespread across the former stamp mill property in Subarea A. The area of soil contamination, as calculated using ArcView 9.3 GIS software, is an estimated 200,000 square feet, based on shallow soil sampling and XRF screening in the 2002 BFRA. Since this area has now been covered over with potentially clean fill, the direct contact and particulate inhalation risks previously believed to exist from contamination in shallow soils may no longer pose an unacceptable risk. However, the same contaminants can still leach into groundwater at concentrations posing a potential risk to the surface waters of Torch Lake and potentially to Dover Creek, which empties into Torch Lake. No sampling was conducted in Subarea A during the SI.

Contaminated Soils and Waste at the former Tamarack Reclamation Plant:

This source in Subarea C was first documented in a 2007 report by Weston, which is based on the sampling and XRF screening of soils or possible waste materials by MDEQ staff in 2007. Six inorganic analytes – antimony, arsenic, copper, iron, lead, and mercury – exceeded their state cleanup criteria. The estimated area of this contamination, equivalent to the approximate footprint of the former reclamation plant, is about 600,000 square feet. The southern part of the former leach plant, where the samples were screened or sampled, is now filled with potentially clean fill. This could mean that direct contact and particulate inhalation risks previously believed to exist may no longer be relevant. However, the buried waste could still leach into shallow groundwater and migrate to Torch Lake at concentrations injurious to the lake. Five metals were found to exceed GSIPC standards, especially mercury, which is a bioaccumulative metal in surface waters.

During the SI, XRF screening and shallow soil sampling documented contaminated soils. The area of the contaminated soil was calculated to be about 300,000 square feet. Two waste samples were also collected: W-1 and W-2. The results are found in Table 2-1.

3. SITE REGULATORY HISTORY

3.1 Introduction

This section presents information regarding the regulatory history of the Site. This information was obtained through file review and Site representative interviews.

3.2 Regulatory History

Osceola Township currently owns the former Ahmeek Stamp Mill property in Subarea A where the township has completed some response actions (personal communications with Mr. Steven Karpiak and Mr. Steve Rouser; see section 4.2). The township completed and submitted a BEA to the MDEQ in November 2001 for the former stamp mill property [8]. The township received a Coastal Restoration Grant, which it used to cover and vegetate the western part of the former Ahmeek Stamp Mill portion of the Site in 2004 [11]. They used clean soil to cover areas along the west side where high levels of metals in shallow soils posed a human health risk. This work included developing the western part of the former stamp mill into a park. The township also utilized these funds to cover debris piles along the former stamp mill foundations. The property is targeted for historical preservation and potential use as an interpretive center for tourists [6] and is considered a "site of interest" for the Keweenaw National Historic Park (personal communication with Mr. Steven Karpiak; see section 4.2). The National Park Service cannot own the individual properties that would make up the national park.

The MDEQ completed several regulatory actions only for the former Ahmeek Stamp Mill in Subarea A. The MDEQ completed a BFRA of the former stamp mill property in December 2002 [9]. In 2003, MDEQ district staff scored the stamp mill property for inclusion in its state list of contaminated sites, scoring 38 out of a possible 48 [12]. The property was later listed on the state list, which at that time placed responsibilities on owners and operators for conducting response activities at the property. From 2004 to 2005, the MDEQ made Clean Michigan Initiative bond funding available for work plan preparation and bidding to stabilize the stamp mill site, but bids received were over budget and interim response actions were delayed [11].

4. RECONNAISSANCE ACTIVITIES

4.1 Introduction

This section outlines procedures and observations of the reconnaissance work portion of the SI for the Site. Individual subsections address the Site representative interviews and reconnaissance inspection observations.

4.2 Site Representative Interviews

This subsection contains phone conversations the Team Leader had with individuals pertinent to this SI.

9/11/2012: Telephone conversation with Mr. Steven Karpiak, Osceola Township Supervisor. He was asked about granting the MDEQ access to the former Ahmeek Stamp Mill property in Subarea A. He said that no special access is needed; the property has public access. Also: rebar and concrete waste has been largely covered (with fill) around the concrete pillars (remaining foundations from former mill); the property is a "site of interest" for the Keweenaw National Historic Park; part of the property is now a public park; the Western UP Planning and Development Region (WUPPADR) may have parcel information (used for development of an SI work plan).

9/11/2012: Telephone call with Ms. Rene Cunningham, Osceola Township Treasurer. She was asked about availability of maps. She suggested contacting WUPPADR for parcel boundary maps.

9/11/2012: Telephone conversation with Mr. Steve Rouser, WUPPADR. He said they have parcel shape files usable in GIS that he could send the MDEQ.

9/17/2012: Spoke by telephone with Mr. Doug Pascoe, District Engineer, MDEQ Resource Management Division, Upper Peninsula District. He was asked about the extent and reach of public water supplies near the Site. He said that Tamarack City is the farthest south that the Michigan American Water Company supply reaches, and the same supply also reaches to the Houghton County airport. He also said that a water supply from Dollar Bay reaches to Mason.

10/3/2012: Spoke by phone with the owner of the property in the middle of Subarea C. He said that his property still contains the remains of the Osceola Mill and a railroad grade. In addition, he said some older remains are still present in the northern part of his property. He added that public water supplies reach all three of his properties and some other properties to the south of his land. He agreed to provide access to the MDEQ for his properties.

10/4/2012: Phone conversation with a property owner in the north part of Subarea C. He said he has lived in the area since he was an infant and remembers some of the C & H operations in the area. He stated that surplus dirt

from recent road construction projects had been moved into a portion of subarea C.

10/5-11/2012: Heard from several property owners, who agreed to provide access to the MDEQ for sampling activities.

For copies of original notes from the personal communications above, see Appendix D, Field Log Book.

4.3 Reconnaissance Inspection Observations

On October 11, 2012, the investigation team, composed of two MDEQ project managers, conducted a reconnaissance inspection of the Site and surrounding area in accordance with MDEQ Health and Safety guidelines. The inspection confirmed that Subareas A and B of the Site are located within the unincorporated community of Hubbell in Houghton County and Subarea C is at the south end of Hubbell. See Figure 2-1 for a location map.

The investigation team only observed Subarea C during the October reconnaissance inspection. This area consists of several privately-owned properties, including one house used as a residence near the middle of Subarea C. The team took some photographs of potential areas of concern, screened some suspect surficial materials with an XRF unit, and recorded GPS locations of XRF readings. No physical samples were collected during this inspection. The northern property of Subarea C contained the remains of at least three buildings. This property was being used to store scrap metal from former underground storage tanks and other uses, including some old trucks. Scrap tires were also being stored between the remaining concrete foundations of the former reclamation plant closest to M-26 at its north end, where the recent fill dirt had not yet filled in between the concrete foundations. The southern part of this plant is filled in with what looked like recently moved fill dirt, completely covering portions of the former plant.

During November 2012 MDEQ field activities, Subarea A was found to still contain large concrete structures from the former stamp mill and included one rusted metal structure that was once a stamp that crushed copper-containing ores. The MDEQ investigated this area in 2002 as part of a BFRA. A small public park now exists next to the remains of the former stamp mill. The park was not present in 2002. Much of the former debris scattered about Subarea A in 2002 is now covered with fill dirt. The Team Leader decided that because much of Subarea A had been covered with what appeared to be clean fill, there was no need to sample surficial materials during the SI. See Figure 4-1 for a Site Features map.

The natural topography of the area is quite variable. Subarea A has a topographic relief of about 20 to 30 feet difference from the area along state highway M-26 to areas closer to Torch Lake. Subarea B is fairly flat and of lower elevation than the other two subareas, while Subarea C includes steep terrain with elevation differences of 40 feet or more.

The areas around the Site consist of primarily residential properties, along with some small businesses. Residential properties are found to the northwest along Osceola Road, D Street, and Oneco Road, in the northern part of Subarea C, and to the northeast into Hubbell/Tamarack City. Several small businesses are found along M-26 through Hubbell. Recreational uses would include the township park in Subarea A and a number of recreational uses associated with Torch Lake.

The immediate drainage pattern for the Site is to the southeast, in the direction of the adjacent stamp sands and Torch Lake. The Probable Point of Entry (PPE) of this shallow groundwater would be an area along the shoreline of Torch Lake as seen in Appendix B.

5. FIELD INSPECTION SAMPLING PROCEDURES

5.1 Introduction

This section outlines the sampling procedures of the SI of the Site. Individual subsections address the media specific sampling procedures. Rationale for specific activities is also provided. The SI was conducted in accordance with the U.S. EPA approved work plan dated November 2, 2012. Photographs of the samples obtained during the SI and the sample locations are provided in Appendix C. The Team Leader's field log book for the field inspection activities is provided in Appendix D.

5.2 Sampling Procedures

Samples were collected at the Site by the investigation team from November 5 to 6, 2012. These samples were collected to determine potential contaminant source areas, the presence or impacts of Site wastes, background concentrations in the target media, and observed releases to two of the four pathways (groundwater and soil) used by the U.S. EPA to evaluate sites.

The team collected 14 surficial soil, 12 soil boring, 4 groundwater samples, and 2 waste samples, along with 2 field blanks and 1 pump blank. In addition, field staff collected 4 duplicate samples and screened surficial materials with a hand-held XRF unit. Split samples were offered to property owners but were declined.

Standard MDEQ sample collection, preservation, and decontamination procedures, as outlined in the work plan, were followed for all samples except as noted in the next paragraph. Sample collection and preservation followed the MDEQ Remediation and Redevelopment Division (RRD) Operational Memorandum No. 2, Attachments 4-6. Soil samples analyzed for volatile organic compounds (VOCs) were field preserved with methanol. Soil samples collected for other analyses were not chemically preserved. Water samples analyzed for VOCs were field preserved with hydrochloric acid. Water samples analyzed for semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyl (PCB) compounds were not field preserved. Water samples analyzed for total metals were field preserved with nitric acid to a hydrogen ionization potential (pH) of less than 2 and water samples analyzed for cyanide were field preserved with sodium hydroxide to a pH of more than 12.

Exceptions for field activities compared to the approved work plan are noted below:

1. Six groundwater samples were planned according to the approved work plan, but four, plus a duplicate, were collected only at lower elevations. Monitoring wells were difficult to install, especially at higher elevations, due to frequent refusal of the drive point at bedrock while attempting well installation.

2. The work plan called for monitoring the water level drawdown while collecting a sample and limiting the drawdown to four inches, in accordance with low-flow protocols. Well TMW-01 purged dry with slow recharge, but this well water eventually cleared up before sampling.
3. The work plan called for soil sampling to take place throughout the Site, but soil sampling was only conducted in Subarea C. This was due to the fact that much of the previous surficial material thought to pose a health risk in Subarea A was now covered with what appeared to be clean fill. However, the thickness of the fill was not determined during this SI. Subarea B did not appear to contain any observable areas of concern.
4. Thirty-three soil samples were planned, but only 26 were collected. This reduction of planned sampling is partially due to the elimination of samples in Subareas A and B.

Field staff adhered to standard MDEQ decontamination procedures during the collection of all samples. Prior to mobilizing to the field, this included the scrubbing of all hand trowels with a tri-sodium phosphate and tap water solution and rinsing with tap and deionized water. In the field, all used sampling equipment was power washed with a steam cleaner before reusing for further sampling.

All samples were processed in accordance with U.S. EPA and MDEQ required procedures. The volatile fraction of soil samples was sent to the MDEQ Laboratory. Remaining soil samples and organic water samples were labeled and placed in individual protective bubble plastic bags. Inorganic water samples were labeled and placed in individual zip-lock bags. All samples were placed in shipping coolers. The interiors of the coolers were kept at a temperature of approximately 4^{o} Celsius with ice. A small glass water-filled bottle was placed in each cooler and marked "TEMPERATURE," for use by the laboratory to measure temperature. The coolers were sent by UPS next-day delivery to the laboratories assigned to the project by the U.S. EPA Contract Laboratory Program (CLP) or to the MDEQ Laboratory. Sample identity, security, and chain of custody procedures specified by the CLP and MDEQ were followed. Samples were analyzed by the MDEQ Laboratory or by a CLP laboratory. The U.S. EPA approved of the volatile fraction analysis of soil samples to be completed at the MDEQ Laboratory. The U.S. EPA directed which CLP laboratories to use for the rest of the analyses. The table below summarizes which laboratory completed the required parameter analysis.

Laboratory	Soil/Sediment Samples				Water Samples			
	V	SV	PCB/P	IN	V	SV	PCB/P	IN
MDEQ Laboratory 3350 N. Martin Luther King Blvd. Bldg. 44, 3rd Floor Lansing, MI 48909	x							x
KAP Technologies Inc. 9391 Grogans Mill Road Suite A2 The Woodlands, TX 77380		x	x		x	x	x	
A4 Scientific, Inc. 1544 Sawdust Road Suite 505 The Woodlands, TX 77380				x				x

V = volatile; SV = semi-volatile; PCB/P = polychlorinated biphenyls/pesticides; IN = inorganic

5.2.1 X-Ray Fluorescence Soil Screening

XRF screening of surficial soil and other materials was conducted in October and also during the November field event. During November, this screening was conducted in conjunction with the surficial soil sampling. The sampling team first screened a suspect area with the XRF unit, and if high levels of metals were found, a surficial soil sample was also collected at or near that location. XRF screening descriptions and results are shown in Table 5-1. XRF screening locations are shown in Figures 5-1 and 5-2.

5.2.2 Waste Samples

Two waste samples were collected. These were determined to be waste by either visual observation or by XRF screening. The waste was sampled in the same manner as surficial soil samples, as described below.

5.2.3 Surficial Soil Samples

Fourteen surficial soil samples, along with two duplicates, were collected from Subarea C of the Site by the investigation team from November 5 to 6, 2012. Sample SS-01 was designated the background sample, due to its location being somewhat removed from the areas where milling and reclamation took place. Thus, sample SS-01 would be expected to be less impacted by past Site operations. The locations of these samples are shown on Figure 5-3. Location information and sample descriptions for the surficial soil samples can be found in Table 5-2.

The surficial soil samples were obtained using stainless steel trowels at depths ranging from 0 to 8 inches below the ground surface. The volatile portions of the surficial soil samples were collected with the use of a dedicated syringe. An

approximate 10 gram sample of soil was collected in the syringe directly from the hole created by collecting the sample. This soil was then immediately placed in a 40 milliliter (ml) glass vial and preserved with 10 ml of methanol. The remainder of the soil sample was transferred from the sample location to an aluminum pan where all visible debris (stones, roots, etc.) was removed. The sample was then thoroughly mixed and transferred to the appropriate sample containers using a stainless steel trowel.

5.2.4 Soil Boring Samples

Twelve deep soil samples were collected from 11 individual boring locations around the Site by the investigation team on November 5 or 6, 2012. These samples were collected in order to find buried waste, if present. The locations of these samples are shown on Figure 5-4. Location information, soil boring lithology, and sample descriptions for the soil boring samples can be found in Table 5-3.

