HISTORICAL DATA REVIEW AND COMPILATION TECHNICAL MEMORANDUM

ABANDONED MINING WASTES – TORCH LAKE NON-SUPERFUND SITE
QUINCY MINING COMPANY MASON OPERATIONS AREA
HOUGHTON COUNTY, MICHIGAN
SITE ID# 31000098

FEBRUARY 2017

PREPARED FOR:
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REMEDIATION & REDEVELOPMENT DIVISION
CALUMET FIELD OFFICE
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1.0 INTRODUCTION

The Mannik & Smith Group, Inc. (MSG) has prepared this *Historic Data Review and Data Compilation Technical Memorandum* (TM) as part of the Abandoned Mining Wastes – Torch Lake non-Superfund Site (Project) http://www.michigan.gov/deq/0,4561,7-135-3311_4109_9846_76560---,00.html (Site ID: 31000098). This TM summarizes previous studies and investigations completed in the Quincy Mining Mason Operations Area (QMCM), Houghton County, Michigan. The TM findings will support the development of a Sampling and Analysis Plan (SAP) for QMCM. The TM was prepared in accordance with the *Indefinite Scope Indefinite Delivery (ISID) Discretionary Proposal for FS and Remedial Action Activities* (24 February 2016) prepared by MSG in response to a request from the Michigan Department of Environmental Quality (DEQ), Remediation and Redevelopment Division (RRD), Calumet Field Office under MSG's 2015 Environmental Services ISID Contract Number 00538 with the State of Michigan.

1.1 Project Location

The Project area is located along the shoreline and in Torch Lake, Houghton County, Michigan. Due to the complex nature and very large area, RRD subdivided the Project into study areas based on past use and known issues. Depicted on *Figure 1, Project Location Map* are the QMCM, Calumet and Hecla Lake Linden Operations Area (CHLL), and Calumet and Hecla Tamarack City Operations Area (CHTC) areas and their respective former industrial operations.

The QMCM encompasses the former Quincy Mining Company (QMC) copper mining and processing operations in Mason, Michigan and a former residential/commercial property along the south shore of Torch Lake, north of Dollar Bay, Michigan. The QMCM consists of approximately 680 acres of land extending approximately 5.6 miles along the shoreline of Torch Lake and incorporates over 64 different parcels with multiple property owners. The QMCM is located along both sides of Highway M-26 with the east side of the highway generally characterized as an in-lake stamp sand deposit associated with the industrial operations conducted on the east and west sides of the highway, as well as the residential/commercial/vacant properties southwest of Torch Lake between the shoreline and Montroal Road. Residential (single-family residences), undeveloped forested lands, industrial (capped stamp sands) properties, and Torch Lake border the QMCM. *Figure 2, Area Features Map,* depicts the area and site features.

1.2 Project Background

Copper mining was extensive in the Keweenaw and formed the backbone of the regional economy and society. Copper ore milling and smelting operations conducted from the mid-1860s to the 1960s, including the importation, reprocessing, and smelting of various scrap metals in the later years of operation. Consistent with past industrial practices, Torch Lake served as dumping grounds for virtually all mining industry related waste products produced, including tailings, slag, and various chemicals. At least 20 percent of the Torch Lake's volume is estimated to be filled with tailings and other waste products.

The environmental legacy resulting from over 100 years of mining and reclamation led to Torch Lake and its western shoreline to be designated as a Superfund site by the United States Environmental Protection Agency (EPA) https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0503034 and a Great Lakes Area of Concern by the U.S./Canada Great Lakes Water Quality Agreement https://www.epa.gov/torch-lake-aoc. The EPA undertook cleanup activities to address some of the byproducts of the mining industry, while others were not addressed or left to recover through natural processes.

QMC

With the construction of several facilities between 1892 and 1943, the QMCM was industrialized and continued operations until circa 1967. As summarized from Michigan Technological University's (MTU) February 2015 document entitled *Quincy Mining Facilities on Torch Lake, Narratives and Supporting*

Documents, Part 1, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties, Task 3: Historical Archive Research & Mapping, QMC built its steam-powered Mill No. 1 on the Torch Lake shore, at Mason, in 1892, and Mill No. 2 about a decade later. In these mills, Quincy processed amygdaloid ore from its mines north of Hancock. Over the course of decades, these mills deposited stamp sand, the waste product of the milling process, in Torch Lake. Early milling technologies were inefficient, and significant copper values remained in the stamp sand. In the early decades of the 20th century, improvements in milling technology, most significantly the introduction of the flotation process, made it possible to reclaim the copper that was in the stamp sand. QMC's Reclamation Plant went into operation in 1943 at a newly constructed location south of the mill locations to re-process stamps sands generated during mill operations and disposed of in Torch Lake.

Photo 1: Current conditions at Quincy Stamp Mill No.1 (facing northwest)

The Reclamation Plant had three principal parts: the Dredge, the Shore Plant, and the Regrinding Plant. QMC's reclamation dredge sunk in 55 feet of water on January 14, 1956 and was replaced by a second dredge. Machinery in the Shore Plant served mostly to remove water from the dredged tailings before conveyance to the Regrinding Plant where the core operations of the reclamation process took place: grinding, classification, and flotation. The conveyor dropped its dewatered stamp sand into a "surge bin," which fed the sand into ball mills. Ball mills were horizontally mounted, conical drums filled with hardened steel balls. When the drums rotated, the balls pulverized the stamp sand into a powder fine enough for treatment by flotation. The consistency was roughly that of baking flour. From the ball mills, the fine-ground slime went through a series of concentrating and classifying apparatus, which separated copper-rich material from copper-poor material. Copper-rich material proceeded to flotation machines. In one chamber of the flotation machine, agitators beat a mixture of water and pine oil into a bubbly froth. In another, the reagent xanthate mixed with "pulp" from the ball mills. A chemical reaction with the xanthate caused the copper particles to adhere to the pine oil bubbles when the pulp moved into the frothing chamber. The bubbles lifted the copper particles and a rotating paddle mechanism skimmed the copper-bearing froth off the top. Pumped through filtration and classifying machinery, then into a thickener, the copper-bearing froth was dewatered. Xanthate and pine oil were the only chemicals used in the flotation process. Before the concentrated mineral material left the Reclamation Plant, it went through a drier to remove further moisture in preparation for smelting. This drier may have been fuel oil fired. The post-reclamation tailings, which still contain copper, were disposed of in Torch Lake.

Electric lines running parallel to the Mineral Range Railroad line carried electricity produced at the C&H Power Plant in Lake Linden to power the Reclamation Plant. The power entered the Reclamation Plant through a substation located at the northwest corner of the plant. Part of the substation, including its switchgear and circuit breakers, was located inside the plant itself. There were three large, oil-filled transformers located just outside the plant, also at the northwest corner. The electrically powered Dredge(s) contained at least three oil-filled transformers in addition to a circuit breaker that held six gallons of oil.

There were three small transformers associated with the Shore Plant; it is not clear whether these transformers were dry or oil-filled.

Photo 2: Current conditions at the former Quincy Reclamation Plant (facing north).

The Reclamation Plan shut down in 1967 and several years later a scrap metal company dismantled the Regrinding Plant, Shore Plant, and conveyor apparatus. Of the four major structures that were part of the facility, only the enclosed conveyor system that carried stamp sand from the Shore Plant to the regrinding plant is absent from the landscape. The Shore Plant's foundation and pilings still stand on the shore and in Torch Lake, respectively. The Regrinding Plant foundation is intact. Foundations of substation equipment remain in the northwest corner of the plant ruins, though the equipment itself is absent with the exception of a few power poles and insulators. The original dredge remains at the bottom of Torch Lake, marked by a red buoy. Quincy's second dredge rests on the bed of Torch Lake, close to shore and is mostly intact and visible above the water.

As part of the Torch Lake Superfund Site remedy, the EPA completed capping 225 acres of the QMC between the Torch Lake Shoreline and Highway M-26 in 2002. The property west of Highway M-26, however, has not been improved since the mining era and features widespread disposition of tailings and stamp sand within and proximal to the stamp mill ruins and widespread debris. The EPA delisted the QMC from the National Priorities List in 2012.

South Shore of Torch Lake

Review of file information for the QMCM area identified a former commercial operation that conducted furniture stripping using various chemicals. The furniture stripping operation buildings are still present; however, the furniture stripping business has since discontinued operation. The facility name according to DEQ files is Furniture Stripping Dollar Bay Site (FSDB) (Site ID: 31000008). Releases at the FSDB were due to the discharge of furniture stripping waste to the ground surface over a period of seven years. Further releases may have occurred from improper operation of hazardous waste storage systems. The operators claim to have burned most of the waste prior to 1992, and to have stored the waste in buckets from 1992 to 1994. The operators reportedly used an annual average of 200 gallons of methylene chloride-based furniture stripper during the period of surface discharge from 1987 to 1994.

Methylene chloride was detected in the facility's shallow commercial well at concentrations of 141 parts per billion (ppb) in 1994. A single drilled well provides drinking water at the property. Sample analyses for this well have been non-detect for methylene chloride in the past.

Contaminated soil in the source area has not been remediated and may continue to act as a source of groundwater contamination. Groundwater leaving the operator's facility may extend to Torch Lake, which is less than ¼ mile away.