The deep soil boring samples were collected utilizing a Geoprobe® rig with a high density polyethylene (HDPE) lined Macro-Core® sampler at depths ranging from 1 to 8 feet below the ground surface according to the procedures outlined in the work plan. Borings were drilled to total depths of 4 to 16 feet, depending on the location. These procedures included screening the core with a photoionization detector to help determine the presence of VOCs and potential sampling points within the cores. Upon screening of the core, the volatile portion of the sample was collected with the use of a dedicated syringe. An approximate 10 gram sample of soil was collected in the syringe directly from the core. This soil was then immediately placed in a 40 ml glass vial and preserved with 10 ml of methanol. The remainder of the soil boring sample was transferred from the core to an aluminum pan where all visible debris (stones, roots, etc.) was removed. The sample was then thoroughly mixed and transferred to the sample containers using a stainless steel spoon.

All soil boring boreholes were properly abandoned following an approved standard operating procedure. This procedure entailed slowly filling the abandoned borehole with bentonite chips to within six inches of the surface, then topping off the borehole with immediate surrounding material.

5.2.5 Groundwater Monitoring Well Samples

Five groundwater monitoring well samples were collected from four temporary monitoring wells to determine whether organic and inorganic contaminants had migrated into the glacial aquifer underlying the Site. The monitoring well sample locations are shown in Figure 5-5. Location information, some basic groundwater parameters, and sample descriptions for the groundwater samples can be found in Table 5-4. Field staff attempted to install background wells northwest of the former regrinding plant, but could not do so due to bedrock refusal of the Geoprobe bit. The Team Leader directed field staff to install a background well hydraulically

upgradient from TMW-05 at a location near the existing building at the Whiteman property.

The four temporary monitoring wells were installed using a Geoprobe® rig. The Geoprobe® rig is a truck mounted hydraulic/pneumatic rig that installs small diameter monitoring wells by driving a well screen and casing into the aquifer system. Upon installing these wells, readings were taken using a photoionization meter. No readings above background levels were detected at any of the temporary wells. Static water level readings and well depths were recorded for each temporary well to determine the standing water elevation and the volume of standing water in the wells. These measurements were made with an electronic water level indicator.

The temporary wells were developed using tubing and a peristaltic pump until a steady low-flow rate of water free of heavy suspended solids was established. Conductivity, pH, temperature, oxidation reduction potential, and total dissolved solids measurements were taken of the purge water at regular intervals to ensure that the wells had been purged properly and that fresh groundwater was entering the wells. The same pump used to purge the well was used to sample the well. The volatile portion of the sample was collected first with the pump set at a low-flow rate to minimize bubble formation and sparging. The remaining portions of the sample were then collected by pumping the water directly into the sample bottles.

Since disposable tubing was used for collecting the temporary well samples, there was no need to decontaminate any of the sampling equipment. All well screens, casing, and Geoprobe rods are steam cleaned prior to each use. Two deionized water field blank samples, and one deionized water pump blank sample were also collected in accordance with the U.S. EPA quality assurance/quality control requirements.

After installation of the temporary monitoring wells, the top of casing (TOC) and ground elevations for all wells were surveyed in using a survey level and rod to the nearest 0.01 foot. Due to the temporary nature of the monitoring wells, an arbitrary benchmark of 100.00 feet was set at the top of casing for TMW-01 and the wells were surveyed in to that point. To determine depth to groundwater, static water levels were measured for each well from the TOC with an electronic water level meter. The static water level measurements were taken on November 8, 2012, to let the wells equilibrate to aquifer pressure. Static water level elevations were then determined using these measurements. Table 5-5 contains the groundwater elevation data. Based on the static water level elevations calculated on November 8, 2012, the groundwater flow direction appears to be flowing to the southeast, toward Torch Lake. Figure 5-6 displays the groundwater contours and elevation data.

After the final static water level elevations were collected, the temporary monitoring wells were removed and the boreholes were properly abandoned following an approved standard operating procedure. This procedure entailed

slowly filling the abandoned borehole with bentonite chips to within six inches of the surface then topping off the borehole with immediate surrounding material.

5.2.6 Media Not Sampled

Surface water and sediment were not sampled during this SI. The reason for this is that Torch Lake Superfund Site stamp sands are located between the C & H Tamarack Operations Site and Torch Lake. These stamp sand wastes, and any other wastes found associated with the stamp sands, were generated at the Site and directly deposited into Torch Lake by C & H. The presence of these wastes in Torch Lake is documented evidence by direct observation of an observed release to the surface water pathway.

6. ANALYTICAL RESULTS

6.1 Introduction

This section includes results of chemical analysis of all samples collected during this assessment. Laboratory analytical data with the laboratory narratives for the water and soil sample analyses are provided in Appendix E.

6.2 Sample Analytical Results

Key sample analytical results are summarized in the appropriate tables for each of the following media when the sample analytical results met either of the following criteria: the sample concentration is greater than three times the background concentration, or the sample concentration is greater than the detection limit when the background sample concentration was not detected at the laboratory reporting limit. These key sample results are an indication of what is considered an "observed release" for Hazard Ranking System scoring for the Site.

6.2.1 X-Ray Fluorescence Soil Screenings

XRF screening results were not used to determine observed releases as are the surficial soil samples that were analyzed at the laboratories. Instead, the XRF screening results were compared to appropriate direct contact and soil protection criteria to aid in the determination of the extent of surficial soil contamination. See Table 5-1 for the results of XRF screening conducted in October and November 2012.

6.2.2 Surficial Soil Samples

Analysis of the surficial soil samples revealed the presence of SVOCs, inorganic analytes, and PCB compounds (Aroclors) as observed releases. The key surficial soil sample analytical results for all these samples are provided in Table 6-1. All the samples collected contained contaminants at high enough concentrations to be considered observed releases.

6.2.3 Soil Boring Samples

Analysis of the soil boring samples revealed the lack of any obvious waste.

6.2.4 Groundwater Monitoring Well Samples

Analysis of the groundwater monitoring well samples revealed the presence of arsenic, copper, and manganese at concentrations significantly above background. The key groundwater monitoring well sample analytical results for all these samples are provided in Table 6-2. Observed release samples were limited to samples TMW-02 and TMW-03, located in the vicinity of the former leach plant. No observed release was found associated with sample TMW-05.

7. DISCUSSION OF MIGRATION PATHWAYS

7.1 Introduction

This section discusses data and information that apply to possible contaminant migration pathways and possible sources of contamination that may be attributable to the Site. The four migration pathways of concern discussed are groundwater, surface water, soil exposure, and air.

7.2 Groundwater

The analysis of groundwater samples collected during this SI investigation has indicated an observed release of contaminants to the groundwater in the area of the Site. The key sample results are summarized in Table 7-1. To determine an inherent risk, this table also compares the contaminant concentration ranges to Michigan's Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 201), cleanup criteria (Criteria). Copper, iron, and manganese exceeded Criteria for drinking water. Iron and manganese exceeded their aesthetic drinking water criteria, while only iron exceeded its health-based drinking water criteria. Copper also exceeded its GSI criterion.

Observed releases in groundwater were only found in the two groundwater monitoring wells installed closest to the former reclamation facility leach plant. Groundwater in this area flows under the remains of the former reclamation plant, possibly picking up contaminants that may have leached out of contaminated soils or waste, and then flows past the two monitoring wells, TMW-02 and TMW-03. Sample TMW-03 had the highest concentration of copper, possibly the result of copper leaching out of the now-buried waste in the south end of the former leach plant, in combination with copper leaching out of copper-containing contaminated soils prevalent in the area.

This contamination in the groundwater is attributable to the Site because arsenic and copper in particular were found in high concentrations in contaminated soils and source areas. This contamination is documented to include much of the area that includes the remains of the three buildings that were part of the former reclamation plant. There is also a potential for continued migration of contaminants from the Site to groundwater based on the following information:

- There are no engineered caps or liners in the source area or areas to inhibit infiltration and migration to groundwater;
- Some of the soils on the Site have shown elevated levels of contaminants, especially arsenic and copper;
- There is no containment in the areas of contaminated soils;
- The soils in the area are comprised of highly permeable sands; and
- The groundwater is located near the surface at depths of less than approximately 20 feet.

The geology in the area of the Site is described in Section 2.2, consisting essentially of shallow coarse-grained glacial deposits overlying bedrock. Representative drinking water well logs for the surrounding area can be found in Appendix F. Many of the drinking water wells in the area are set in bedrock. Clay layers are present in some of these wells, but the clay is either thin (less than 10 feet) or interbedded/mixed with sand or gravel. Because of these characteristics and no continuous clay layer throughout the area, it is believed the shallow glacial aquifer is interconnected with the bedrock aquifers in the area.

All area residents utilize groundwater for their drinking water. Many Hubbell residents who live along M-26 get their drinking water from the Michigan American Water Company, which has its water supply wells outside the 4-Mile TDL [13] on the north shore of Lake Superior. However, some residents who live away from M-26 have their own drinking water wells. Residents of Mason, about 1 to 2 miles southwest of the Site, use drinking water from Dollar Bay wells [13] but also get drinking water from two public water supply wells located in Mason [14]. The Dollar Bay municipal wells are just outside the 4-Mile TDL. Residents of the village of Lake Linden obtain their drinking water from three municipal wells operated by the village. These wells are located in the northeast part of the village limits, less than three miles north-northeast of the Site. The total population served by these wells is approximately 1,081, based on 2000 census data. The remainder of the population located within the 4-Mile radius of the Site utilizes residential wells and the Michigan American Water Company supply outside the TDL. Many of the more populated areas within four miles of the Site, for example along M-26 from Laurium to Lake Linden to Hubbell, are served by the north shore wells, according to a personal communication with Mr. Steve Dlubala, contact person for the Michigan American Water Company, which owns and operates the north shore wells. For this reason, the population numbers for the groundwater migration pathway are smaller than the population numbers for the air migration pathway. See Appendix A for a 4-Mile Site Radius Map. The approximate population served by groundwater within four miles of the Site by radius ring is listed in the table below:

Distance from Site	Estimated population served by residential wells	Estimated population served by municipal wells
0 – ¼ Mile	67	
¼ - ½ Mile	17	
½ - 1 Mile	79	
1 – 2 Mile	237	
2 – 3 Mile	437	1218
3 – 4 Mile	545	890
Total	1382	2108

7.3 Surface Water

The surface water pathway is an exposure pathway of concern for this Site. The Site is located within 500 feet of Torch Lake. Contaminants are likely entering the lake from contaminated soil source areas and from waste piles on land, leaching through coarse-grained soils into groundwater, and discharging to the lake. The ground surface topography is sloped steeply towards Torch Lake and this also causes the groundwater gradient to be sloped similarly towards the lake. Groundwater contaminants, especially copper, have been documented in the shallow groundwater just east and north of M-26, where groundwater was also documented to be flowing towards Torch Lake.

In addition, past operations at the Site have been documented to deposit stamp sands and related wastes directly into Torch Lake. The presence of these wastes in Torch Lake adjacent to the Site is documentation by direct observation of an observed release to the surface water pathway.

The 15-Mile TDL for the surface water pathway lies within all of Torch Lake proper and reaches into portions of Portage Lake, but does not reach into Lake Superior. The PPE of contaminants into the surface water pathway is near the north end of the Site in Subarea A and along the lakeshore in Subarea C. Endangered and threatened species were documented through a search of the Michigan Natural Features Inventory database, the results of which can be found in Appendix G. Sensitive resources along the TDL include wetlands and state-designated threatened species. Wetlands frontage along the TDL is about 15 miles, based on calculations made in a GIS. Two state-designated threatened species are known within the TDL in at least three public land survey sections: lake sturgeon and the common loon. MDEQ personnel observed a family of common loons on June 23, 2011, in Torch Lake waters just north of the Site. See Appendix B.

There are no known surface water intakes along the TDL but the waters of Torch and Portage Lakes are connecting waters of the Great Lakes and are designated by the state for use as drinking water. The flow rate of the Trap Rock River into Torch Lake averages about 43 cubic feet per second [15]. Several other small creeks also discharge into Torch Lake. The only outlet for this water is through the connection to Portage Lake. These waters are also used for numerous other purposes. According to a 2007 MDEQ report, "Torch Lake is used for fishing, boating, limited contact recreation (swimming, jet skis, and water skis), non-contact cooling water supply, treated municipal waste assimilation, and wildlife habitat" [16]. Similar activities are known to be common on Portage Lake.

7.4 Soil Exposure

According to state and local file information reviewed, there is no documentation of an incident of direct contact with contaminants at the Site. However, numerous organic and inorganic contaminants have been documented in shallow soils of Subarea C during this SI, posing potential risks from direct contact. Access to areas of contaminated soil or waste is not reliably restricted, although one area in

the southern part of Subarea C has a cable across the entrance drive to limit access.

The soil samples collected during this SI investigation indicate that an observed release is documented in all the samples collected. Numerous SVOCs and inorganic analytes were detected at concentrations significantly above background. These contaminants are summarized in Table 7-2. Several of the inorganic analytes exceeded concentrations deemed to be safe for direct contact.

Vehicular and pedestrian access to the Site is not reliably restricted. The Site is located in a mixed residential and commercial area of Hubbell and there is no fencing to restrict access to the areas where surface contamination is present. There are no schools located within close proximity (less than 200 feet) of the Site. A total of approximately 781 people live within a one-mile radius of the Site. The total population living within the various distance rings is summarized in the table below.