Unaccounted for is an estimated 2900+ gallons of methylene chloride-based furniture stripper reportedly purchased by the owner/operator. Throughout the entirety of the facility's operation, only one 55-gallon drum of waste stripper is recorded to have been properly removed from the premises. An adjacent landowner recounted observing the owner/operator burying unknown objects in the wetlands on his property; however, this has not been verified. The owner/operator does not have the required funds to determine the extent of contamination nor the funds to remediate contaminated soils/groundwater on the property and the DEQ project has been inactive since 1997.

2.0 OBJECTIVES AND SCOPE OF WORK

The objective of the DEQ Project is addressing some of the remaining environmental concerns in the Mason area that were not previously addressed by the EPA, or in the case of FSDB, concerns that the owner/operator cannot address. The Project concerns involve groundwater, surface water, sediments, and "upland" media. Known or suspected problems which are being evaluated include: an unidentified, significant in-lake and/or terrestrial source of polychlorinated biphenyls (PCBs), uncharacterized waste deposits and >750 uncharacterized drums on the lake bottom, slag, landfills, industrial ruins, coal storage areas, underground storage tanks (USTs), residual process materials (RPM), asbestos containing materials (ACM), and any other waste materials identified during future investigations.

RRD conducted Site Investigation (SI) activities in the CHLL and CHTC areas, and confirmed the remaining concerns in the Project area involve groundwater, surface water, sediments, and "upland" media. Priority concerns which were evaluated and deemed to require interim responses (IRs) include: significant terrestrial source of PCBs; ACM; RPM; abandoned mining era containers; seeps; limited areas of soil in which there are Direct Contact Criteria (DCC) and Particulate Soil Inhalation Criteria (PSIC) exceedances; and, physical hazards.

In addition to the CHLL and CHTC IRs, RRD staff has initiated work to assimilate historic information and prepare a SAP for undertaking SI activities at the QMCM in 2017. The primary focus of the SAP is to ascertain the source, nature, and extent of contaminants (including PCBs) in all affected environmental media (soil, groundwater, surface water, waste materials, and sediments) within Torch Lake, including former industrial areas in the QMCM.

3.0 APPLICABLE REGULATORY CRITERIA

Evaluation of potential environmental and human health risks present in the QMCM requires uniformly compared analytical results to regulatory criteria. Previous investigations had specific goals and objectives that may have placed emphasis on evaluating specific locations, environmental media, or chemical analytes, intentionally narrowing the scope of each investigation. In addition, due to the constraint of focused objectives, these investigations are also prone to common limiting factors such as funding, personnel, and equipment resources. As such, the findings of a given investigation are also limited, potentially providing a compartmentalized view of a larger, more prolific problem. Similar to limitations identified above, the findings and interpretation of each investigation were also contingent upon the selected regulatory criteria utilized in the evaluation. Over the course of time, regulatory criteria are refined and subject to change, often including criteria revisions and new rule promulgation. As a result, regulatory criteria for a specific exposure pathway and environmental medium evaluated in 2007, for example, may have been evaluated differently using the same regulatory criteria in 2013.

In support of developing a comprehensive approach for evaluating risks, the analytical results from previous investigations summarized herein were compiled and compared to the same regulatory criteria. Consistent with this approach, the same regulatory criteria will be used to evaluate the findings derived from implementation of the SAP. The following provides a summary of the regulatory criteria utilized for evaluating analytical results from surface soil, subsurface soil, groundwater, sediment, and surface water during interpretation of the identified key documents:

- Part 201 of Michigan's Natural Resources and Environmental Protection Act (NREPA), being PA 451 of 1994, as amended Residential and Non-Residential Cleanup Criteria for Response Activity (December 30, 2013).

- Surface Soil;
- Subsurface Soil;
- Waste Materials;
- Residual Process Materials (RPM); and,
- Groundwater.

- EPA, Resource Conservation and Recovery Act (RCRA), Identification and Listing of Hazardous Waste Criteria (40 Code of Federal Regulations, Part 261, Subpart C).

  - Abandoned Containers; and,
  - Waste Materials.

- EPA, National Emission Standards for Hazardous Air Pollutants (NESHAP).

  - Suspect Asbestos Containing Material (SACM).

- EPA, Region 5, RCRA, Ecological Screening Levels (August 2003).

  - Sediment; and,
  - Surface Water.

- MDEQ – Rule 57 Water Quality Values, Surface Water Assessment Section (February 2014).

  - Surface Water.

- Sediment Quality Guidelines, Threshold Effect Concentrations (TECs) and Probable Effect Concentrations (PECs), MacDonald, et al, 2000.

  - Sediment.

Although relevant, the MDEQ drinking water/surface water pathway criteria exceedances for metals are excluded from the soil and groundwater evaluation. The rationale for this exclusion is twofold:

- The Project investigation and anticipated response actions are being undertaken pursuant to Part 201 of Michigan's NREPA, being PA 451 of 1994, as amended. The concentrations of metals in excess of the MDEQ drinking water/surface water pathway criteria are ubiquitous in the study area and are predominantly the result of the presence of stamp sands. Stamp sands are not defined as a hazardous substance nor are subject to regulation under Part 201 unless the property otherwise contains hazardous substances in excess of concentrations that satisfy the cleanup criteria for unrestricted residential use; and,

- The study area is part of Operable Unit (OU) 2 for which the EPA Record of Decision (ROD) remedy called for No Action. The EPA's ROD OU 2 includes groundwater, surface water, submerged tailings and sediments in Torch Lake, Portage Lake, the Portage Canal, and other area water bodies. Note that EPA's No Action determination relies on the following to mitigate the effects of stamp sand to the extent practicable:

  – The reduction of stamp sand loading to surface water bodies expected because of the remedial action taken at OU 1 and OU 3;

  – Ongoing natural sedimentation and detoxification;

  – Institutional programs and practices controlling potential future exposure to site-affected drinking water that were intended to be administered at the county and state level; and,

- The long-term monitoring and the five-year review process monitoring requirements of the remedy selected for OU 1 and OU 3 under the 1992 ROD.

Note that metals criteria for other relevant pathways, and organic and cyanide contaminants for all pathways were included in the evaluation.

The regulatory screening criteria summarized above may be applicable to all or select study areas in the QMCM. A limiting factor in the assessment of the applicability of these criteria may include, but not be limited to, specific environmental media (as noted above), current and anticipated future land use categories, and relevant exposure pathways for human and ecological receptors. Assessment of these factors requires that the analytical results of the SI and the respective geological and hydrogeological characteristics of the Project area be evaluated to determine generally, which exposure pathways, risks, and conditions are relevant and applicable.

4.0 SAP DEVELOPMENT

Screening results and sample analytical data from previous investigations will be incorporated into the sample design. By doing so MSG will be able to identify potential data gaps, while considering the recommendations in each document and available screening and analytical results for soil, groundwater, and sediment from the investigations.

As discussed in the preceding subsection, results derived from individual investigations limit interpretation, particularly as it relates to the presence of potential source areas, localized concentrations of contaminated media, and potential exposure routes. As such, analytical and screening results compiled from the key documents summarized in this document were also integrated into the Project database. The result creates a more comprehensive look at the historical findings while also reducing the potential for redundant sampling activities. The historical analytical and screening results are depicted on multiple figures summarized as follows:

Figure 3a Soil Sample Location Map – Quincy Stamp Mills
Figure 3b Soil Sample Location Map – Quincy Reclamation Plant
Figure 3c Soil Sample Location Map – Furniture Stripping Dollar Bay Site
Figure 3d Soil Sample Location Map – Quincy Stamp Sands
Figure 4a Soil Screening Results Map – QMCM North
Figure 4b Soil Screening Results Map – QMCM North Central
Figure 4c Soil Screening Results Map – QMCM South Central
Figure 4d Soil Screening Results Map – QMCM South
Figure 5a Groundwater Sample Location Map – Quincy Stamp Mills and Reclamation Plant
Figure 5b Groundwater Sample Location Map – Furniture Stripping Dollar Bay Site
Figure 5c Groundwater Sample Location Map – Quincy Stamp Sands
Figure 6 Surface Water and Sediment Sample Location Map – QMCM
Figure 7 Asbestos and Waste Sample Location Map – QMCM
Figure 8 SPMD and Fish Tissue Sampling Location Map – QMCM
Figure 9 ROV Video Observation Location Map July 2016 – QMCM
Figure 10 Preliminary Reconnaissance Observations October 2016 – QMCM

The volume of analytical data derived from the historical documents and presented on the aforementioned figures required the use of graphical and analytical details to simplify the overall presentation of the data. With the exception of soil screening results of X-ray fluorescence (XRF) data presented on Figures 4a through 4d, the following graphics were used to present the analytical results:

- Green Dots – A sample location labeled with the sample date, sample location, and sample interval if known. These dots represent sampling or screening results were below the figure criteria for all sample results at that location. Green dots may be derived from any of the historical investigations.

- Red Dots – A sample location labeled with a callout box that lists the sample identification, the sample interval, and the sample date. These dots represent an exceedance of figure criteria, a summary of which is presented in the corresponding callout box that includes the analyte that exceeded, the concentration, and a key indicating what criteria was exceeded.