Distance from Site	Estimated population
0 – ¼ Mile	356
¼ - ½ Mile	203
½ - 1 Mile	222
Total	781

7.5 Air

There is a potential for migration of Site contaminants through the air pathway, primarily by particulate migration. As noted above, significant surficial soil contamination with inorganic constituents is found in Subarea C. The approximate population affected by the air exposure pathway within a four-mile radius of the Site is detailed in the table below:

Distance from Site	Estimated population
0 – ¼ Mile	356
¼ - ½ Mile	203
½ - 1 Mile	222
1 – 2 Mile	865
2 – 3 Mile	1037
3 – 4 Mile	1485
Total	4168

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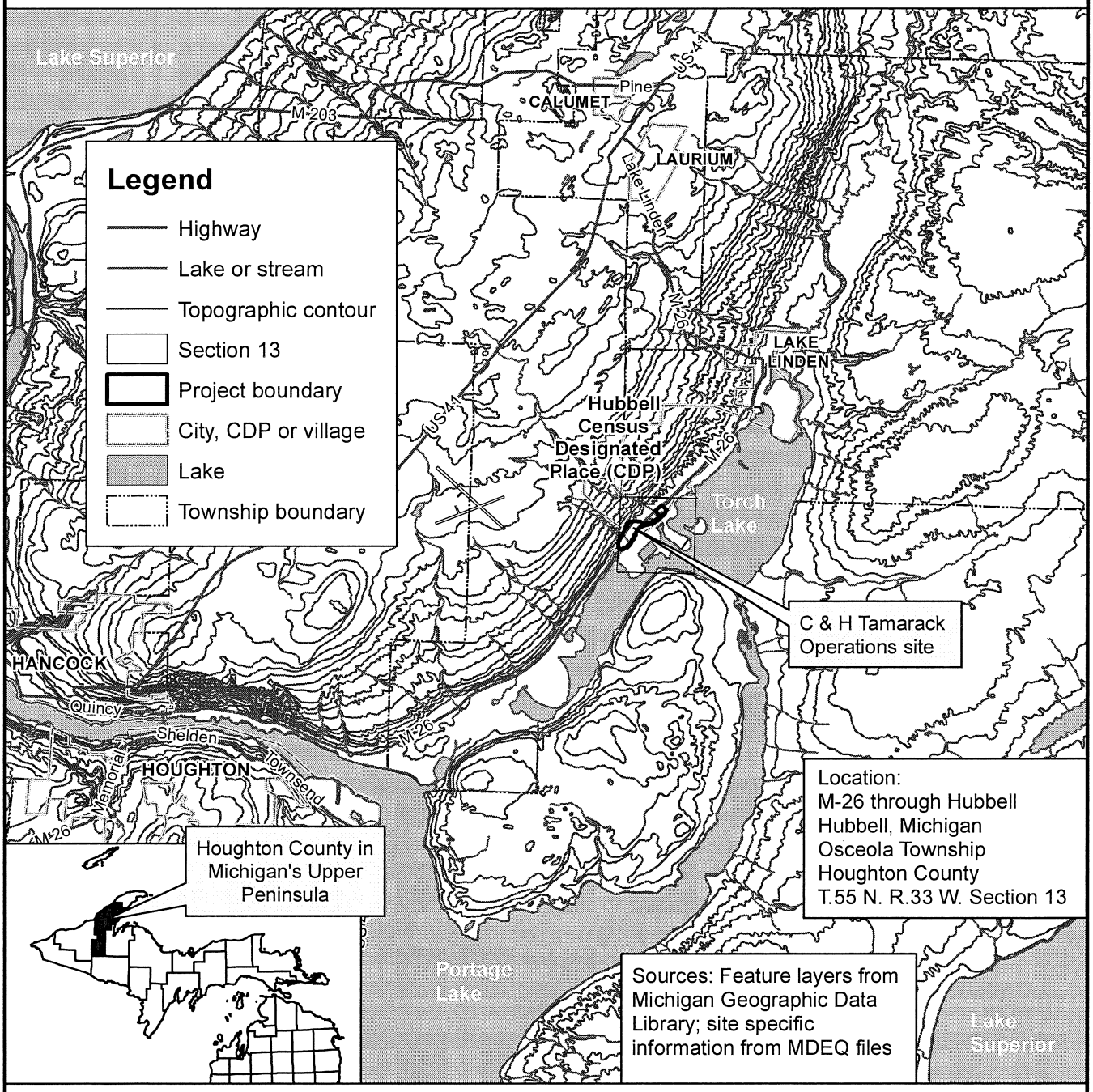
FIGURES

FIGURE 2-1
SITE LOCATION

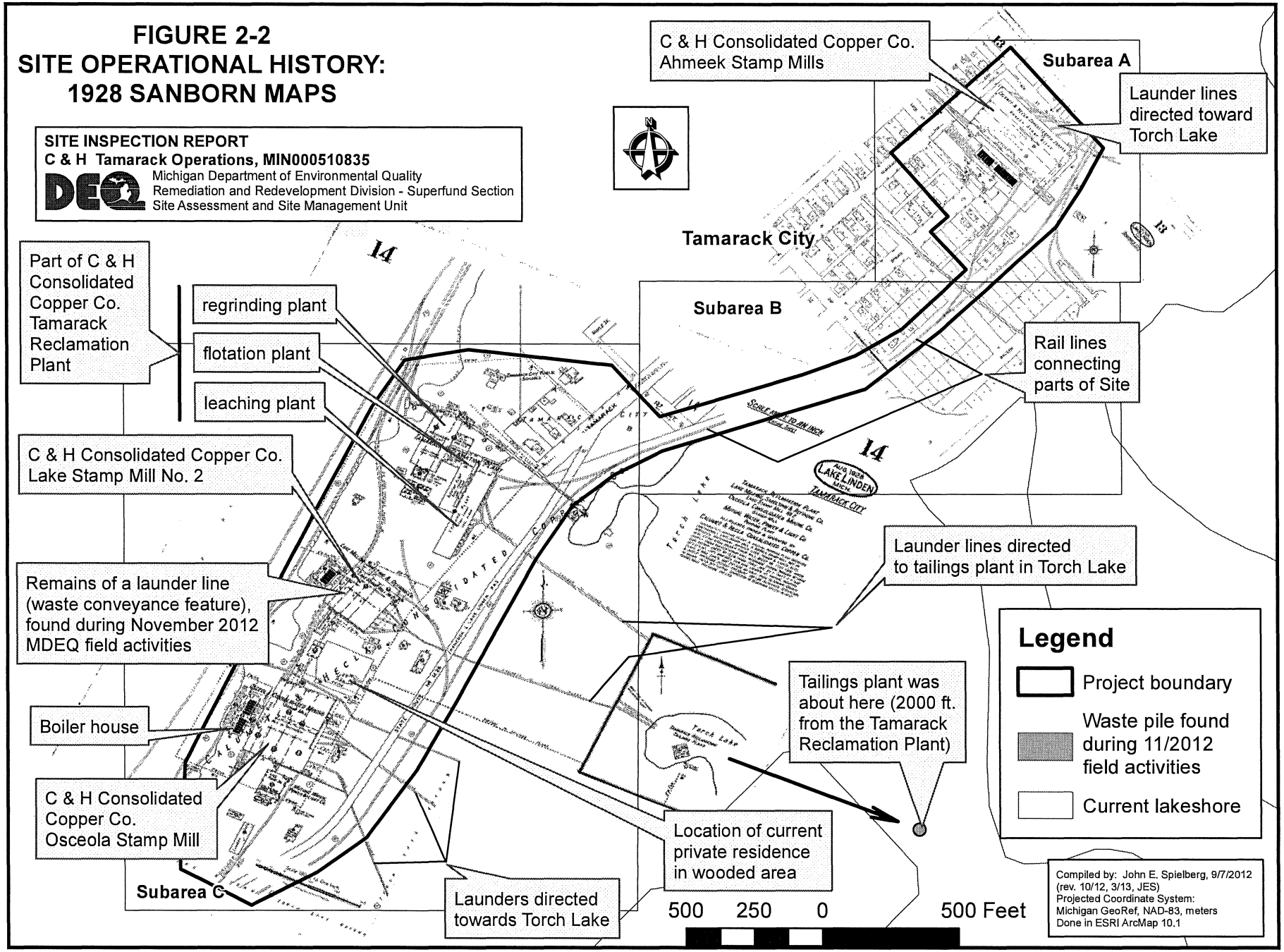


SITE INSPECTION REPORT
C & H Tamarack Operations, MIN000510835

Michigan Department of Environmental Quality
Remediation and Redevelopment Division - Superfund Section
Site Assessment and Site Management Unit

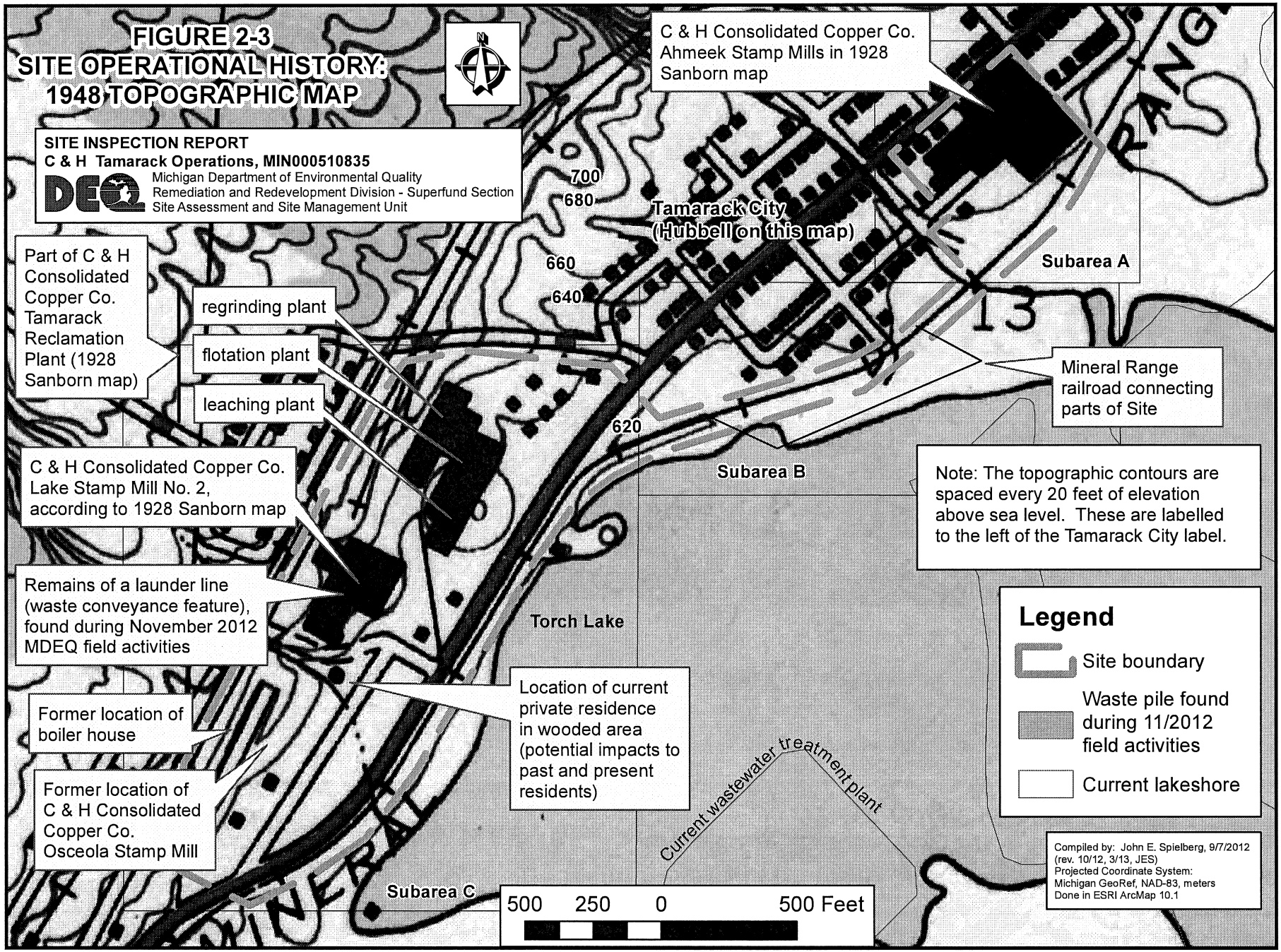
Compiled by: Leni Steiner-Zehender, 1/2011
Revised by: John E. Spielberg, 4/12, 10/12, 12/12
Projected Coordinate System:
Michigan GeoRef, NAD-83, meters
Done in ESRI ArcMap 10.1

FIGURE 2-2
SITE OPERATIONAL HISTORY:
1928 SANBORN MAPS



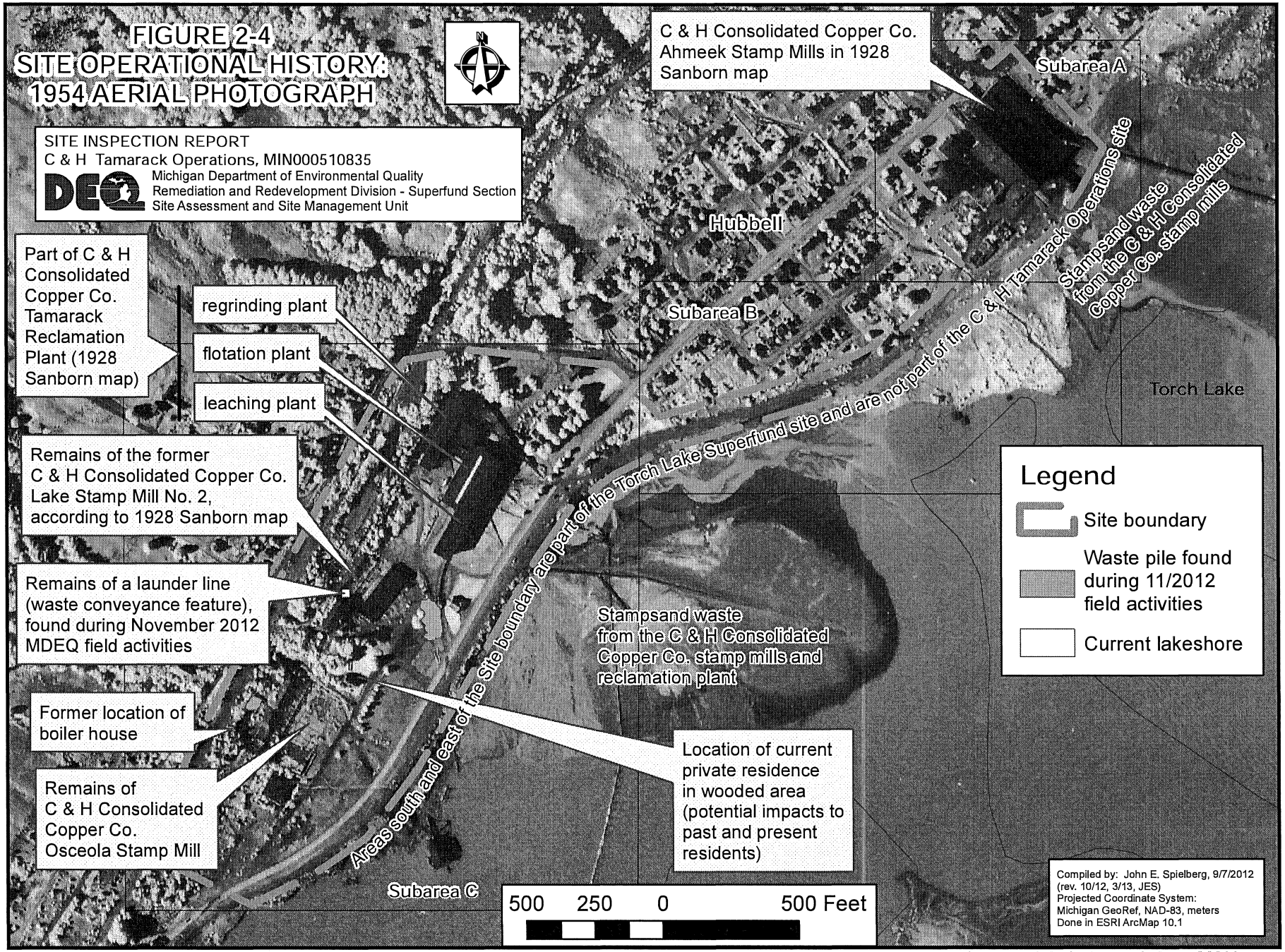
Sources: Feature layers from Michigan Geographic Data Library website; 1928 Sanborn fire insurance maps from previous MDEQ work done on Torch Lake; site specific information from MDEQ files and local governments

Figure 2-2: Site Operational History - 1928 Sanborn Maps



Sources: Feature layers from Michigan Geographic Data Library website; some information is taken from 1928 Sanborn maps; 1948 topographic map from USGS (1948); site specific information from MDEQ files and local governments

Figure 2-3: Site Operational History - 1948 Topographic Map



Sources: Feature layers from Michigan Geographic Data Library website; some information from 1928 Sanborn maps; 1954 aerial photograph from MSU Aerial Archive; site specific information from MDEQ files and local governments