- Yellow Ring – A red or green sample location with the addition of a yellow ring indicates that it was analyzed for PCBs and no congeners were detected. The green portion indicates that sample results of PCBs and all other analytes if tested were below criteria. The red portion indicates that there was an exceedance of criteria, in this case something other than PCBs.

- Light Blue Ring – A red or green sample location with the addition of a light blue ring means that it was analyzed for PCBs and at least one congener was detected. The red or green portion indicates if any of the sampling results exceeded criteria following the rules described above. If PCBs or any other analytes exceeded criteria, they would be listed in the callout box. All PCB exceedances are highlighted with red text in the callout boxes.

5.0 KEY DOCUMENT REVIEW AND INTERPRETATION

This Section provides a summary of the key documents selected for review as well as a synopsis of the investigation and conclusions relevant to the development of the SAP.

Numerous investigations have been conducted on and along the shoreline of Torch Lake with various purposes, often specific to a particular property or investigative focus. Although often referenced in individual reports, a comprehensive approach that consolidates the findings of these investigations has not been completed. In support of the development of the SAP, the Project key deliverables associated with the QMCM were selected to assist in the identification of historic areas of contamination or data gaps requiring further assessment.

The following is a summary of the key documents reviewed to support preparation of the SAP along with how the findings will be incorporated into the *Draft Sampling and Analysis Plan for the Abandoned Mining Wastes, Quincy Mining Company Mason Operations Area, Torch Lake Non-Superfund Site, Houghton County, Michigan*:

- *Michigan Department of Public Health – Division of Laboratory Services, Laboratory Report for Sample: C94012848 – 1 February 1994.* Commercial water well sample collected by the Western Upper Peninsula Health Department (WUPHD).

- *Dollar Bay Furniture Stripping Site, Osceola Township, Houghton County Limited Investigation – October 14, 1997. Interoffice Communication.* Prepared by the MDEQ RRD Geological Services Unit (GSU).

- *Archaeological Survey Report of The Quincy Mining Company, Torch Lake Smelter & Reclamation Plant, At Mason Sands, Torch Lake EPA Superfund Site – May 2001*. Prepared by Julia A. Blair & Michigan Technological University Department of Social Sciences Archaeology Laboratory for U.S Department of Agriculture Natural Resources Conservation Service.

- *Final Report, PCB Study Using Semipermeable Membrane Devices in Torch Lake, Houghton County – March 2006*. Prepared by the Great Lakes Environmental Center.

- *Summary Report for the Torch Lake Area Assessment, Torch Lake NPL Site and Surrounding Areas, Keweenaw Peninsula, Michigan – December 2007*. Prepared by Weston Solutions of Michigan, Inc.

- *PCB Concentrations in Walleye Collected from Torch Lake (Houghton County) and Lake Superior - June 2008*. Prepared by the MDEQ Water Bureau.

- United States Environmental Protection Agency, Region V, Pollution Report, Mason Sand Removal – December 12, 2008. Prepared by EPA Emergency Response Branch (ERB).

- *Aroclor Sediment Investigation, Torch Lake Area of Concern, Houghton County, Michigan – June 2009*. Prepared by the EPA Great Lakes National Program Office (GLNPO).

- *Quincy Mining Facilities on Torch Lake, Narratives and Supporting Documents, Part 1, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties, Task 3: Historical Archive Research & Mapping* – February 2015. Prepared by Michigan Technological University.

- *Quincy Mining Facilities on Torch Lake, Maps and Blueprints, Part 2, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties), Task 3: Historical Archive Research & Mapping* – February 2015. Prepared by Michigan Technological University.

- *Site Inspection Report for Quincy Mason Operations, M-26, Along the Torch Lake Shoreline, Osceola Township, Michigan 49913, U.S. EPA ID NO.:MK000510939-April 2, 2015.* Prepared by the MDEQ-RRD, Superfund Section, Pre-remedial Group.

- *Staff Report, Status of Fish Contaminant Levels in the Torch Lake Area of Concern 2013. January 2016.* Prepared by the MDEQ Water Resources Division.

- *Remotely Operated Vehicle (ROV) Videos for Torch Lake within the QMCM – July 2016.* Prepared by the MDEQ RRD GSU.

- *Preliminary Reconnaissance Observations for QMCM – 24 October 2016.* Prepared by MSG.

- *Baseline Environmental Assessment Conducted Pursuant to Section 20126(1) (c) 1994 PA451, Part 201, as amended and the rules promulgated thereunder for Mason Sands, Houghton County, Michigan – January 2017. Prepared by U.P. Engineers and Architects, Inc. (UPEA).*

The following subsections summarize the findings of these investigations and the conclusions derived from the performance of each assessment.

Michigan Department of Public Health – Division of Laboratory Services, Laboratory Report for Sample: C94012848 – 1 February 1994

WUPHD personnel collected a groundwater sample from the FSDB Barn Well for volatile organic compound (VOC) analysis. Reportedly, the Barn Well is a 12 feet (ft) deep commercial well located in the furniture-stripping barn. Field activities were conducted on 1 February 1994. Analysis of the sample detected the presence of methylene chloride at a concentration greater than the applicable Generic Residential and Non-Residential Drinking Water Cleanup Criteria (DWC) of Part 201, Environmental Remediation, of the NREPA, 1994 PA 451, as amended.

Coordinates associated with the Barn Well were not provided; therefore, the sample location was approximated based on the information provided in the MDEQ Limited Investigation Report. The well location and the associated analytical results are depicted on *Figure 5b, Groundwater Sample Location Map – Furniture Stripping Dollar Bay Site.*

Dollar Bay Furniture Stripping Site, Osceola Township, Houghton County Limited Investigation – October 14, 1997

The MDEQ RRD GSU conducted a limited investigation at the FSDB. The limited investigation included a reconnaissance inspection of the property, the collection of soil, sediment, and groundwater samples with photoionization detector (PID), field gas chromatograph (GC) screening and/or laboratory analysis to determine the general extent of groundwater contamination and the groundwater flow direction at the FSDB. Field activities were conducted between 29 September and 1 October 1997 and resulted in the collection of the following:

- The collection of one soil sample (Barn Floor Drain) for VOC and metals analysis;
- The advancement of 12 soil borings (TMW-1 through TWM-6, TMW-8, TMW-9; MCW-7, and MCW-10 through MCW-12) and the collection of subsurface soil samples for PID screening; and,
- The collection of 16 groundwater samples from 12 temporary monitoring wells, and the on-site Barn Well for laboratory and/or field GC analysis for VOC analysis. A limited number of samples were also analyzed for metals.

Analysis of the samples did not detect the presence of contaminants at concentrations greater than the applicable Generic Cleanup Criteria of Part 201, Environmental Remediation, of the NREPA, 1994 PA 451, as amended as discussed in Section 3.0. The following subsections summarize analytical results derived from the investigation.

Surface Soil Sampling

One soil sample (identified as a sediment sample in the laboratory report) was collected from the Barn Floor Drain and analyzed. No volatile organic compounds (VOCs) were determined to exceed criteria.

Subsurface Soil Sampling

All samples were collected from the 0-4 and/or 4-8 ft below ground surface (BGS) interval and field screened with a PID for VOCs. None of the samples contained detectable VOC concentrations.

Groundwater Sampling

All temporary monitoring well samples were collected utilizing disposable polyethylene tubing and a peristaltic pump. Field GC analysis indicated VOCs in groundwater at TMW-2 and MCW-7. TMW-2 and MCW-7 were located on either side of the 500-gallon concrete holding tank located northeast of the Barn. No VOCs or metals were determined to exceed applicable criteria as discussed in Section 3.0 in other ground water sampled around the furniture-stripping barn, including the Barn Well that did have an exceedance of methylene chloride in 1994, or the partially buried waste pile. Groundwater flow was determined to be to the east, towards Torch Lake with a hydraulic gradient of 0.00046 foot/foot.

Historical references, analytical results, and observations documented during the implementation of the Limited Investigation will be incorporated into the SAP. Coordinates associated with the sampling locations were not provided; therefore, were approximated based on the information provided in the MDEQ Limited Investigation Report. The soil and groundwater locations and the associated analytical results are depicted on *Figure 3c, Soil Sample Location Map – Furniture Stripping Dollar Bay Site* and *Figure 5b, Groundwater Sample Location Map - Furniture Stripping Dollar Bay Site*.

Archaeological Survey Report of The Quincy Mining Company, Torch Lake Smelter & Reclamation Plant, At Mason Sands, Torch Lake EPA Superfund Site – May 2001

The MTU Department of Social Sciences Archeology Laboratory prepared the survey report of the QMCM to evaluate and document the cultural remains at the QMCM. The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) commissioned the report to comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, prior to capping the QMCM stamp sand deposits in Torch Lake as part of the U.S. EPA Superfund Site remediation. The survey concluded that the capping would have only a minor negative impact on the cultural and historical values of the QMCM.

Survey results will not be directly incorporated into the SAP, but will be taken into consideration if an IR is deemed necessary for the QMCM.

Final Report, PCB Study Using Semipermeable Membrane Devices (SPMD) in Torch Lake, Houghton County – March 2006

The MDEQ Water Bureau contracted Great Lakes Environmental Center, Inc. (GLEC) to conduct a contaminant concentration study using SPMDs in Torch Lake, Portage Lake, and the Keweenaw Waterway in Houghton County, and Huron Bay in Baraga County. The intent of the study was to collect data for comparison of PCB residues at the various sites to determine if Torch Lake was a source of PCBs.

The general purpose of the collection method is to provide a time-weighted exposure that is representative of chemical uptake through fish respiration. SPMD sample results do not provide for a direct comparison to surface water criteria, but are an indicator of contaminants in the water column. One advantage of SPMDs is that they isolate only the truly dissolved portion of these compounds from the water; the portion that is adsorbed to particulates, and therefore not bioavailable, is excluded. SPMDs mimic the transfer of dissolved compounds across biological membranes (e.g., gills), effectively concentrating them and allowing the detection of compounds that may be present at concentrations below the analytical method detection level in water samples. At constant temperature and flow velocity, the amount of a particular compound absorbed by an SPMD is linearly proportional to the dissolved concentration of the compound in the water (Booij et al. 2003). The utility of SPMDs for monitoring aqueous residues of PCBs, as well as other low to moderate molecular weight nonpolar organic environmental contaminants, has been repeatedly demonstrated.

SPMDs were deployed at 10 locations (Sites 1-10) in Torch Lake, Portage Lake, and the Keweenaw Waterway in Houghton County, and Huron Bay in Baraga County. SPMD location Site 5 was located within the QMCM. PCBs detected at Sites 2, 5, 7, 8, 9, and 10 were very similar in concentration, congener pattern, and number of congeners. Total PCB concentrations at these sites ranged from 22 to 26 micrograms per liter (µg/L) with nearly identical congeners being detected. Of the 13 to 16 congeners detected at these six sites, 12 were detected at all ten sites. Sites 2, 5, 7, 8, 9, and 10 were all located outside the main basin of Torch Lake.

- Site 2 was upstream of Torch Lake, in the Trap Rock River;
- Site 5 was in the southern basin of the lake, connected to the main basin by only a narrow strait, and partially fed by tributaries;
- Site 7 was located in Portage Lake;
- Sites 8 and 9 were in the Keweenaw waterway; and,
- Site 10 was in Lake Superior.

The MDEQ selected Sites 5 and 7 to determine whether the stamp sands or the old mill near Site 5, and the abandoned equipment near Site 7, were sources of PCBs; the results from this study suggest that there were not. Sites 8, 9, and 10 were chosen to demonstrate background levels of PCBs in the Keweenaw waterway and Lake Superior. The similarity of PCB results for these six sites suggests that PCBs at Sites 2, 5, and 7 were also at background levels.

In contrast, the remaining sites within Torch Lake (Sites 1, 3, 4, and 6) had elevated levels of PCBs, with the highest concentrations and the greatest number of congeners detected at Site 4. Sites 3 and 4 were selected because they were near potential PCB sources, which the results support. The fact that Site 1 (without stamp sands) had elevated levels of PCBs, and Site 5 (with stamp sands) had background levels of PCBs indicates that the stamp sands were not a source of PCBs. Site 6 was representative of the discharge from the lake. Overall, the results demonstrated that the surface water in the main basin of Torch Lake contains elevated levels of PCBs.

Analytical results from the SPMD study will not be directly incorporated into the SAP. The analytical results were evaluated and compared to the analytical results from the other studies summarized herein. The SPMD results confirm the presence of PCBs in surface waters; however, the study was inconclusive in identifying a specific PCB source within Torch Lake. Further, concentrations of PCBs measured in the SPMD samples were consistent with historical data; demonstrating higher concentrations of PCB congeners in Torch Lake. Analytical results for SPMD samples collected from Torch Lake are depicted on *Figure 8, SPMD and Fish Tissue Sampling Locations - QMCM.*

Summary Report for the Torch Lake Area Assessment, Torch Lake NPL Site and Surrounding Areas, Keweenaw Peninsula, Michigan – December 2007

In September 2007, the EPA, at the request of the MDEQ, conducted assessment activities near Torch Lake and Portage Lake. The focus of the assessment was on 17 Areas of Investigation (AOI) identified jointly by the EPA and the MDEQ impacted by historical copper mining operations in the Keweenaw Peninsula. The Torch Lake Area Assessment included portions of the Torch Lake NPL Site where stamp sands are the primary media of concern.

The primary project objectives of the Torch Lake Area Assessment were to evaluate imminent threats to human health, welfare and the environment, including the identification of areas for additional investigation. The geographical locations specific to Torch Lake, and pathways evaluated during the assessment were:

- Direct-contact hazards associated with exposed stamp sand and the potential presence of other mining-era related waste along the western shoreline of Torch Lake. At the time of the investigation, the evaluated area included recently exposed shoreline between the edge of the EPA-installed vegetative cover and the water's edge because of the significantly lower surface-water levels in Lake Superior and its contiguous water bodies. These previously shallow water areas had not been investigated; and,

- Limited evaluation of potential environmental concerns at abandoned mining-era related industrial buildings, ruins, and land areas proximal to the western shoreline of Torch Lake and Portage Lake.

Targeted AOIs relevant to the QMCM portion of the Torch Lake NS Site included in the Torch Lake Area Assessment included:

- AOI 10 – Mason Sands; and,

- AOI 18 – Building in Mason (also referenced as Quincy Stamp Mill No. 1).

A comprehensive assessment of all environmental hazards known to affect historical industrial properties and structures was not within the scope of the assessment; however, the EPA's report provided specific

recommendations by AOI for further investigation, maintenance, and or no further action. The following presents the general findings related to the aforementioned AOIs derived from the Torch Lake Area Assessment:

- AOI 10 – Mason Sands: Surface soil was screened with an XRF unit at 25 locations along the Torch Lake shoreline and 12 locations within the building ruins in the QMCM. Seven samples were collected and submitted for verification of metals concentrations and PCBs via laboratory analysis. XRF screening indicated metals concentrations greater than the MDEQ Residential Direct Contact Criteria (RDCC) along the Torch Lake shoreline and within the building ruins. The laboratory analysis confirmed the presence of metals in excess of RDCC. PCBs were not detected. No further action was recommended based on current land use.

- AOI 18 – Building in Mason: Approximately 50 ft of piping wrapped with potential ACM was located on the western interior of the building. Damaged pipe wrap was also present in piles on the floor along the western interior of the building. Roofing material expected to contain asbestos was observed on the second level of the building. No materials expected to contain elevated concentrations of metals were observed; therefore, no XRF screening was conducted. It was recommended that the MDEQ issue a due care letter to the property owner regarding the unrestricted access to the building and the potential presence of ACM.

The Torch Lake Area Assessment will be used to evaluate surface soil conditions that might be indicative of mining wastes. The assessment included a substantial number of surface soil screening results, recorded using an XRF hand held analyzer, within the QMC footprint. Soil sampling and soil screening locations derived from the QMCM during implementation of the Torch Lake Area Assessment are depicted on *Figure 3a, Soil Sample Location Map – Quincy Stamp Mills, Figure 3b, Soil Sample Location Map – Quincy Reclamation Plant*, and *Figures 4a-4d, Soil Screening Results Maps - QMCM*. The analytical data generated during the investigation will be used to evaluate the potential presence of terrestrial mining wastes that would be represented by elevated levels of inorganic contaminants.

PCB Concentrations in Walleye Collected from Torch Lake (Houghton County) and Lake Superior - June 2008

The EPA, in part because of elevated levels of PCBs in fish, currently lists Torch Lake, Houghton County, as a Great Lakes Area of Concern. The PCB concentrations in fish collected from Torch Lake have been consistently higher than in fish found in nearby surface water bodies. The Michigan Department of Community Health (MDCH) first issued a fish consumption advisory due to elevated levels of PCBs for Torch Lake fish in 1998.

The Torch Lake watershed contains elevated levels of PCBs, but the question remained as to whether the watershed is the cause of elevated concentrations in fish. It had been postulated that the elevated concentrations of PCBs in fish caught in Torch Lake might actually represent exposure to the contaminant in Lake Superior since PCBs are elevated in several species in Lake Superior, and there are no barriers to fish movement between the two water bodies. The elevated PCB concentration in Lake Superior fish is believed to be due primarily to atmospheric deposition.

Prior to this study, no walleye from Lake Superior near Torch Lake had been analyzed for chemical contamination. The goal of this study was to compare concentrations of total PCBs in walleye collected from Torch Lake (Houghton County) with concentrations in walleye collected from Portage Lake and Huron Bay, Lake Superior. The null hypothesis was that PCB concentrations within Torch Lake fish were no different from in fish collected from Portage Lake and nearby waters of Lake Superior. In general, the study included the following findings:

- The length ranges of walleye collected from all three locations were equivalent.

- Total PCB and lipid-normalized total PCB concentrations in Torch Lake walleye collected in 2007 were equivalent to the concentrations in walleye collected in 2000.

- Total PCB and lipid-normalized total PCB concentrations in walleye collected from Torch Lake were higher than concentrations in walleye collected from Huron Bay, and the data suggest that walleye from the two areas represent distinct groups.

- Total PCB concentrations in Portage Lake walleye appear similar to the concentrations in walleye collected from Huron Bay, but the comparisons are weak due to a small Portage Lake sample.

- The MDCH fish consumption guidelines for Torch Lake and Portage Lake walleye are unlikely to be relaxed based on the total PCB concentrations measured in the 2007 samples.