Figure 2-4: Site Operational History - 1954 Aerial Photograph

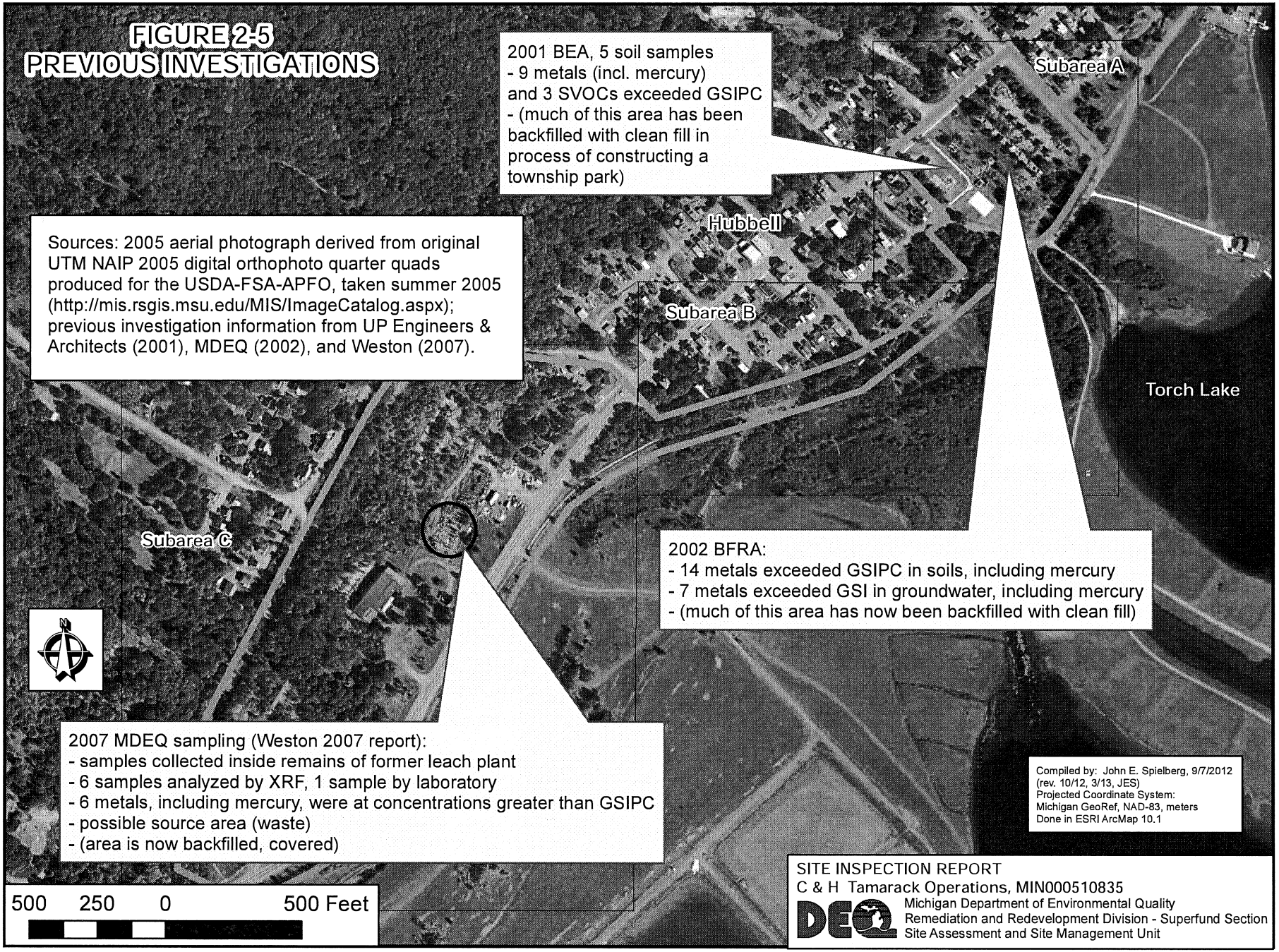


Figure 2-5: Previous Investigations

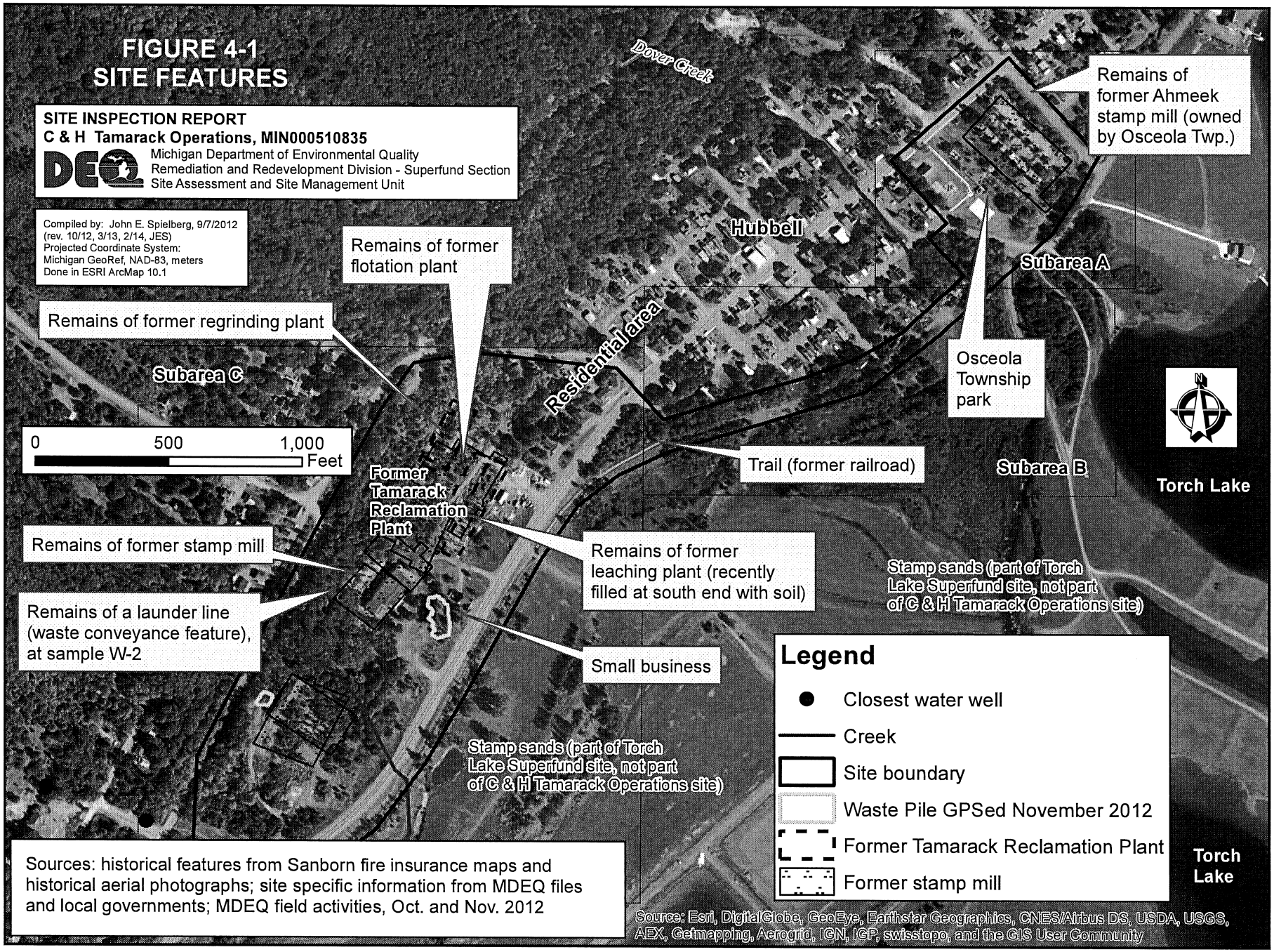


Figure 4-1: Site Features

Figure 5-1: XRF Screening Locations - October 2012

Sources: Feature layers from Michigan Geographic Data Library website; site specific information from MDEQ files and local governments; XRF screening locations and associated data from MDEQ field activities, Oct 11, 2012.

Sources: Feature layers from Michigan Geographic Data Library website; site specific information from MDEQ files and local governments; XRF screening locations and associated data from MDEQ field activities, November 5-6, 2012.

Figure 5-2: XRF Screening Locations - November 2012

Figure 5-3: Surficial Soil Sample Locations

Sources: Feature layers from Michigan Geographic Data Library website; site specific information from MDEQ files and local governments; surficial soil sample locations and associated data from GPS data collected by MDEQ staff during field activities, November 5-6, 2012.

Figure 5-4: Soil Boring Sample Locations

Sources: Feature layers from Michigan Geographic Data Library website; site specific information from MDEQ files and local governments; soil boring sample locations and associated data from GPS data collected by MDEQ staff during field activities, November 8, 2012.

Figure 5-5: Temporary Monitoring Well Sample Locations

Sources: Feature layers from Michigan Geographic Data Library website; site specific information from MDEQ files and local governments; soil boring sample and temporary monitoring well sample locations and associated data from GPS data collected by MDEQ staff during field activities, November 8, 2012.

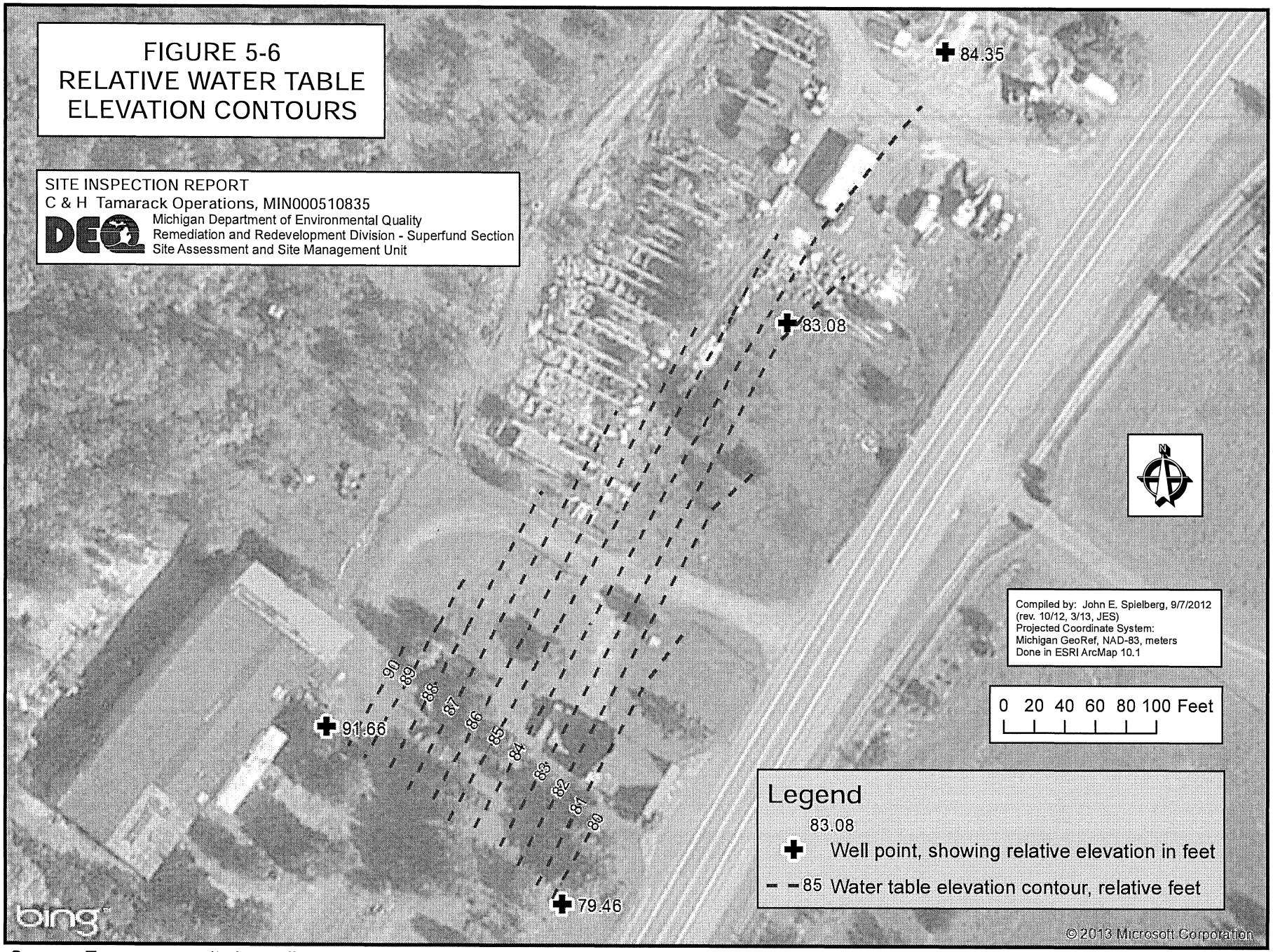


Figure 5-6: Relative Water Table Elevation Contours

Sources: Temporary monitoring well water table data collected by MDEQ staff during field activities, November 8, 2012.

TABLES

TABLE 2-1

WASTE SAMPLE RESULTS

SAMPLE #	CONTAMINANT	RESULT	FLAG
W-1	**Semi-volatile**	**µg/Kg dry**	
	Isophorone	260	5
	Inorganic	**mg/kg dry**	
	Antimony - Sediment	10	
	Arsenic - Sediment	120	
	Barium - Sediment	51	
	Beryllium - Sediment	0.57	
	Cadmium - Sediment	4.3	
	Chromium - Sediment	4,600	
	Cobalt - Sediment	53	
	Copper - Sediment	76,000	
	Iron - Sediment	210,000	D
	Lead - Sediment	35	
	Manganese - Sediment	1,900	
	Mercury - Sediment	0.40	3
	Molybdenum - Sediment	74	
	Nickel - Sediment	260	
	Selenium - Sediment	4.3	
	Silver - Sediment	49	
	Vanadium - Sediment	87	
	Zinc - Sediment	170	
W-2	**Inorganic**	**mg/kg dry**	
	Antimony - Sediment	1.1	
	Arsenic - Sediment	1,300	
	Barium - Sediment	29	
	Beryllium - Sediment	0.48	
	Cadmium - Sediment	0.42	
	Chromium - Sediment	35	
	Cobalt - Sediment	69	
	Copper - Sediment	36,000	
	Iron - Sediment	75,000	D
	Lead - Sediment	15	
	Manganese - Sediment	560	
	Mercury - Sediment	0.38	3
	Molybdenum - Sediment	140	
	Nickel - Sediment	500	
	Silver - Sediment	220	
	Vanadium - Sediment	65	
	Zinc - Sediment	41	

For flag descriptions, see the MDEQ Environmental Laboratory results, page 106, Appendix E.