The higher total PCB concentrations and different congener composition in the Torch Lake walleye as compared to the Huron Bay walleye are consistent with the sediment and surface water studies indicating that there is a source of PCBs in the Torch Lake watershed. It seems likely that the walleye collected in Torch Lake are in the lake for extended periods of time and that the elevated concentrations of PCBs measured in those fish are a result of sources within the Torch Lake watershed over and above atmospheric inputs.

Analytical results from the fish tissue study will not be directly incorporated into the SAP. However, the offshore sampling program will be positioned to evaluate environmental conditions along the lake bottom and shoreline of Torch Lake to determine whether contributing sources of PCB contamination may be present. Analytical results for SPMD samples collected from Torch Lake and the time-series results for total PCBs in walleye are depicted on *Figure 8, SPMD and Fish Tissue Sampling Locations - QMCM.*

United States Environmental Protection Agency, Region V, Pollution Report, Mason Sand Removal – December 12, 2008.

During the Torch Lake Area Assessment, exposed stamp sands that contained elevated arsenic and drums that contained residual waste were identified in the Mason Sands (AOI 10). At the request of the MDEQ, EPA's ERB mobilized to the site on 17 November 2008 and removed approximately 30 tons of arsenic contaminated soil and 10 drums containing residual waste. The contaminated soils removal area was backfilled with clean fill. Prior to backfill, U.S. EPA's FIELDS team conducted XRF screening at the base of the excavation and all arsenic levels were <5 milligrams/kilogram (mg/kg). Laboratory confirmation samples showed the highest level remaining before backfill was 1.6 mg/kg. Final disposal occurred on 11 December 2008 with shipment of the wastes to Delta Solid Waste Management Authority.

The approximate area of contaminated soil and drum removal, depicted on *Figure 2, Area Features Map - QMCM,* will be considered in locating sampling locations during SAP development.

Aroclor Sediment Investigation Torch Lake Area of Concern, Houghton County, Michigan – GLNPO - 2009

The objective of this study was to evaluate surficial sediments throughout Torch Lake to determine if there are areas of higher PCB concentrations that might indicate a terrestrial and/or aquatic source of PCBs. The report summarizes the results of the 2008 sediment-sampling event and provides some context for those results. In addition, the data evaluation presented incorporated the results of the 2007 sampling efforts completed by the MDEQ and the EPA GLNPO.

Between 26 and 28 August 2008, eighty surficial sediment samples, along with nine duplicate samples were collected. All sample locations were randomly selected prior to mobilization of the EPA's research vessel, *Mudpuppy,* to the lake. The locations were reviewed and discussed with both MDEQ and the Torch Lake Public Advisory Council (TLPAC).

Of the eighty-nine samples collected and analyzed, only two had detectable concentrations of PCBs, sample TL08-75 (90 micrograms per kilogram [µg/kg]) and TL08-76 (26 µg/kg). Both TL08-75 and TL08-76 were located within

CHLL and were near the samples collected in 2007 that had detectable concentrations of PCBs in the top 1-2 inches of sediment. The 2007 data from this area ranged from a low of 130 µg/kg to 1,100 µg/kg (MDEQ 2008a). The 2007 sampling event did identify subsurface concentrations of PCBs ranging from 180 µg/kg to 8,900 µg/kg in samples ranging from 6 inches to 64 inches below the sediment surface. Combining the two data sets results in a detectable range of PCB concentrations in surficial sediments from a low of 26 µg/kg to a high of 1,100 µg/kg.

Sediment analytical results summarized in this document were used to establish baseline conditions in the sediment of Torch Lake. The objective of the investigation, determining whether areas of elevated PCB concentrations may indicate a terrestrial and/or aquatic source of PCBs, tied directly to the objectives of the QMCM investigative activities. The conclusions derived from the report supported the development of both terrestrial and offshore investigative locations. Sample locations and contaminant concentrations, depicted on *Figure 6, Surface Water and Sediment Sample Location Map - QMCM,* will be used to evaluate the presence of existing contamination and determine where data gaps may be present. In addition, land use was also considered to determine where potential unidentified terrestrial sources of contamination may be present or where potential exposure risks were greatest.

The resulting offshore sampling program will be developed to minimize the duplication of previous investigative activities, while also providing results that contribute to a comprehensive understanding of waste and contaminant distribution along the lake bottom.

Quincy Mining Facilities on Torch Lake, Narratives and Supporting Documents, Part 1, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties, Task 3: Historical Archive Research & Mapping – February 2015

Quincy Mining Facilities on Torch Lake, Maps and Blueprints, Part 2, Phase 3: Building Narratives, Maps, and Documentation Torch Lake Industrial Waterfront, From Mason/Quincy Property to Torch Lake South End (Quincy historic properties, Task 3: Historical Archive Research & Mapping – February 2015

MTU Department of Social Sciences staff prepared these documents for the MDEQ. Divided into two parts, these reports document the facilities present along the southern and western end of the Torch Lake industrial milling and reclamation district that supported the QMC. Part 1 covers the historical and archival research completed on QMC milling and reclamation activity. Part 2 provides the geo-referenced Google and GIS maps and the historical maps and blueprints that document and geo-reference the location of each facility. Completed during fall 2014, research draws upon the business archives, photos, maps, blueprints, and drawings of the QMC at MTU Archives and the Keweenaw National Historical Park (KNHP) Archives.

These references to historical structures and operations will be incorporated into the SAP, allowing the investigation to target specific operations and potential contaminant sources, minimizing the amount of approximation needed to locate a given structure. The main QMC buildings are depicted on *Figure 2, Area Features Map - QMCM.* Additional buildings and features identified by MTU are shown on subsequent figures.

Site Inspection Report for Quincy Mason Operations, M-26, Along the Torch Lake Shoreline, Osceola Township, Michigan 49913, U.S. EPA ID NO.:MK000510939-April 2, 2015

Under the authority of a cooperative agreement between the MDEQ and the EPA, the MDEQ's Pre-Remedial Group conducted assessment activities in the QMCM in September 2013. The MDEQ completed the assessment activities under an approved work plan dated 14 August 2013. The Site Inspection (SI) fieldwork was completed between 9 and 12 September 2013. The findings documented in a report prepared by the MDEQ details the completed investigative activities, analytical findings, and demographics for the QMCM.

The investigation was prompted by historical findings documenting that source areas exist and releases to the environment have occurred at the properties within the QMCM. The MDEQ concluded that the results from historical investigations demonstrated that soil and groundwater contamination pose risks to the surface waters of Torch Lake.

The scope and objectives of the SI were designed to meet the investigative requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (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. The performance of the SI included interviews with local residents; reconnaissance inspections of the properties; installation of temporary groundwater monitoring wells; collection of soil, groundwater, surface water, and sediment samples; and documentation of Site conditions. Four migration pathways of concern were discussed in the report and included groundwater, surface water, soil, and air.

Soil

Analysis of the surficial soil samples revealed the presence of VOCs, semi-VOCs (SVOCs), pesticides, PCBs, and inorganic analytes. Analysis of the soil boring samples revealed the presence of VOCs, SVOCs, pesticides, and inorganic analytes. The MDEQ concluded that all the samples collected during the SI contained contaminants at high enough concentrations to be considered observed releases. The MDEQ utilized an XRF to screen waste and surface soils during the implementation of the SI. XRF screening documented many areas where inorganic contaminant concentrations exceeded applicable criteria. XRF screening results were not used to determine observed releases as are the soil samples that were analyzed at the laboratories. Instead, the XRF screening results were compared to appropriate direct contact criteria to aid in the determination of the extent of surficial soil contamination.

The MDEQ concluded that this contamination in surficial soils pose a direct contact risk.

Groundwater

Analysis of the groundwater monitoring well samples revealed the presence of inorganic compounds at high enough concentrations to be considered observed releases, and exceeded appropriate drinking water criteria. One groundwater sample also contained SVOCs and pesticides. The MDEQ concluded that this contamination in the groundwater is attributable to the QMCM because contaminants were detected in high concentrations in contaminated soils and source areas, and that there is the potential for continued migration of contaminants to groundwater.

Surface Water and Sediment

Analysis of the surface water and sediment samples revealed the presence of inorganic compounds at high enough concentrations to be considered observed releases. The MDEQ determined that contaminants are likely entering surface water bodies from contaminated soil and waste areas running off and/or leaching through coarse-grained soils into groundwater, and discharging to the lake. The ground surface topography is sloped steeply towards Torch Lake and this causes the groundwater gradient to be sloped similarly towards the lake. In addition, the MDEQ noted that past operations at the QMCM 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.

Air

A release of potential contaminants to the air was not documented during the investigation of the Site; however, the MDEQ believes that potential releases to air exist. Significant surface waste and soil contamination have been documented making the surface soil subject to wind erosion potentially allowing particulates to become airborne and respirable.

Asbestos

Analysis of SACM revealed the presence of asbestos (15 percent chrysotile).

Wastes

Analysis of waste samples revealed the presence of SVOCs and inorganic compounds.

Geophysics

A ground penetrating radar (GPR) survey in a suspect area near the Reclamation Plant did not review any anomalies and as a result, USTs have been ruled out.