Site Inspection Report
C & H Tamarack Operations
XRF results, 10/11/12

TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

				Molybdenum		Strontium		Lead		Arsenic		Zinc		Copper		Cobalt		Iron		Manganese		Chromium		Vanadium	
#	Media	Description	Units	Mo	Mo Error	Sr	Sr Error	Pb	Pb Error	As	As Error	Zn	Zn Error	Cu	Cu Error	Co	Co Error	Fe	Fe Error	Mn	Mn Error	Cr	Cr Error	V	V Error
55	soil	brown/black sand	ppm	< LOD	9.4	247	11.96	226.04	23.49	< LOD	27.78	71	22.34	821	64.48	< LOD	234.3	25,505	524.9	139	89.38	< LOD	31.21	< LOD	51.05
56	soil	black soil	ppm	< LOD	6.7	108	6.07	30.09	7.92	11	6.48	37	12.14	322	31.21	< LOD	127.34	13,623	286.12	144	59.16	59	25.34	< LOD	73.07
57	soil	red soil	ppm	< LOD	6.8	55	4.7	21	7.51	< LOD	8.57	< LOD	14.95	114	23.14	< LOD	115.02	10,090	255.97	97	55.96	< LOD	38.85	< LOD	54.82
58	soil	tan sand pile	ppm	< LOD	6.9	167	7.97	12	6.78	< LOD	7.65	< LOD	14.82	45	20.15	< LOD	88.63	4,859	185.9	131	58.62	83	24.54	< LOD	52.51
59	soil	reddish brown soil	ppm	< LOD	7.7	70	5.78	721	34.27	< LOD	37.69	422	41.09	9144	168.54	< LOD	133.37	10,960	294.1	215	75.28	89	23.47	< LOD	69.04
60	rock	blue/green heavy rock	ppm	13	7.7	68	8.4	26	13.81	58.49	15.14	< LOD	181.68	98056	799.25	< LOD	453.12	62,059	1015.79	1255	233.7	< LOD	45.65	< LOD	92.01
61	soil	Fill dirt at south end of former reclamation plant	ppm	10	4.7	62	4.92	19	7.24	< LOD	8.07	17	10.38	240	28.92	< LOD	86.2	5,483	188.03	< LOD	70.94				
62	rock	white, soft rock	ppm	< LOD	9.0	84	7.38	17	9.56	< LOD	9.97	< LOD	22.59	106	34.19	< LOD	56.8	967	110.96	< LOD	89.48	89	18.71	37	22.42
63	soil	brown medium to coarse sand w gravel fill, south end and west of former leach plant	ppm	< LOD	7.6	80	5.98	30	8.98	< LOD	10.53	27	13.67	461	41.35	< LOD	147.37	14,528	332.45	291	79.53	91	23.87	< LOD	63.89
64	waste	stamp sand pile	ppm	< LOD	9.1	120	8.63	23	10.29	< LOD	12.99	70	24.51	1608	87.34	396	202.49	41,072	671.14	616	134.09	< LOD	42.93	< LOD	102.16
65	soil	red sand pile covered with vegetation	ppm	< LOD	6.9	68	5.05	13	6.61	< LOD	7.43	30	10.99	59	19.37	< LOD	94.16	6,433	202.06	182	59.59	< LOD	64.51	< LOD	117.04
66	soil	reddish brown soil pile	ppm	< LOD	13	61	9.57	< LOD	21.53	< LOD	17.54	< LOD	33.91	165	50.4	< LOD	233.4	9,990	495.47	214	125.24				
67	soil	reddish brown soil pile	ppm	< LOD	7.1	60	4.91	30	8.17	< LOD	9.35	38	12.54	140	24.71	< LOD	112.94	10,046.67	256.84	171	62.12				
68	soil	tan/brown fine sand pile	ppm	< LOD	408	< LOD	47.13	< LOD	52.43	< LOD	40.9	< LOD	114.16	< LOD	260.81	< LOD	1000.67	< LOD	9387.98	< LOD	385.7				
RDCC:				2,600		330,000		400		7.6		170,000		20,000		2,600		160,000		25,000		2,500		750	
NDCC:				9,600		1,000,000		900		37		630,000		73,000		9,000		580,000		90,000		9,200		5,500	
GSIPC:				64		420		2,100		4.6		65		29		2.0		NA		21		NA		190	
Default background (= criterion if >C):				NA		NA		21		5.8		47		32		6.8		12,000		440		18		NA	
Conclusion of risk based on screening levels:				none		none		a		a, b		b		b		b				b					

Notes:
All readings were obtained by XRF on 10/11/12.
Rock - no cleanup criteria
Exceeds RDCC
Exceeds GSIPC
RDCC = Residential Direct Contact Criteria
NDCC = Nonresidential Direct Contact Criteria
GSIPC = Groundwater Surface Water Interface Protection Criteria
NA = not available or not applicable
>C = greater than health-based cleanup criteria or criterion (e.g., RDC or GSIPC)
Some element data are hidden: 1) if not detected, or 2) if no criteria are available.
Conclusions of risk:
a If used for nonresidential use, no problem found
b Potential risk to surface water (Torch Lake)

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TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Molybdenum		Strontium		Lead		Arsenic		Zinc		Copper		Cobalt	
#	Sample Type	Units	Collected Soil Symbol Soil Sample No.	Source Area	Molybdenum	Mo Error	Strontium	Sr Error	Lead	Pb Error	Arsenic	As Error	Zinc	Zn Error	Copper	Cu Error	Cobalt	Co Error
1	Shutter Cal.	cps		NA														
2	Blank	ppm		NA	< LOD	6.4	68.01	5.04	9.4	6.14	< LOD	6.74	< LOD	31.88	44	18.43	< LOD	33.57
3	NIST High	ppm		NA	13.66	6.09	282.8	12.45	4567	96.19	597	77.25	5443	329.89	7253	97.38	< LOD	224.89
4	SOIL	ppm		Soil	< LOD	7.41	340.89	11.58	41	10.11	23	8.72	< LOD	20.83	731	49.7	373	148.84
5	SOIL	ppm		Soil	8.27	4.48	90.58	5.6	25	7.58	< LOD	8.78	38	32.07	307	30.7	< LOD	107.18
6	SOIL	ppm		Soil	8.31	4.61	70.19	5.2	31	8.21	< LOD	8.76	32	32.7	423	36.4	194	91.43
7	SOIL	ppm		Soil	6.42	4.26	101	5.71	36	8.12	< LOD	9.21	178	19.03	228	26.12	103	67.69
8	SOIL	ppm		Soil	10.3	4.11	102.73	5.52	34	7.61	< LOD	8.59	179	18.64	339	29.36	104	59.55
9	SOIL	ppm		Soil	< LOD	6.52	49.77	4.11	17	6.84	< LOD	7.64	41	11.66	145	23.44	< LOD	81.96
10	SOIL	ppm		Soil	< LOD	6.89	183.04	7.96	55	10.08	< LOD	11.8	64	14.81	502	31.76	< LOD	124.58
11	SOIL	ppm		Pile	7.27	4.82	319.38	10.77	42	9.73	19	8.15	40	14.38	540	41.74	177	103.45
12	SOIL	ppm		Pile	< LOD	7.07	236.46	9.15	32	8.82	19	7.48	32	12.43	267	30.91	< LOD	131.98
13	SOIL	ppm		Pile	8.68	4.71	103.7	6.14	173	15.82	< LOD	18.16	114	18.19	678	43.97	194	82.87
14	SOIL	ppm		Pile	< LOD	8.51	105.78	7.49	35	10.5	< LOD	11.94	42	22.29	2723	102.05	248	185.79
15	SOIL	ppm	SS-02	Pile	< LOD	7.11	254.58	9.53	181	16.6	73	13.15	582	28.36	556	41.38	< LOD	124.69
16	SOIL	ppm		Pile	< LOD	7.16	366.8	7.97	53	10.3	< LOD	11.9	93	17.3	369	36.03	< LOD	119.91
17	SOIL	ppm		Soil	8.36	4.17	121.79	6.04	14	8.43	< LOD	9.69	129	16.61	315	28.81	< LOD	90.79
18	SOIL	ppm		Soil	< LOD	6.88	168.07	7.71	34	8.71	< LOD	9.72	115	18.43	669	44.26	< LOD	119.01
19	SOIL	ppm		Soil	< LOD	9.73	104.14	8.75	476	85.86	< LOD	41.79	< LOD	42.01	410	53.51	2241	483.44
20	SOIL	ppm		Soil	< LOD	8.6	108.47	7.9	29	10.3	< LOD	12.15	< LOD	30.98	1818	88.4	< LOD	281.64
21	SOIL	ppm		Soil	< LOD	6.57	43.91	4.24	733	30.23	< LOD	34.03	840	31.09	1178	55.85	< LOD	109.43
22	SOIL	ppm		Pile	< LOD	8.24	133.77	8.2	57	12.11	< LOD	13.78	72	22.96	2279	92.53	< LOD	255.42
23	SOIL	ppm		Soil	9.01	3.73	30.65	3.11	36	7.07	< LOD	7.48	95	12.04	146	19.33	< LOD	42.41
24	SOIL	ppm		Soil	7.33	4.89	81.72	5.95	304	22.03	< LOD	25.03	181	24.81	1834	74.88	178	93.69
25	SOIL	ppm		Soil	< LOD	7.15	62.16	5.1	26	8.09	< LOD	9.28	23	11.75	281	32.31	122	69.65
26	SOIL	ppm		Soil	< LOD	6.67	49.15	4.4	12	6.43	< LOD	6.82	15	9.52	56	19.02	< LOD	82.86
27	SOIL	ppm		Soil	< LOD	7.43	108.54	6.69	19	7.8	13	6.48	< LOD	21.41	1168	60.39	< LOD	137.23
28	SOIL	ppm		Soil	9.05	4.44	49.32	4.35	81	11.13	< LOD	12.21	106	18.78	364	32.9	135	75.75
29	SOIL	ppm		Soil	< LOD	6.29	101.44	5.73	93	11.46	< LOD	13.22	135	17.38	308	29.7	109	65.06
30	SOIL	ppm		Soil	13.53	3.89	38.75	3.46	14	5.56	< LOD	6.38	96	14.2	753	38.73	59	94.53
31	SOIL	ppm		Soil	< LOD	7.59	178.1	8.7	64	11.75	< LOD	14.15	40	16.28	812	53.37	187	120.5
32	SOIL	ppm		Pile	17.87	4.58	50.06	4.38	482	24.62	< LOD	27.75	129	18.84	800	45.71	< LOD	90.49
33	SOIL	ppm		Soil	< LOD	8.03	71.8	6.08	31	9.74	12	8.06	54	18.56	896	58.79	< LOD	208.74
34	SOIL	ppm		Pile	< LOD	7.87	136.11	7.84	47	10.67	< LOD	11.9	68	19.06	1057	61.35	< LOD	207.49
35	SOIL	ppm		Pile	< LOD	7.88	134.55	7.87	54	11.28	< LOD	12.93	54	20.27	2109	85.23	< LOD	201.99
36	SOIL	ppm	SS-03	Soil	11.17	4.46	61.31	4.76	133	13.64	< LOD	15.12	139	39.25	1042	51.99	107	89.45
37	SOIL	ppm		Soil	12.66	3.85	30.09	3.16	23	6.21	< LOD	6.79	65	11.59	182	21.19	< LOD	47.43
38	SOIL	ppm		Soil	< LOD	6.66	53.05	4.54	52	9.53	< LOD	11.05	150	19.55	421	35.4	< LOD	153.65
39	SOIL	ppm		Soil	< LOD	7.66	143.54	7.74	51	10.62	< LOD	11.77	< LOD	24.47	1767	74.62	< LOD	172.11
40	SOIL	ppm		Soil	< LOD	7.3	105.78	6.57	112	13.91	< LOD	15.87	59	20.23	3040	94.15	< LOD	166.86
41	SOIL	ppm		Soil	9.78	5.22	90.23	6.34	48	10.48	< LOD	12.02	96	19.97	1028	58.7	< LOD	180.88
42	SOIL	ppm		Pile	< LOD	8.7	54.62	5.61	94	14.79	< LOD	17.04	52	21.27	2063	88.46	< LOD	211.44
43	SOIL	ppm	SS-04	Soil	< LOD	15.48	67.58	12.01	1688	148.61	< LOD	171.18	6002	362.14	312204	1902.69	< LOD	522.41

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TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Iron		Manganese		Chromium		Vanadium		Barium	
#	Sample Type	Units	Collocated Surficial Soil Sample No.	Source Area	Iron	Fe Error	Manganese	Mn Error	Chromium	Cr Error	Vanadium	V Error	Barium	Ba Error
1	Shutter Cal.	cps		NA										
2	Blank	ppm		NA	319	52.34	< LOD	57.34	103	21.13	< LOD	34.52	< LOD	950.43
3	NIST High	ppm		NA	24925	507.05	7561	361.1	53	26.61	< LOD	77.73	< LOD	1508.76
4	SOIL	ppm		Soil	32181	489.27	199	79.11	73	27.5	105	54.21	< LOD	616.43
5	SOIL	ppm		Soil	9271	236.81	189	60.36	92	24.23	< LOD	60.05	< LOD	628.2
6	SOIL	ppm		Soil	13530	296.05	252	69.58	78	25.1	78	45.86	< LOD	715.07
7	SOIL	ppm		Soil	8447	219.63	128	53.69	93	25.23	< LOD	59.19	< LOD	781.44
8	SOIL	ppm		Soil	6882	190.69	128	50.38	70	24.62	< LOD	54.64	< LOD	622.89
9	SOIL	ppm		Soil	5363	179.77	128	53.13	70	22.78	< LOD	53.96	< LOD	769.14
10	SOIL	ppm		Soil	11539	273.09	130	58.55	100	24.84	< LOD	63.49	< LOD	866.61
11	SOIL	ppm		Pile	16811	340.07	142	64.5	86	25.8	< LOD	73.91	< LOD	702.08
12	SOIL	ppm		Pile	12800	291.33	117	59.74	74	23.18	< LOD	62.45	< LOD	691.85
13	SOIL	ppm		Pile	11276	268.53	235	67.49	119	26.29	< LOD	70.99	< LOD	773.57
14	SOIL	ppm		Pile	32257	546.54	518	113.2	44	23.47	< LOD	73.63	< LOD	764.87
15	SOIL	ppm	SS-02	Pile	11732	281.26	593	93.35	113	25.24	< LOD	76.97	< LOD	1622.26
16	SOIL	ppm		Pile	10306	270.01	914	113.51	90	23.38	< LOD	63.11	< LOD	936.97
17	SOIL	ppm		Soil	7718	204.3	140	51.85	74	24.39	62	46.54	< LOD	804.18
18	SOIL	ppm		Soil	10571	262.47	160	61.18	74	23.86	74	48.69	< LOD	693.99
19	SOIL	ppm		Soil	202425	1598.2	1011	214.83	< LOD	38.92	< LOD	64.27	< LOD	752.25
20	SOIL	ppm		Soil	39243	629.5	645	129.9	88	25.36	83	50.47	< LOD	741.47
21	SOIL	ppm		Soil	9349	241.25	181	59.43	90	23.79	60	34.37	< LOD	736.41
22	SOIL	ppm		Pile	36771	575.38	457	109.77	73	26.31	85	53.03	< LOD	1377.13
23	SOIL	ppm		Soil	1584	87.15	70	38.13	< LOD	34.69	< LOD	46.08	< LOD	348.45
24	SOIL	ppm		Soil	12463	303.4	307	79.34	66	22.33	< LOD	54.06	< LOD	775.15
25	SOIL	ppm		Soil	7057	221.47	219	66.67	71	21.91	< LOD	57.49	< LOD	719.55
26	SOIL	ppm		Soil	4868	175.12	119	53.19	82	21.85	< LOD	52.23	< LOD	675.78
27	SOIL	ppm		Soil	13387	312.38	176	67.81	70	23.16	< LOD	63.6	< LOD	646.92
28	SOIL	ppm		Soil	9898	245.14	228	64.06	112	25.75	< LOD	58.49	< LOD	667.39
29	SOIL	ppm		Soil	7701	209.88	114	52.14	75	24.22	< LOD	59.57	< LOD	651.72
30	SOIL	ppm		Soil	2237	104.32	85	40.79	56	24.19	< LOD	50.11	< LOD	446.04
31	SOIL	ppm		Soil	20365	398.67	268	80.93	72	23.02	< LOD	63.34	< LOD	915.44
32	SOIL	ppm		Pile	6306	195.38	219	61.57	75	23.81	< LOD	54.92	< LOD	608.78
33	SOIL	ppm		Soil	25290	466.01	405	98.44	79	24.44	< LOD	73.16	< LOD	1883.52
34	SOIL	ppm		Pile	26191	461.09	435	98.44	65	25.49	123	51.81	< LOD	970.76
35	SOIL	ppm		Pile	24659	451.59	276	86.96	62	24.44	92	49.62	< LOD	928.62
36	SOIL	ppm	SS-03	Soil	8249	224.61	183	59.7	52	22.73	< LOD	57.49	< LOD	627.09
37	SOIL	ppm		Soil	2025	98.63	< LOD	50.06	56	24.43	< LOD	44.09	< LOD	512.11
38	SOIL	ppm		Soil	19540	347.77	672	96.64	< LOD	38.97	< LOD	65.87	< LOD	663.07
39	SOIL	ppm		Soil	19376	352.34	197	73.81	95	25.23	83	49.84	< LOD	897.78
40	SOIL	ppm		Soil	19138	370.46	287	80.48	103	25.59	81	45.09	< LOD	1123.21
41	SOIL	ppm		Soil	20978	401.47	316	85.13	82	24.8	< LOD	73.31	< LOD	750.61
42	SOIL	ppm		Pile	25604	481.8	338	97.31	105	24.78	< LOD	73.93	< LOD	862.85
43	SOIL	ppm	SS-04	Soil	40348	1113.71	501	286.01	119	24.84	< LOD	76.09	2555	991.69