The SI findings will be incorporated into the sample design. Sample locations, screening locations, and contaminant concentrations are depicted on: *Figure 3a, Soil Sampling Location Map – Quincy Stamp Mills, Figure 3b, Soil Sampling Location Map – Quincy Reclamation Plant; Figure 4b, Soil Screening Results Map – QMCM North Central; Figure 4c, Soil Screening Results Map – QMCM South Central; Figure 5a, Groundwater Sampling Location Map – Quincy Stamp Mills and Reclamation Plant; Figure 6, Surface Water and Sediment Sample Location Map - QMCM; Soil Screening Results Map - QMCM; and, Figure 7, Asbestos and Waste Sample Location Map - QMCM* will be used to evaluate the presence of existing contamination and determine where data gaps may be present.

Staff Report, Status of Fish Contaminant Levels in the Torch Lake Area of Concern 2013 – January 2016

The MDEQ WRD and Michigan Department of Health and Human Services (MDHHS) (formerly MDCH) continue to monitor fish contaminant levels in Torch Lake and from two Lake Superior reference sites to allow comparisons of key contaminant concentrations between sites as well as temporal trend evaluations. This report provides an update of the status of contaminant concentrations using fish samples collected in 2013 from Torch Lake and from two Lake Superior reference sites. The study concluded that "Overall, the evidence indicates that total PCB concentrations in Torch Lake fish remain elevated compared to other water bodies in northern Michigan, even though levels have declined since monitoring began in 1988. Mercury concentrations in Torch Lake fish have not declined since monitoring began in 1988 and may have increased over that time; however, mercury levels are lower than in fish from other Upper Peninsula inland lakes." The report also projected anticipated continued fish consumption guidelines for Total PCBs and mercury.

Analytical results from the fish tissue study will not be directly incorporated into the SAP; however, the offshore sampling program will be positioned to further evaluate environmental conditions along the lake bottom and shoreline of Torch Lake to determine whether contributing sources of PCB contamination may be present. Analytical results for SPMD samples collected from Torch Lake and the time-series results for total PCBs in walleye are depicted on *Figure 8, SPMD and Fish Tissue Sampling Locations - QMCM*.

ROV Videos for Torch Lake within the QMCM – July 2016

The MDEQ RRD GSU conducted a side scan sonar (SSS) survey to identify anomalies such as submerged drums, containers, and waste deposits on the bottom of Torch Lake in the QMCM. MDEQ RRD GSU subsequently used an ROV to visually confirm the anomalous observations. The MDEQ RRD reviewed the ROV videos and observations were recorded along with their GPS coordinates. These observations will be incorporated into the SAP, allowing the investigation to target specific potential surface water and sediment contaminant sources within Torch Lake.

ROV video findings will be incorporated into the SAP by positioning the offshore sampling program to evaluate environmental conditions along the lake bottom and shoreline of Torch Lake to determine whether contributing sources of PCB contamination may be present because of observed abandoned containers and/or waste deposits.

Locations of observed abandoned containers and/or waste deposits are depicted on *Figure 9, ROV Video Observation Location Map July 2016 - QMCM*.

Preliminary Reconnaissance Observations for QMCM – 24 October 2016

The objective of the preliminary reconnaissance was to locate and inventory structures and similar surficial artifacts associated with the mining era industrial operations. Potential physical and health hazards were preliminarily documented, photographed, and located with a GPS unit. On 24 October 2016, a field team comprised of MSG, MDEQ RRD, and MTU personnel performed reconnaissance activities at the properties in the QMCM where written access was granted to the MDEQ. The following provides a summary of the relevant findings associated with the reconnaissance activities.

QMCM – Preliminary Reconnaissance Summary	
Potential Chemical or Physical Hazards	Recorded Observations
Suspect Asbestos Containing Material (SACM)	Suspect thermal insulation was observed on steam piping in a vault adjacent to the east side of Quincy Stamp Mill No. 1 and the ground at Quincy Stamp Mill No. 2. Asphaltic roofing material was observed at several locations including on the east side of the concrete coal bin at Quincy Boiler House No. 1 and on remnant wood structures and on the ground near the former Coal Shed. Other SACM was observed mixed in with household debris near the Drum Removal Area. Near the former Turbine (Power) House, a piece of countertop was also SACM.
Residual Process Materials	At Quincy Stamp Mill No. 1, residual process materials in the form of suspect tailings and stamp sand were observed to be widespread across the footprint. At the Quincy Stamp Mill No. 2 location, residual process materials in the form of suspect tailings were observed within the building footprint.
Potentially Abandoned Containers	Several mining era containers were observed during the inspection of the properties including crushed or otherwise compromised drums on the hillside south of Quincy Stamp Mill No 1, at Quincy Boiler House No. 1, Quincy Boiler House No. 2, and near the Drum Removal Area. More modern-era containers were also observed near the Drum Removal Area including an empty 5-gallon can and numerous paint cans.
Soil Staining/Stressed Vegetation	No barren or stressed areas of the ground surface were documented on the inspected properties except for the eroding railroad embankment constructed of mine rock and stamp sand between Quincy Stamp Mill No. 1 and the Turbine (Power) House.
Potential Polychlorinated Biphenyl (PCB) or Mercury Containing Equipment	No potential PCB or mercury containing equipment was observed on the inspected properties.
Other: Household Waste and Debris	Bottles, cans, and similar household debris were observed on the ground surface near the Drum Removal Area in what appeared to be a former small dumping area.

Numerous significant hazards were identified in the QMC during the preliminary reconnaissance activities. The inventoried hazards will be qualitatively assessed for potential human health and environmental risks to determine if analytical sampling should be incorporated into the SAP. The properties contain remnants of abandoned mining-era structures. The majority of the property east of Highway M-26 has been capped during previous remedial activities, including both capped and vegetated areas out to the shoreline as well as a graded strip with gravel cover to provide a roadway that parallels M-26 inside the perimeter fence line. The property west of Highway M-26, however, has not been improved since the mining era and features widespread disposition of tailings and stamp sand within and proximal to the stamp mill ruins and widespread debris. Other items of concern include abandoned drums, most of which appeared to be rusting carcasses, that are present in a number of areas across the properties. In particular, a number of abandoned containers were observed near the former Drum Removal area adjacent to what appeared to be a small former dumping area for household debris. Quincy Creek flows through the ruins, discharging to Torch Lake, and erosion channels to the creek were observed from Quincy Stamp Mill No. 1 and the neighboring eroding railroad embankment constructed of mine rock and stamp sand. In addition, several locations feature structural voids in foundations and floors at or above grade in mining era building footprints, including a vault on the east side of Quincy Stamp Mill No. 1 containing SACM wrapped piping inside a tunnel leading beneath Highway M-26. The above ground casing of Mason Well No. 2 was observed near the Quincy Reclamation Plant ruins. According to DEQ's Wellogic the well is a Type I public well that is owned by the Village of Mason. Wellogic also indicates that Mason Well No. 1 is located near the Quincy Reclamation Plant ruins but it was not observed during the preliminary reconnaissance. It is unknown if these wells are currently in service.

Preliminary reconnaissance findings will be incorporated into the sample design. Preliminary reconnaissance observation locations and descriptions are depicted on *Figure 10, Preliminary Reconnaissance Observations - QMCM,* will be used to evaluate the presence of existing contamination and determine where data gaps may be present.

Baseline Environmental Assessment Conducted Pursuant to Section 20126(1) (c) 1994 PA451, Part 201, as amended and the rules promulgated thereunder for Mason Sands, Houghton County, Michigan – January 2017.

To support a property transaction related to approximately 193 acres of the Mason Sands (large in lake stamp sand deposit within the QMCM) UPEA conducted environmental site assessment activities. A Phase I Environmental Site Assessment (ESA) identified Recognized Environmental Conditions related to stamps sands on the subject property, and surrounding Part 201 sites. A Phase II ESA confirmed the presence of environmental contamination related to the presence of stamp sands. Subsequently a Baseline Environmental Assessment (BEA) was prepared to support a property transaction. The Portage Lake Water and Sewer Authority, the new property owner, intends to use the land for placement of biosolids from the Houghton-Hancock Wastewater Treatment Plant.

In a collaborative effort, UPEA provided the DEQ with the Phase II ESA soil and groundwater analytical data, sample coordinates, and boring logs for review and inclusion in the Project database. The following provides a summary of the results.

Soil Sampling

UPEA collected 10 stamp sand samples from 10 soil borings on 30 November and 1 December 2016.The stamp sands samples were collected from beneath the EPA-installed cap via a hollow steam auger drill rig and split spoon sampler. Only one soil sample had a contaminant concentration that exceeded applicable Part 201 Generic Residential Cleanup Criteria. The soil sample had a methylene chloride concentration that exceeded Part 201 Generic Residential and Non-Residential Drinking Water Protection Cleanup Criteria (DWPC) as discussed in Section 3.0. The BEA author, based on the laboratory data package case narrative, concluded that the methylene chloride, a common lab cleaner and solvent, was detected because of laboratory error and was not representative of actual soil conditions.

Groundwater Sampling

UPEA collected nine groundwater samples from temporary monitoring wells installed at nine of the 10 soil boring locations on 30 November and 1 December 2016. The groundwater samples were collected via a 1-inch diameter, 5-foot screen temporary monitoring well installed with a hollow steam auger drill rig. No groundwater samples had contaminants that exceeded applicable Part 201 Generic Cleanup Criteria as discussed in Section 3.0.

The BEA concluded that the Mason Sands area is a Facility as defined under Section 20101(1) (o) of Part 201 of the NREPA based on the analytical results for the soil and groundwater samples that indicated the presence of hazardous substances in concentrations that exceeded the MDEQ Groundwater Surface Interface Criteria (GSIC), GSIC Protection Criteria, and drinking water criteria.

The Phase II ESA findings will be incorporated into the sample design. The stamp sand and groundwater sampling locations and the associated analytical results, depicted on *Figure 3d, Soil Sample Location Map – Quincy Stamp Sands* and *Figure 5c, Groundwater Sample Location Map – Quincy Stamp Sands,* will be used to evaluate the presence of existing contamination and determine where data gaps may be present.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The evaluation and interpretation of analytical results and findings from previous key investigations was completed to create a baseline understanding of conditions within the QMCM. The incorporation of these findings into the SAP will minimize redundancies while also creating a more comprehensive approach for assessing potential environmental impacts across the QMCM.

6.1 Conclusions

The QMC portion of the QMCM features EPA-capped and unmitigated mining area structures and waste in a mixed residential/non-residential area near Mason. The FSDB portion of the QMCM is located in a residential area. The contaminants attributable to the QMCM include VOCs, SVOCs, PCBs, inorganic contaminants, and asbestos. Concerns at Torch Lake and the surrounding areas, identified by the MDEQ and others, include known or suspected impacts to groundwater, surface water, sediments, and upland media that were not addressed under the Superfund program. Furthermore, the analytical and screening results indicate that inorganic contaminants are present in environmental media in excess of Part 201 of Michigan's NREPA, being PA 451 of 1994, as amended Residential and Non-Residential Cleanup Criteria for Response Activity in the QMC portion of the QMCM. Contaminants of concern were not detected in concentrations exceeding applicable criteria during the most recent sampling at the FSDB portion of the QMCM.

6.2 Recommendations

It is recommended that the review and evaluation of the summarized reports be used in the preparation of a SAP that builds upon existing analytical results and focuses on potential environmental impacts, including the following:

- Unidentified, significant in-lake and/or terrestrial sources of contamination including PCBs;
- Uncharacterized waste deposits on the lake bottom;
- Bulk disposal areas, including stamp sand deposits, slag dumps, and landfills; and,
- Industrial ruins including coal storage areas, USTs, SACM, and any other waste materials identified in future investigations.

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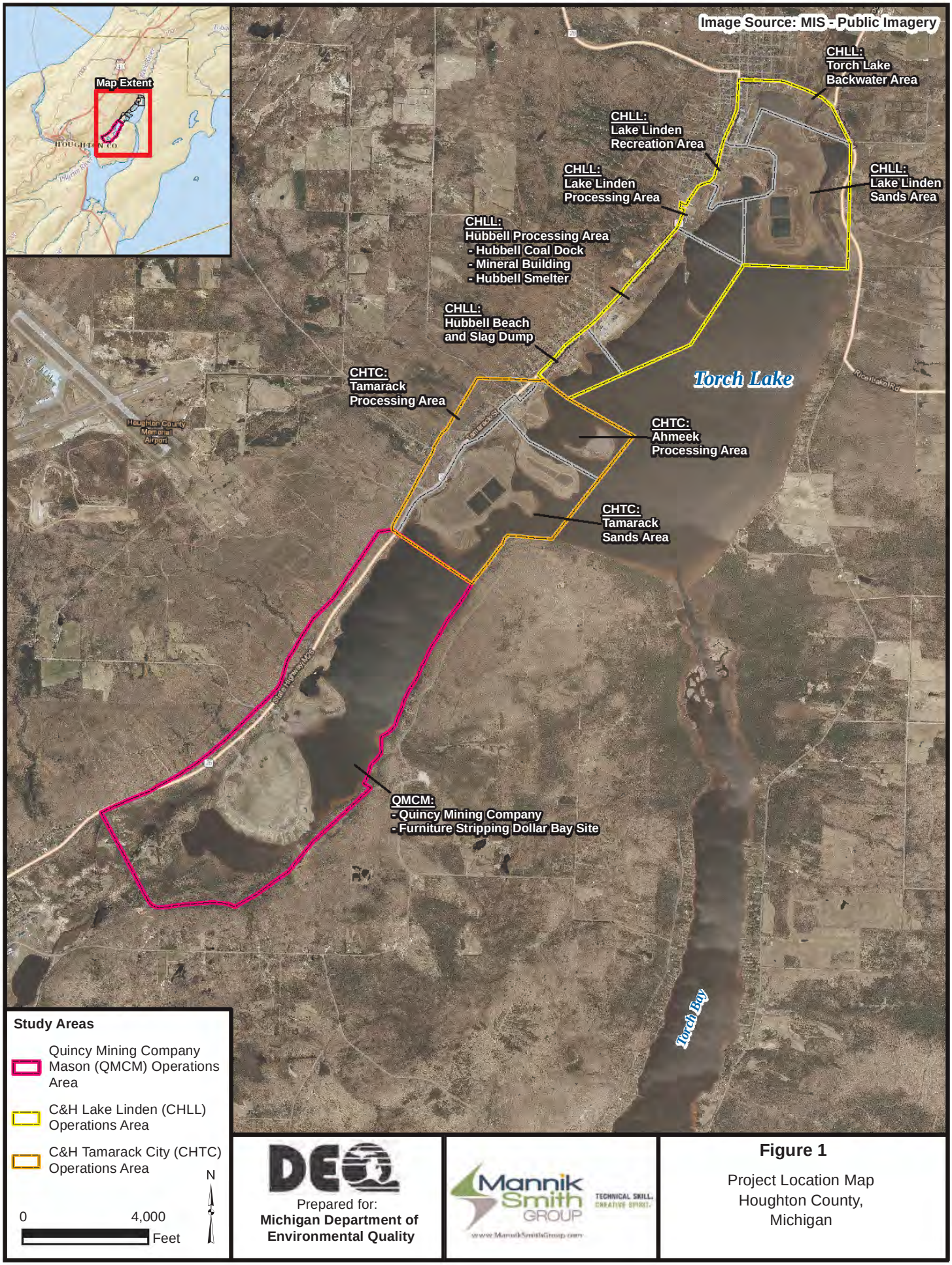
FIGURES



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Prepared for:
Michigan Department of Environmental Quality

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Figure 1

Project Location Map
Houghton County,
Michigan

Image Source: ESRI World Imagery (NAIP 2014)

QUINCY MINING COMPANY (QMC) AREA

Quincy Stamp Mill No 2
Quincy Boiler No 2
Drum Removal (EPA 2008)
Quincy Turbine (Power) House
Quincy Stamp Mill No 1
Arsenic Removal (EPA 2008)
Quincy Coal Shed and Dock
Quincy Boiler No 1
Quincy Regrinding Plant
Quincy Shore Plant

0 800 Feet
Coordinate System: MIGeoRef(m)

FURNITURE STRIPPING DOLLAR BAY SITE (FSDB) AREA

Barn Floor Drain
Brown House
White House
Barn
Residential Well
Mobile Home
Junk Pile
House
Partially Buried Waste
Junk Pile

0 250 Feet
Coordinate System: MIGeoRef(m)

Map Extent

Houghton County Memorial Airport
Junction Rd
Bunker Hill St
State Highway M26
Flood Wood Trl
Forsman Rd
Nightingale Dr
Woodside Ln
Barfield Ave
Avenue G
Avenue D
Elm Ave
Pointe Shores Rd

- Mining Era Buildings and Structures
- Building Outline (from MDEQ CAD)
- Debris / Junk Piles (from MDEQ CAD)
- Cap Boundary (2005 NRCS)
- QMCM Study Area Boundary

Mining Era Buildings and Structures from:
- *Michigan Technological University Archive Research Phase 3 Report*

N
0 1,500 Ft
Coordinate System: MIGeoRef(m)

Prepared for:
Michigan Department of Environmental Quality

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Figure 2
Area Features Map
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0007\GIS\mxds\2017_QMCM_Data_TM\Fig_02_QMCM_Area_Features_Map_v2017022\1.mxd 1:23:35 PM 2/21/2017 KBrown

Image Source: MIS - Public Imagery

SS-13 9/12/2013

(0-6")