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TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Molybdenum		Strontium		Lead		Arsenic		Zinc		Copper		Cobalt	
#	Sample Type	Units	Collocated Duplicate Split Sample No.	Source Area	Molybdenum	Mo Error	Strontium	Sr Error	Lead	Pb Error	Arsenic	As Error	Zinc	Zn Error	Copper	Cu Error	Cobalt	Co Error
44	SOIL	ppm		Soil	< LOD	8.45	99.52	7.21	43	11.11	< LOD	12.49	38	20.01	1059	79.9	305	170.47
45	SOIL	ppm		Pile	75.5	11.84	64.99	9.98	41	19.01	28	17.24	< LOD	103.38	15167	383.82	< LOD	1237.11
46	SOIL	ppm		Soil	< LOD	7.37	128.86	7.26	88	12.78	< LOD	14.87	49	19.54	2671	89.54	186	119
47	SOIL	ppm		Soil	< LOD	8.2	186.84	9.55	93	14.40	< LOD	17.24	51	21.07	1751	81.55	325	176.1
48	SOIL	ppm		Soil	< LOD	7.22	182.19	8.42	106	17.82	< LOD	20.88	125	20.58	916	53.62	211	112.65
49	SOIL	ppm		Soil	< LOD	13.95	233.23	16.4	32	16.42	< LOD	21.74	< LOD	72.87	8611	285.27	< LOD	1604.17
50	SOIL	ppm		Waste	< LOD	8.47	186.34	9.6	142	17.53	47	14.98	147	28.47	3114	107.62	328	181.45
51	SOIL	ppm		Waste	9.01	5.2	57.75	5.28	50	10.65	< LOD	11.82	63	18.14	1409	69.49	< LOD	111.06
52	SOIL	ppm		Soil	7.8	5.06	95.26	6.47	266	21.06	36	16.81	312	31.37	2771	92.04	< LOD	140.41
53	SOIL	ppm		Pile	45.57	8.19	155.12	11.35	< LOD	15.23	380	28.36	< LOD	76.95	18187	329.39	1280	520.76
54	SOIL	ppm		Pile	< LOD	8.9	70.85	6.79	37	9.19	< LOD	11.07	86	26.31	1682	88.32	< LOD	161.01
55	SOIL	ppm		Soil	< LOD	9.68	170.85	10.65	343	30	38	23.74	370	64.63	24566	342.3	473	269.52
56	SOIL	ppm	SS-05	Soil	< LOD	9.73	181.09	10.82	417	32.40	72	26.46	370	65.75	27168	359.44	< LOD	427.31
57	SOIL	ppm		Soil	< LOD	7.53	48.89	4.99	743	34.66	103	27.89	< LOD	29.92	4933	116.65	< LOD	198.94
58	SOIL	ppm		Soil	< LOD	7.8	124.24	7.61	236	20.75	67	17.36	94	25.93	4360	120.9	< LOD	196.51
59	SOIL	ppm		Soil	11.49	4.37	50.16	4.27	69	10.19	< LOD	11.55	125	17.19	589	39.1	< LOD	81.25
60	SOIL	ppm		Soil	8.84	3.93	37.82	3.52	22	6.48	< LOD	7.51	65	12.11	255	25.27	< LOD	57.17
61	SOIL	ppm		Soil	16.24	4.29	30.68	3.75	32	7.58	< LOD	8.77	65	12.84	204	24.66	< LOD	69.82
62	SOIL	ppm		Pile	< LOD	6.65	68.23	4.96	24	7.34	< LOD	8.4	21	10.2	184	23.03	< LOD	89.32
63	SOIL	ppm		Soil	10.78	4.24	69.31	4.57	34	9.01	< LOD	10.36	53	12.14	166	23.29	< LOD	79.53
64	SOIL	ppm		Soil	12.53	4.76	75.05	5.32	30	8.23	11	6.71	128	20.26	1515	63.53	197	100.46
65	SOIL	ppm		Soil	< LOD	8.41	80.51	6.83	99	15.45	99	16.01	533	46.54	4238	129.81	< LOD	356.46
66	SOIL	ppm		Soil	< LOD	7.68	137.95	7.75	668	32.95	< LOD	37.81	319	31.34	3614	72.78	217	142.67
67	SOIL	ppm		Soil	< LOD	7.99	102.88	7.13	160	17.86	15	14.34	109	26.28	9880	112.08	326	160.95
68	SOIL	ppm		Soil	13.43	4.07	58.62	4.25	89	10.59	< LOD	11.65	97	14.27	245	25.42	< LOD	75.48
69	SOIL	ppm		Soil	11.31	3.96	68.81	4.46	29	6.9	< LOD	7.81	41	10.59	230	24.34	< LOD	63.45
70	SOIL	ppm		Soil	16.87	4.23	67.83	4.62	39	7.93	< LOD	8.86	194	19.35	328	29.13	< LOD	65.07
71	SOIL	ppm		Soil	< LOD	6.96	282.8	9.81	53	10.05	17	8.24	34	13.48	659	43.66	218	102.38
72	SOIL	ppm		Pile	< LOD	7.06	137.75	7.28	26	8.2	< LOD	9.82	< LOD	20.83	1228	60.26	< LOD	159.24
73	SOIL	ppm		Soil	< LOD	7.19	113.18	7.07	109	13.9	< LOD	16.26	57	18.49	1815	73.89	< LOD	176.30
74	SOIL	ppm		Soil	< LOD	9.85	89.19	8.15	180	23.34	< LOD	27.08	< LOD	134.7	70647	591.41	< LOD	258.00
75	SOIL	ppm		Soil	9.3	4.89	99.59	6.42	109	13.71	< LOD	16.01	74	18.46	1354	64.35	< LOD	148.76
76	SOIL	ppm		Pile	< LOD	7.33	65.54	5.43	46	10.07	< LOD	11.5	61	16.87	1001	56.91	< LOD	130.47
77	SOIL	ppm		Soil	< LOD	7.5	72.39	5.63	43	9.88	< LOD	11.68	47	14.81	349	36.35	< LOD	120.53
78	SOIL	ppm		Yellow Paint	< LOD	8.04	146.37	8.86	< LOD	11.03	< LOD	7.36	< LOD	38.2	77	28.84	< LOD	71.8
79	SOIL	ppm		Soil	< LOD	7.63	49.76	4.97	35	9.53	< LOD	10.38	40	14.05	184	30.4	< LOD	105.45
80	SOIL	ppm		Soil	< LOD	7.68	118.22	7.22	52	10.87	< LOD	12.82	78	18.17	603	47.02	< LOD	158.39
81	SOIL	ppm		Soil	16.23	3.93	33.6	3.27	23	6.33	< LOD	6.77	93	13.16	162	20.59	< LOD	43.65
82	SOIL	ppm	Aborted Test	NA	12.36	4.59	45.16	4.33	104	12.68	< LOD	14.29	83	36.44	20685	228.45	< LOD	67.04
83	SOIL	ppm		Soil	14.58	4.53	45.13	4.28	111	12.94	< LOD	14.38	< LOD	51.53	20563	225.43	< LOD	66.66
84	SOIL	ppm		Soil	< LOD	8.28	70.31	6.92	1356	50.58	< LOD	57.72	55	28.58	5895	147.54	542	223.99
85	SOIL	ppm		Soil	< LOD	8.05	140.18	8.17	77	13.06	< LOD	15.14	37	21.89	3031	111.45	< LOD	202.93
86	Shutter Cal.	cps		NA														
87	SOIL	ppm		Soil	< LOD	8.45	195.99	9.94	57	12.32	< LOD	13.72	45	23.34	3262	111.46	< LOD	247.8
88	SOIL	ppm		Soil	12.52	4.68	72.83	5.26	162	15.31	< LOD	17.17	200	22.86	3171	58.3	179	92.29
89	SOIL	ppm		Soil	< LOD	8.02	82.14	6.42	43	10.69	< LOD	12.34	109	20.79	823	58.24	226	130.32
90	SOIL	ppm	SS-06	Soil	11.32	4.82	68.49	5.96	488	26.5	< LOD	30.5	711	40.3	943	52.95	174	111.83
91	SOIL	ppm		Soil	< LOD	8.46	83.38	6.86	33	10.54	< LOD	12.48	52	19.9	936	63.83	< LOD	239.28
92	SOIL	ppm		Soil	< LOD	8.42	94.49	7.11	14	8.21	< LOD	9.98	30	17.32	756	57.03	< LOD	233.47

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C & H Tamarack Operations
XRF Results, 11/5-6/12

TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Iron		Manganese		Chromium		Vanadium		Barium	
#	Sample Type	Units	Collocated Surficial Soil Sample No.	Source Area	Iron	Fe Error	Manganese	Mn Error	Chromium	Cr Error	Vanadium	V Error	Barium	Ba Error
44	SOIL	ppm		Soil	35541	566.99	513	113.55	68	25.57	< LOD	82.08	< LOD	1045.13
45	SOIL	ppm		Pile	337191	2851.21	12951	866.95	1781	68.05	< LOD	69.48	< LOD	2574.75
46	SOIL	ppm		Soil	21108	394.33	310	82.52	98	26.6	< LOD	73.04	< LOD	846.22
47	SOIL	ppm		Soil	38329	586.11	454	109.07	47	25.72	< LOD	85.96	< LOD	1060.3
48	SOIL	ppm		Soil	19151	370.05	255	76.73	75	24.35	< LOD	60.99	< LOD	1527.24
49	SOIL	ppm		Soil	586186	3680.87	617	382.15	< LOD	34.76	< LOD	60.54	< LOD	3454.95
50	SOIL	ppm		Waste	40425	604.8	341	107.03	217	31.39	< LOD	75.32	< LOD	1064.76
51	SOIL	ppm		Waste	7650	245.08	183	68.21	100	22.2	< LOD	48.66	< LOD	1179.65
52	SOIL	ppm		Soil	12882	313.76	279	77.68	76	23.25	64	39.17	< LOD	690.29
53	SOIL	ppm		Pile	206104	1752.89	961	234.23	< LOD	36.84	< LOD	64.3	< LOD	1282.83
54	SOIL	ppm		Pile	62150	817.71	995	163.15	43	27.63	150	68.33	< LOD	589.95
55	SOIL	ppm		Soil	78818	973.02	959	197.91	1004	54.06	144	58.12	< LOD	2172.2
56	SOIL	ppm	SS-05	Soil	80398	970.72	905	175.42	162	32.72	< LOD	85.79	< LOD	1048.01
57	SOIL	ppm		Soil	27076	458.69	121	73.11	77	26.06	< LOD	74.38	< LOD	662.29
58	SOIL	ppm		Soil	23111	438.06	424	98.52	111	25.84	< LOD	65.66	< LOD	735.79
59	SOIL	ppm		Soil	5977	186.51	229	60.93	126	25.57	< LOD	54.9	< LOD	655.89
60	SOIL	ppm		Soil	3065	124.43	76	41.49	34	22.26	< LOD	47.24	< LOD	448.44
61	SOIL	ppm		Soil	3986	147.8	< LOD	60.44	52	22.91	< LOD	49.67	< LOD	502.21
62	SOIL	ppm		Pile	6036	191.93	148	55.55	77	22.95	< LOD	57.36	< LOD	937.85
63	SOIL	ppm		Soil	6036	182.73	96	47.9	78	24.12	< LOD	55.98	< LOD	695.99
64	SOIL	ppm		Soil	16978	329.55	746	101.35	45	24.86	< LOD	56.22	< LOD	656.67
65	SOIL	ppm		Soil	66730	806.45	831	148.6	120	31.21	126	64.6	< LOD	1020.61
66	SOIL	ppm		Soil	29162	476.27	529	101.56	49	26.06	104	51.89	< LOD	777.51
67	SOIL	ppm		Soil	32925	532.39	554	111.27	64	25.77	< LOD	74.61	< LOD	1353.52
68	SOIL	ppm		Soil	5447	167.01	171	51.77	45	23.69	< LOD	53.53	< LOD	597.22
69	SOIL	ppm		Soil	3895	130.02	< LOD	56.69	58	24.58	< LOD	53.44	< LOD	533.74
70	SOIL	ppm		Soil	3604	139.86	238	57.26	60	24.01	< LOD	48.2	< LOD	482.49
71	SOIL	ppm		Soil	17386	334.24	190	66.55	117	27.91	94	52.87	< LOD	638.64
72	SOIL	ppm		Pile	19033	363.09	157	67.59	59	24.84	100	51.05	< LOD	786.04
73	SOIL	ppm		Soil	22105	399.81	261	78.89	75	25.96	< LOD	75.79	< LOD	1031.08
74	SOIL	ppm		Soil	25280	567.72	303	124.54	97	27.93	< LOD	59.23	< LOD	1269.33
75	SOIL	ppm		Soil	14821	327.48	290	78.19	63	23.88	62	38.99	< LOD	831.54
76	SOIL	ppm		Pile	11129	288.13	198	69.49	78	22.29	< LOD	58.38	< LOD	1245.27
77	SOIL	ppm		Soil	15168	333.97	303	80.06	91	24.79	< LOD	70.23	< LOD	866.84
78	SOIL	ppm		Yellow Paint	2396	150.33	< LOD	89.28	72	20.11	< LOD	87.15	< LOD	984.4
79	SOIL	ppm		Soil	9847	232.59	150	65.33	82	20.56	< LOD	47.2	< LOD	898.46
80	SOIL	ppm		Soil	15906	353.35	316	83.39	86	23.89	< LOD	68.37	< LOD	662.63
81	SOIL	ppm		Soil	3533	86.8	< LOD	50.8	43	22.86	< LOD	44.1	< LOD	447.37
82	SOIL	ppm	Aborted Test	NA	2867	141.66	540	88.06	< LOD	36.28	< LOD	33.32		
83	SOIL	ppm		Soil	2820	139.14	561	87.01	109	25.15	< LOD	50.01	< LOD	545.36
84	SOIL	ppm		Soil	60657	745.14	905	145.08	52	25.99	< LOD	69.22	< LOD	735.78
85	SOIL	ppm		Soil	24310	452.24	322	91.09	101	25.02	91	45.82	< LOD	894.08
86	Shutter Cal.	cps		NA										
87	SOIL	ppm		Soil	33933	552.95	646	109.64	106	26.61	< LOD	75.11	< LOD	1107.06
88	SOIL	ppm		Soil	14383	300.86	368	78.06	73	23.39	< LOD	68.18	< LOD	853.12
89	SOIL	ppm		Soil	21646	429.42	367	93.63	65	23.08	81	44.62	< LOD	1274.02
90	SOIL	ppm	SS-06	Soil	20197	370.9	452	88.24	60	24.94	< LOD	66.01	< LOD	1268.79
91	SOIL	ppm		Soil	29660	533.9	457	110.2	62	22.96	< LOD	67.35	< LOD	980.47
92	SOIL	ppm		Soil	28595	518.43	508	111.77	82	24.15	134	48.44	< LOD	1177.01

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C & H Tamarack Operations
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TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Molybdenum		Strontium		Lead		Arsenic		Zinc		Copper		Cobalt	
#	Sample Type	Units	Collocated Surficial Soil Sample No.	Source Area	Molybdenum	Mo Error	Strontium	Sr Error	Lead	Pb Error	Arsenic	As Error	Zinc	Zn Error	Copper	Cu Error	Cobalt	Co Error
93	SOIL	ppm		Soil	< LOD	6.95	50.13	4.65	27	8.28	< LOD	9.52	98	16.96	288	30.24	< LOD	103.33
94	SOIL	ppm		Soil	< LOD	7.07	57.82	4.98	36	9	< LOD	10.47	81	16.63	824	34.27	< LOD	102.69
95	SOIL	ppm	SS-09	Soil	< LOD	7.2	68.73	5.32	111	13.58	< LOD	16.12	443	32.98	1410	63.83	< LOD	143
96	SOIL	ppm		Soil	10.83	5.73	185.3	9.61	48	11.62	< LOD	13.5	67	20.6	900	61.04	256	162.87
97	SOIL	ppm	SS-12	Soil	< LOD	7.87	78.86	6.31	285	23.03	< LOD	25.68	67	19.52	1177	86.22	< LOD	182.05
98	SOIL	ppm		Soil	10.47	4.11	53.98	4.2	115	12.01	< LOD	13.92	154	18.42	947	46.16	135	69.21
99	SOIL	ppm		Soil	< LOD	6.73	78.86	5.41	186	16.24	< LOD	18.63	204	23.55	1719	66.9	< LOD	132.9
100	SOIL	ppm		Soil	< LOD	7.14	82.54	5.79	139	14.99	< LOD	17.75	165	20.68	1872	73.4	< LOD	168.46
101	SOIL	ppm		Pile	< LOD	6.89	43.64	4.3	106	12.92	< LOD	14.82	132	18.32	189	27.01	< LOD	100.91
102	SOIL	ppm		Soil	9.76	4.23	35.39	3.64	42	8.27	< LOD	9.46	53	14.91	1749	62.94	< LOD	84.75
103	SOIL	ppm		Soil	< LOD	8.34	113.6	7.53	144	17.27	< LOD	20	137	25.44	1796	81.65	< LOD	239.27
104	SOIL	ppm	SS-08	Soil	< LOD	9.28	120.24	8.98	2237	72.38	< LOD	81.78	5779	145.97	9798	232.03	< LOD	343.39
105	SOIL	ppm		Soil	< LOD	11.21	112.93	10.07	666	46.52	58	36.56	< LOD	117.09	38713	486.51	858	435.04
106	SOIL	ppm		Soil	< LOD	9.08	102.21	8.09	298	26.81	< LOD	30.29	87	27.08	1559	78.7	< LOD	422.95
107	SOIL	ppm		Soil	< LOD	6.86	47.14	4.48	68	10.98	< LOD	12.21	127	19.02	528	40.45	< LOD	118.58
108	SOIL	ppm		Soil	< LOD	7.35	88.62	6.07	153	15.94	< LOD	18.38	51	16.91	1368	64.4	< LOD	146.81
109	SOIL	ppm		Soil	11.07	5.17	123.45	7.29	107	14.22	< LOD	16.52	51	19.14	2184	82.81	< LOD	197.62
110	SOIL	ppm		Soil	< LOD	7.44	60.56	5.45	65	11.76	< LOD	13.66	74	19.72	1084	61.23	322	168.07
111	SOIL	ppm		Waste	< LOD	16.19	63.06	12.47	1036	86.78	135	69.65	1104	354.6	304537	2313.56	< LOD	688.8
112	SOIL	ppm		Soil	9.77	5.42	93.77	6.83	305	23.82	39	18.99	102	22.83	1824	81.13	< LOD	171.87
113	SOIL	ppm		Soil	7.7	4.77	63.67	5.18	250	18.47	< LOD	22.6	90	18.38	1046	55.87	< LOD	159.09
114	SOIL	ppm		Soil	< LOD	7.67	93.33	6.65	56	11.37	< LOD	12.88	32	16.55	904	60.07	289	130.17
115	SOIL	ppm		Soil	< LOD	7.38	138.89	7.53	62	11.28	< LOD	13.15	79	18.36	1047	57.75	< LOD	182.59
116	SOIL	ppm		Soil	8.98	4.23	152.07	8.75	277	18.07	< LOD	20.93	140	18.41	1110	60.57	< LOD	95.33
117	SOIL	ppm		Soil	< LOD	9.02	91.75	7.82	736	41.55	< LOD	47.99	278	72.03	42116	432.86	864	221.76
118	SOIL	ppm	SS-10	Soil	< LOD	9.81	115.17	9.39	4834	105.58	238	81.69	4337	133.1	5293	165.25	1397	368.08
119	SOIL	ppm		Soil	< LOD	8.31	91.54	7.39	1799	58.16	216	66.72	1768	77.41	7686	172.14	< LOD	293.24
120	SOIL	ppm		Soil	< LOD	7.57	88.49	6.31	268	21.28	< LOD	24.51	190	27.28	2462	88.44	< LOD	194.4
121	SOIL	ppm		Soil	8.23	4.05	74.03	5.69	205	18.29	< LOD	20.98	118	22.15	1369	65.24	< LOD	176.82
122	SOIL	ppm	SS-11	Soil	< LOD	8.25	288.32	11.56	180	26.65	< LOD	31.23	185	28.52	1955	84.47	< LOD	279.98
123	SOIL	ppm	SS-13	Soil	< LOD	8	100.44	7.03	1506	50.9	63	39.35	836	49.45	2289	89.11	< LOD	232.54
124	SOIL	ppm		Soil	9.17	5.22	90.26	6.96	22	8.38	< LOD	10.18	25	13.29	313	36.13	< LOD	135.12
125	SOIL	ppm		Soil	< LOD	7.97	218.36	9.83	470	28.64	45	22.52	206	26.93	1101	62.79	< LOD	214.92
126	SOIL	ppm		Soil	17.01	3.91	58.88	3.99	46	7.74	< LOD	8.95	64	11.61	208	24.64	< LOD	45.57
127	SOIL	ppm		Soil	12.6	3.82	20.04	2.71	18	5.83	< LOD	6.03	39	9	156	19.82	< LOD	38.65
128	SOIL	ppm		Soil	< LOD	6.5	55.28	4.48	48	9.07	< LOD	10.81	56	13.9	619	40.42	< LOD	94.7
129	SOIL	ppm		Soil	< LOD	6.02	32.47	3.43	18	6.24	< LOD	6.79	40	10.76	145	21.39	< LOD	74.76
130	SOIL	ppm		Soil	< LOD	8.03	65.17	5.94	45	10.95	< LOD	13.42	41	18.52	844	61.13	537	175.07
131	SOIL	ppm		Soil	< LOD	8.54	102.68	7.51	40	11.06	< LOD	13.7	50	21.06	1492	78.52	< LOD	270.18
132	SOIL	ppm		Soil	< LOD	7.7	106.4	6.99	165	17.46	< LOD	20.16	145	22.99	894	48.83	299	150.04
133	SOIL	ppm		Soil	6.15	4.1	39.2	3.71	97	7.89	< LOD	8.52	80	13.97	358	30.2	< LOD	94.34
134	SOIL	ppm	SS-14	Pile	10.95	4.06	72.2	4.69	403	20.89	25	16.16	617	31.84	823	28.36	< LOD	76.47
135	SOIL	ppm		Soil	13.36	3.97	37.75	3.46	15	5.75	< LOD	6.04	88	15.26	1705	57.52	< LOD	44.28
136	SOIL	ppm		Soil	< LOD	8.39	85.72	7.12	99	15.78	< LOD	19.07	36	20.76	1368	77.57	< LOD	285.84
137	SOIL	ppm	SS-01	Soil	< LOD	6.4	49.88	4.25	20	6.89	< LOD	7.75	101	15.68	307	29.81	< LOD	98.86
138	SOIL	ppm		Soil	< LOD	7.01	93.62	6	61	10.49	< LOD	12.69	50	17.44	1965	73.65	< LOD	166.76
139	SOIL	ppm		Soil	< LOD	6.37	50.04	4.23	26	7.22	< LOD	8.03	109	15.82	257	27.72	< LOD	109.21

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TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Iron		Manganese		Chromium		Vanadium		Barium	
#	Sample Type	Units	Collocated Surficial Soil Sample No.	Source Area	Iron	Fe Error	Manganese	Mn Error	Chromium	Cr Error	Vanadium	V Error	Barium	Ba Error
93	SOIL	ppm		Soil	7449	226.72	217	66.01	83	22.48	< LOD	49.63	< LOD	870.93
94	SOIL	ppm		Soil	7214	225.53	146	60.96	78	21.66	< LOD	52.71	< LOD	927.39
95	SOIL	ppm	SS-09	Soil	14544	316.27	460	87.49	48	24.34	< LOD	74.72	< LOD	735.75
96	SOIL	ppm		Soil	32234	542.82	405	105.1	61	24.32	< LOD	67.44	< LOD	1088.78
97	SOIL	ppm	SS-12	Soil	18963	402.94	225	81.78	66	22.03	69	40.16	1881	3236.39
98	SOIL	ppm		Soil	7601	200.93	183	54.86	78	25.46	< LOD	56.5	< LOD	567.15
99	SOIL	ppm		Soil	14085	298.31	297	72.71	85	25.49	85	44.1	< LOD	635.16
100	SOIL	ppm		Soil	20558	377.47	397	79.13	40	24.82	78	50.09	< LOD	681.22
101	SOIL	ppm		Pile	7728	224.77	305	71.63	66	22.6	< LOD	62.55	< LOD	694.9
102	SOIL	ppm		Soil	6194	186.21	351	67.86	73	24.39	< LOD	53.24	< LOD	545.57
103	SOIL	ppm		Soil	33012	538.72	456	106.16	69	24.81	< LOD	75.6	< LOD	880.36
104	SOIL	ppm	SS-08	Soil	51455	767.59	1225	179.19	71	25.98	< LOD	72.98	< LOD	920.83
105	SOIL	ppm		Soil	138893	1462.45	1430	253.42	220	35.23	116	58.91	< LOD	3625.7
106	SOIL	ppm		Soil	82694	956.77	1042	173.17	< LOD	38.59	< LOD	80.17	< LOD	836.93
107	SOIL	ppm		Soil	10027	258.75	172	62.82	81	23.21	70	38.34	< LOD	828.49
108	SOIL	ppm		Soil	15605	334.39	189	69.23	90	24.34	< LOD	65.49	< LOD	878.87
109	SOIL	ppm		Soil	25768	444.09	341	88.5	54	24.35	< LOD	68.24	< LOD	993.53
110	SOIL	ppm		Soil	39637	560.38	520	106.53	50	29.68	103	68.18	< LOD	1146.36
111	SOIL	ppm		Waste	69254	1500.33	882	383.8	137	26.8	< LOD	84.37	< LOD	1395.27
112	SOIL	ppm		Soil	16995	382.89	567	130.5	75	23.61	< LOD	67.58	< LOD	843.66
113	SOIL	ppm		Soil	17912	352.04	375	83.55	67	24.63	< LOD	65.12	< LOD	792.93
114	SOIL	ppm		Soil	22288	428.94	709	118.64	48	23.68	80	42.64	< LOD	1249.07
115	SOIL	ppm		Soil	22688	407.88	231	77.05	72	24.42	< LOD	69.19	< LOD	760.63
116	SOIL	ppm		Soil	8080	210.9	382	55.99	62	25.02	< LOD	65.33	< LOD	500.19
117	SOIL	ppm		Soil	48156	737.3	642	146.52	99	27.88	104	56.27	< LOD	899.13
118	SOIL	ppm	SS-10	Soil	116510	1211.72	1500	220.11	90	31.65	118	76.87	2353	1269.6
119	SOIL	ppm		Soil	45063	657.75	638	130.33	109	29.79	< LOD	99.97	1889	1042.78
120	SOIL	ppm		Soil	24242	432.62	561	99.22	61	25.03	< LOD	71.64	< LOD	852.34
121	SOIL	ppm		Soil	21043	392.66	297	81.85	59	24.52	101	45.21	< LOD	1068.14
122	SOIL	ppm	SS-11	Soil	46549	635.62	484	112.65	44	26.48	< LOD	78.15	< LOD	805.03
123	SOIL	ppm	SS-13	Soil	32298	519.82	311	94.74	87	27.26	< LOD	83.66	< LOD	1125.22
124	SOIL	ppm		Soil	11961	305.19	161	68.49	105	23.7	< LOD	55.62	< LOD	1265.76
125	SOIL	ppm		Soil	27882	477.85	339	93.18	55	23.52	< LOD	67.44	< LOD	1310.14
126	SOIL	ppm		Soil	1882	95.23	75	39.56	49	23.6	< LOD	46.04	< LOD	351.29
127	SOIL	ppm		Soil	1239	78.1	< LOD	48.18	< LOD	35.39	< LOD	41.81	< LOD	425.18
128	SOIL	ppm		Soil	7441	210.03	117	53.14	64	23.38	100	42.62	< LOD	767.71
129	SOIL	ppm		Soil	5203	165.85	118	48.38	95	25.15	< LOD	59.8	< LOD	665.04
130	SOIL	ppm		Soil	36669	569.41	369	102.1	84	25.16	< LOD	68.68	< LOD	1480.71
131	SOIL	ppm		Soil	38247	605.35	392	108.48	74	24.8	< LOD	70.96	< LOD	844.82
132	SOIL	ppm		Soil	30629	496.56	340	92.92	58	24.08	< LOD	66.75	< LOD	889.08
133	SOIL	ppm		Soil	8090	207.68	305	49.39	58	24.51	< LOD	65.18	< LOD	508.49
134	SOIL	ppm	SS-14	Pile	5616	170.63	157	52.01	105	27.05	< LOD	79.52	< LOD	585.95
135	SOIL	ppm		Soil	1435	86	152	47.16	34	23.16	< LOD	44.43	< LOD	443.29
136	SOIL	ppm		Soil	60934	642.66	1063	155.46	62	25.02	< LOD	73.82	< LOD	1132.18
137	SOIL	ppm	SS-01	Soil	8024	215.15	197	58.96	59	23.6	< LOD	59.43	< LOD	662.22
138	SOIL	ppm		Soil	21086	375.25	339	80.92	46	25.97	< LOD	77.4	< LOD	835.59
139	SOIL	ppm		Soil	10019	238.77	226	61.67	45	24.04	< LOD	61.47	< LOD	601.06

Site Inspection Report
C & H Tamarack Operations
XRF Results, 11/5-6/12

TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Molybdenum		Strontium		Lead		Arsenic		Zinc		Copper		Cobalt	
#	Sample Type	Units	Collected Surficial Soil Sample No.	Source Area	Molybdenum	Mo Error	Strontium	Sr Error	Lead	Pb Error	Arsenic	As Error	Zinc	Zn Error	Copper	Cu Error	Cobalt	Co Error
140	SOIL	ppm		Soil	7.97	4.51	94.81	5.83	70	10.74	< LOD	12.54	83	14.15	162	33.4	< LOD	103.44
141	SOIL	ppm		Soil	9.2	3.96	47.75	3.86	35	7.45	< LOD	8.15	172	17.64	266	25.69	< LOD	82.06
RDCC:					2,600		330,000		400		7.6		170,000		20,000		2,600	
NDCC:					9,600		1,000,000		900		37		630,000		73,000		9,000	
GSIPC:					64		420		2,100		4.6		85		29		2.0	
Default background (= criterion if >C):					NA		NA		21		5.8		47		32		6.8	
Conclusion of risk based on screening levels:					<C		<C		a, b		a, b		c		a, c		b, c	

Notes:
All readings were obtained by XRF on 11/5/13 or 11/6/13

Exceeds residential or nonresidential direct contact criteria

Exceeds GSIPC

RDCC = Residential Direct Contact Criteria
NDCC = Nonresidential Direct Contact Criteria
GSIPC = Groundwater Surface Water Interface Protection Criteria
NA = not available or not applicable
>C = greater than cleanup criteria shown here (e.g., RDCC or GSIPC)
<C = less than cleanup criteria shown here (e.g., RDCC or GSIPC)
Some element data are hidden: 1) if not detected, or 2) if no criteria are available

Conclusions of risk:

a May not be safe for either residential or nonresidential use due to direct contact risks
b Potential risk to surface water (Torch Lake)
c Appears to be safe from direct contact risks
d May be safe from direct contact risks if use is limited to nonresidential

Site Inspection Report
C & H Tamarack Operations
XRF Results, 11/5-6/12

TABLE 5-1

XRF SCREENING DESCRIPTIONS AND RESULTS

					Iron		Manganese		Chromium		Vanadium		Barium	
#	Sample Type	Units	Collocated Surficial Soil Sample No.	Source Area	Iron	Fe Error	Manganese	Mn Error	Chromium	Cr Error	Vanadium	V Error	Barium	Ba Error
140	SOIL	ppm		Soil	8668	233.43	169	60.22	65	22.8	< LOD	55	< LOD	638.79
141	SOIL	ppm		Soil	3466	332.51	89	43.64	82	24.29	< LOD	52.3	< LOD	561.13
RDCC:					160,000		25,000		2,500		750		37,000	
NDCC:					580,000		90,000		9,200		5,500			
GSIPC:					NA		21		NA		190		140	
Default background [= criterion if >C]:					12,000		340		18		NA		75	
Conclusion of risk based on screening levels:					d		b		<C		<C		b	

Notes:
All readings were obtained by XRF on 11/5/13 or 11/6/13

Exceeds residential or nonresidential direct contact criteria

Exceeds GSIPC

RDCC = Residential Direct Contact Criteria
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Some element data are hidden: 1) if not detected, or 2) if no criteria are available

Conclusions of risk:

a May not be safe for either residential or nonresidential use due to direct contact risks
b Potential risk to surface water (Torch Lake)
c Appears to be safe from direct contact risks
d May be safe from direct contact risks if use is limited to nonresidential

TABLE 5-2

SURFICIAL SOIL AND WASTE SAMPLE DESCRIPTIONS

SAMPLE NUMBER	LOCATION COORDINATES		DEPTH (in.)	DESCRIPTION	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing			
SS-01	314620.03	737735.75	0-2 2-8	Moist, dark brown, sandy topsoil. Moist, reddish brown, silty, fine to medium sand with some gravel and trace roots.	Grab sample. Volatile organic analysis (VOA) portion of sample collected at 4 in. Remainder of sample collected at 0-8 in.
SS-02	314438.55	737327.29	0-9	Dry, dark brown, silty, fine to medium sand with some ash, wood, slag and roots.	Grab sample. VOA portion of sample collected at 9 in. Remainder of sample collected at 0-9 in. Duplicate sample collected.
SS-03	314532.24	737346.93	0-6	Very moist, black, organic silt and sand with lots of roots.	Grab sample. VOA portion of sample collected at 4 in. Remainder of sample collected at 0-6 in. Matrix Spike/Matrix Spike Duplicate sample collected.
SS-04	314670.27	737495.90	0-½ ½ -1½	Moist, dark reddish brown, silty sand and gravel, crushed mine rock. Moist, greenish gray sludge material with copper wire at surface.	Grab sample. VOA portion of sample collected at 1 in. Remainder of sample collected at 0-1½ in.

TABLE 5-2

SURFICIAL SOIL AND WASTE SAMPLE DESCRIPTIONS

SAMPLE NUMBER	LOCATION COORDINATES		DEPTH (in.)	DESCRIPTION	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing			
SS-05	314587.33	737508.51	0-5	Very moist, dark brown, silty sand with stamp sand, gravel, crushed mine rock and slag.	Grab sample. VOA portion of sample collected at 2 in. Remainder of sample collected at 0-5 in.
SS-06	314720.87	737579.05	0-3 3-6	Moist, dark brown, silty, fine sand with lots of roots. Moist, reddish brown, silty, fine sand.	Grab sample. VOA portion of sample collected at 3 in. Remainder of sample collected at 0-6 in.
SS-07	314643.00	737571.69	0-8	Moist, dark brown, silty, fine to medium sand with trace gravel and some bricks and roots.	Grab sample. VOA portion of sample collected at 5 in. Remainder of sample collected at 0-8 in.
SS-08	314704.16	737693.90	0-1	Moist, brown, silty, fine to coarse sand with some clay, crushed rock, debris, glass, metal etc. Concrete floor at 1 in.	Grab sample. VOA portion of sample collected at ½ in. Remainder of sample collected at 0-1 in.
SS-09	314752.10	737669.68	0- ½ ½-2	Moist, dark brown silt. Moist, brown, fine sand.	Grab sample. VOA portion of sample collected at 1 in. Remainder of sample collected at 0-2 in.

TABLE 5-2

SURFICIAL SOIL AND WASTE SAMPLE DESCRIPTIONS

SAMPLE NUMBER	LOCATION COORDINATES		DEPTH (in.)	DESCRIPTION	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing			
SS-10	314689.63	737711.34	0-6	Moist, dark brown, silty, fine to medium sand with lots of gravel, mine rock, glass, metal debris and roots.	Grab sample. VOA portion of sample collected at 4 in. Remainder of sample collected at 0-6 in.
SS-11	314708.13	737744.25	0-8	Moist, dark brown, silty, fine to medium sand with some gravel, debris, metal and concrete.	Grab sample. VOA portion of sample collected at 5 in. Remainder of sample collected at 0-8 in.
SS-12	314762.16	737705.95	0-1 1-4 4-8	Moist, dark brown, silty, fine sand with some roots. Moist, dark gray, silty sand and gravel with some slag and crushed mine rock. Moist, reddish brown, silty, fine to medium sand.	Grab sample. VOA portion of sample collected at 5 in. Remainder of sample collected at 0-8 in. Duplicate sample collected.
SS-13	314683.57	737740.85	0-8	Moist, black, silty, fine to medium sand with some gravel, slag, glass and wood.	Grab sample. VOA portion of sample collected at 5 in. Remainder of sample collected at 0-8 in.
SS-14	314597.20	737635.96	0-8	Moist, black, silty, fine to medium sand with mixed fill, slag, brick, glass, metal, shingles etc.	Grab sample. VOA portion of sample collected at 4 in. Remainder of sample collected at 0-8 in.

TABLE 5-2

SURFICIAL SOIL AND WASTE SAMPLE DESCRIPTIONS

SAMPLE NUMBER	LOCATION COORDINATES		DEPTH (in.)	DESCRIPTION	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing			
W-1	314662.77	737504.92	0-3	Moist, brown, medium to coarse sand with fine gravel and possibly scrap metal (felt heavier than soil).	Grab waste sample.
W-2	314573.48	737515.08	0-4	Moist, gray, ashy material with clayey consistency and oily smell.	Grab waste sample.

Location Coordinates: Michigan Georef North American Datum (NAD) 1983 meters

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-01	314662.40	737702.81	0-4	23	0-6	Moist, dark brown/black, medium sand with trace rock.	Grab sample.
					6-23	Moist, red, medium sand with trace rock.	Volatile Organic Analysis (VOA) portion of sample collected at 18 in. of 0-4 ft. core.
						PID = 0.9 at 12-22 in.	
			4-8	38	0-38	Very moist, red, medium sand with trace rock.	Remaining sample portion taken from 12-22 in. of 0-4 ft. core.
						PID = 0.0	
			8-12	14	0-14	Very moist, red, medium sand with trace rock. Refusal at 14 in.	
						PID = 0.0	

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-02	314466.07	737378.70	0-4	46	0-46	Moist, brown, reddish brown, medium sand/clay. PID = 0.4	Grab sample. VOA portion of sample collected at 28 in. of 0-4 ft. core.
			4-8	46	0-46	Moist, dark brown, medium sand/clay with trace rocks. PID = 0.0	Remaining sample portion taken from 22-34 in. of 0-4 ft. core.
			8-12	43	0-6	Moist to very moist, dark brown, medium sand with trace rocks.	Duplicate sample collected.
					6-43	Very moist, reddish brown, medium sand. PID = 0.0	

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-03	314672.13	737495.92	0-4	40	0-40	Moist, reddish brown, medium sand.	Grab sample.
			4-8	38	0-14	Moist, reddish brown, medium sand.	VOA portion of sample collected at 20 in. of 0-4 ft. core.
					14-38	Moist, dark brown, medium sand.	
			8-12	30	0-30	Moist, dark brown, medium sand. PID = 0.0	Remaining sample portion taken from 18-34 in. of 0-4 ft. core. Matrix spike/matrix spike duplicate collected.

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-04	314669.17	737483.82	0-4	38	0-12	Moist, dark brown, medium sand.	Grab sample.
					12-20	Moist, brown, medium sand with trace rocks.	VOA portion of sample collected at 25 in. of 4-8 ft. core.
					20-38	Moist, dark brown, medium sand with gravel and slag.	Remaining sample portion taken from 22-34 in. of 4-8 ft. core.
			4-8	39	0-39	Moist, dark brown, medium sand.	
			8-12	36	0-20	Moist, reddish brown, medium sand.	
					20-30	Moist, dark brown, medium sand.	
					30-36	Moist, reddish brown, medium sand.	
						PID = 0.0	

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-05	314730.84	737592.80	0-4	42	0-6	Moist, dark brown, medium sand. PID = 0.0	Grab sample.
					6-42	Moist, reddish brown, medium sand with trace rock. PID = 0.7	VOA portion of sample collected at 33 in. of 0-4 ft. core.
			4-8	43	0-43	Moist, dark brown and reddish brown, medium sand with rocks. PID = 0.0	Remaining sample portion taken from 26-42 in. of 0-4 ft. core.
			8-12	46	0-11	Moist, brown, medium sand.	
					11-46	Saturated, brown, medium sand. PID = 0.0	Corresponding well TMW-03.

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-06	314762.30	737647.06	0-4	45	0-45	Moist, reddish brown, medium sand.	Grab sample.
			4-8	46	0-46	Moist, reddish brown, medium sand with trace rock.	VOA portion of sample collected at 32 in. of 0-4 ft. core.
			8-12	48	0-36	Saturated, reddish brown, medium sand with trace rock.	Remaining sample portion taken from 22-45 in. of 0-4 ft. core.
					36-48	Moist, peat moss, organics.	
						PID = 0.0	Corresponding well TMW-02.
SB-08	314580.79	737489.94	0-4	36	0-34	Moist, dark brown, medium sand with trace gravel.	Grab sample.
					34-36	Rock fragments.	VOA portion of sample collected at 29 in. of 0-4 ft. core.
			4-8	42	0-38	Moist, brown, medium sand.	
					38-42	Saturated, brown, medium sand.	Remaining sample portion taken from 22-34 in. of 0-4 ft. core.
			8-12	44	0-28	Saturated, brown, medium sand.	
					28-44	Moist, reddish brown, sand/clay and	

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
						moist trace gravel. PID = 0.0	
SB-09	314678.44	737627.34	0-4	20	0-14	Moist, dark brown, medium sand with trace rocks. PID = 0.3	Grab sample. VOA portion of sample collected at 30 in. of 4-8 ft. core. Remaining sample portion taken from 20-40 in. of 4-8 ft. core.
					14-20	Moist, reddish brown, medium sand.	
			4-8	40	0-40	Moist, reddish brown, medium sand. PID = 0.7	
			8-12	36	0-22	Moist, reddish brown, medium sand with rock at bottom.	
					22-36	Rock at top, very moist, reddish brown, medium sand. PID = 0.0	
SB-10	314511.82	737291.87	0-4	36	0-10	Moist, dark brown, medium sand.	Grab sample. VOA portion of sample collected at 12 in. of 4-8 ft. core.
					10-16	Rock.	
					16-36	Moist, dark brown, medium sand with trace rock.	

TABLE 5-3

SOIL BORING LITHOLOGY AND SAMPLE LOG

SAMPLE NUMBER	LOCATION COORDINATES		SPOON INTERVAL (ft.)	RECOVERY (in.)	UNIT THICKNESS (in.)	LITHOLOGICAL DESCRIPTION WITH PHOTOIONIZATION DETECTOR (PID) READING*	SAMPLE INTERVALS AND COMMENTS
	Easting	Northing					
SB-10 Cont.			4-8	42	0-22	Moist, dark brown/black, medium sand with trace rock.	Remaining sample portion taken from 0-22 in. of 4-8 ft. core.
					22-26	Concrete.	
					26-42	Moist, dark brown/black, medium sand with trace gravel.	
			8-12	40	0-15	Moist, dark brown, medium sand with trace gravel.	
					15-40	Moist, brown, medium sand with trace gravel.	
			12-16	45	0-30	Moist, black medium sand with trace gravel.	
					30-33	Moist, brown, medium sand.	
					33-45	Moist, brown, medium sand and clay.	
						PID =0.0	