CYANIDE	0.13 J	mg/kg [2]
2-METHYLNAPHTHALENE (SVOC)	4400	ug/kg [2]
ACENAPHTHYLENE	20000	ug/kg [4,11]
ACENAPHTHYLENE#	15000 J	ug/kg [4]
BENZO(A)ANTHRACENE	130000 J	ug/kg [10,17]
BENZO(A)ANTHRACENE#	120000	ug/kg [10,17]
BENZO(A)PYRENE	120000 J	ug/kg [10,17]
BENZO(A)PYRENE#	110000	ug/kg [10,17]
BENZO(B)FLUORANTHENE	170000 J	ug/kg [10,17]
BENZO(B)FLUORANTHENE#	150000	ug/kg [10,17]
CARBAZOLE	18000	ug/kg [2,4]
CARBAZOLE#	16000 J	ug/kg [2,4]
DIBENZO(A,H)ANTHRACENE	23000	ug/kg [10,17]
DIBENZO(A,H)ANTHRACENE#	20000 J	ug/kg [10,17]
DIBENZOFURAN	8300	ug/kg [2]
FLUORANTHENE	320000 J	ug/kg [2]
FLUORANTHENE#	290000	ug/kg [2]
FLUORENE	12000	ug/kg [2]
FLUORENE#	11000 J	ug/kg [2]
INDENO(1,2,3-CD)PYRENE	72000 J	ug/kg [10]
INDENO(1,2,3-CD)PYRENE#	64000	ug/kg [10]
NAPHTHALENE (SVOC)	8600	ug/kg [2]
NAPHTHALENE (SVOC)#	8300 J	ug/kg [2]
PHENANTHRENE	180000 J	ug/kg [2,4,6,7,8,11]
PHENANTHRENE#	170000	ug/kg [2,4,6,7,8,11]

(4")

NAPHTHALENE (VOC)	1100	ug/kg [2]

SS-08 9/11/2013

(0-8")

CYANIDE	0.19 J	mg/kg [2]
ARSENIC	14	mg/kg [10]
LEAD	777	mg/kg [10]
BENZO(A)PYRENE	5500	ug/kg [10]
FLUORANTHENE	15000	ug/kg [2]
PHENANTHRENE	17000	ug/kg [2]

(6")

1,2,4-TRIMETHYLBENZENE	1100 J	ug/kg [2]
BENZENE	290 J	ug/kg [2,4,11]
XYLENE - TOTAL	3600 J	ug/kg [2]
NAPHTHALENE (VOC)	2900 J	ug/kg [2]

SS-10 9/12/2013

(0-4")

LEAD	501	mg/kg [10]

SS-09 9/12/2013

(0-6")

CYANIDE	0.22 J	mg/kg [2]
LEAD	869	mg/kg [10]

SS-06 9/11/2013

(0-6")

ARSENIC	81.8	mg/kg [10,17]

SS-14 (0-6") 9/12/2013

SB-05 (48-60") 9/11/2013

SB-08 (48-60") 9/10/2013

TM-S1-02 (surface) 9/12/2007

SS-16 (0-10") 9/11/2013

SS-11 (0-8") 9/11/2013

SB-12 (48-60") 9/11/2013

SB-13 (20-32") 9/11/2013

SB-06 (26-38") 9/11/2013

TM-S2-02 (surface) 9/12/2007

SS-12 9/12/2013

(0-3")

CYANIDE	0.19 J	mg/kg [2]
LEAD	417	mg/kg [10]
ACENAPHTHYLENE	7400	ug/kg [4]
ACENAPHTHYLENE#	7900 J	ug/kg [4]
BENZO(A)ANTHRACENE	46000 J	ug/kg [10]
BENZO(A)ANTHRACENE#	53000	ug/kg [10]
BENZO(A)PYRENE	39000 J	ug/kg [10,17]
BENZO(A)PYRENE#	41000	ug/kg [10,17]
BENZO(B)FLUORANTHENE	51000 J	ug/kg [10]
BENZO(B)FLUORANTHENE#	61000	ug/kg [10]
CARBAZOLE	6100	ug/kg [2]
CARBAZOLE#	6400 J	ug/kg [2]
DIBENZO(A,H)ANTHRACENE	8500	ug/kg [10,17]
DIBENZO(A,H)ANTHRACENE#	7300 J	ug/kg [10]
DIBENZOFURAN	3700	ug/kg [2]
DIBENZOFURAN#	4000 J	ug/kg [2]
FLUORANTHENE	110000 J	ug/kg [2]
FLUORANTHENE#	130000	ug/kg [2]
FLUORENE	6400	ug/kg [2]
FLUORENE#	7000 J	ug/kg [2]
INDENO(1,2,3-CD)PYRENE	27000	ug/kg [10]
INDENO(1,2,3-CD)PYRENE#	23000	ug/kg [10]
NAPHTHALENE (SVOC)	4000	ug/kg [2]
NAPHTHALENE (SVOC)#	4500 J	ug/kg [2]
PHENANTHRENE	70000 J	ug/kg [2,4]
PHENANTHRENE#	70000	ug/kg [2,4]

(2")

NAPHTHALENE (VOC)	1800	ug/kg [2]

SS-15 9/11/2013

(0-6")

CYANIDE	0.3 J	mg/kg [2]
ARSENIC	9	mg/kg [10]

MasonB-6 9/6/2007

(surface)

LEAD	1100	mg/kg [10,17]

TM-S1-05 9/12/2007

(surface)

ARSENIC	9.8	mg/kg [10]
LEAD	530	mg/kg [10]

SB-14 9/11/2013

(21-33")

CYANIDE	1.8	mg/kg [2]

SB-07 9/10/2013

(48-60")

CYANIDE	0.33 J	mg/kg [2]
ARSENIC	7.9	mg/kg [10]
2-METHYLNAPHTHALENE (SVOC)	5000	ug/kg [2]
2-METHYLNAPHTHALENE (SVOC)#	4900 J	ug/kg [2]
ACENAPHTHENE	9200	ug/kg [2]
ACENAPHTHENE#	9500 J	ug/kg [2]
BENZO(A)ANTHRACENE	57000 J	ug/kg [10]
BENZO(A)ANTHRACENE#	52000	ug/kg [10]
BENZO(A)PYRENE	37000 J	ug/kg [10,17]
BENZO(A)PYRENE#	34000	ug/kg [10,17]
BENZO(B)FLUORANTHENE	41000 J	ug/kg [10]
BENZO(B)FLUORANTHENE#	36000	ug/kg [10]
DIBENZO(A,H)ANTHRACENE	6600	ug/kg [10]
DIBENZO(A,H)ANTHRACENE#	5300 J	ug/kg [10]
FLUORANTHENE	94000 J	ug/kg [2]
FLUORANTHENE#	87000	ug/kg [2]
FLUORENE	10000	ug/kg [2]
FLUORENE#	9500 J	ug/kg [2]
NAPHTHALENE (SVOC)	3400	ug/kg [2]
NAPHTHALENE (SVOC)#	3700 J	ug/kg [2]
PHENANTHRENE	140000 J	ug/kg [2,4]
PHENANTHRENE#	120000	ug/kg [2,4]

SS-07 9/11/2013

(0-3")

ARSENIC	8.2	mg/kg [10]
BENZO(A)PYRENE	2100	ug/kg [10]
PHENANTHRENE	4500	ug/kg [2]

(3")

1,2,4-TRIMETHYLBENZENE	740	ug/kg [2]
BENZENE	1700	ug/kg [2,4,5,11]
ETHYLBENZENE	380	ug/kg [2]
XYLENE - TOTAL	4000	ug/kg [2]
NAPHTHALENE (VOC)	1300	ug/kg [2]

Quincy Creek

Map Extent

Houghton County Memorial Airport

Torch Lake

Osceola Twp

Dollar Bay

Torch Lake Twp

MTU Identified Mining Era Buildings and Structures

1. Quincy Stamp Mill No. 1
2. Quincy Stamp Mill No.1 - Washing/Classifying Floor
3. Quincy Stamp Mill No. 1 - Rock Bin
4. Quincy Stamp Mill No.1 - Mineral House
5. Quincy Stamp Mill No. 2
6. Quincy Stamp Mill No.2 - Washing/Classifying Floor
7. Quincy Stamp Mill No. 2 - Rock Bin
8. Quincy Pump House No. 1
9. Quincy Boiler House No. 1
10. Chimney
11. Store House
12. Concrete coal bin
13. Concrete chimney
14. Stone base
15. Quincy Pump House No. 2
16. Quincy Boiler House No. 2
17. Coal Shed
18. Quincy Coal Shed Dock
19. Quincy Dock
20. Quincy Carpenter
21. Blacksmith
22. Quincy Turbine (Power) House
23. Oil House - Underground
24. Quincy Boarding
25. Store House
26. Lumber
27. Assayers Laboratory
28. Quincy Dredge No. 1
29. Quincy Dredge No. 2

Site Features from MDEQ 2015 Site Inspection Report

A. Former Foundation (Quincy Booster Pump Station)
B. Drum Removal Area
C. Brick Building Remains
D. Drum Removal Area
E. Arsenic Removal Area
F. Brick Foundation
G. Smokestack

Soil sample location with at least one exceedance

Soil sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures

QMCM Study Area Boundary

Notes:

- *J = estimated value*
- *mg/kg = milligrams per kilogram*
- *ug/kg = micrograms per kilogram*
- *# = result is from dilution run*
- *Sample depths shown in inches below ground surface.*
- *All 2013 samples were analyzed for metals, PCBs, SVOCs, VOCs, and pesticides except SS-18 which was analyzed for PCBs and SVOCs only*
- *All 2007 samples were analyzed for metals and PCBs*

N

0 400 Ft

Coordinate System: MIGeoRef(m)

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Statewide Default Background Level
[2]*=Groundwater Surface Water Interface Protection Criteria
[3]=Soil Saturation Concentration Screening Levels
[4]*=Residential Drinking Water Protection Criteria
[5]=Residential Soil Volatilization to Indoor Air Inhalation Criteria (VSIC)
[6]=Residential Infinite Source Volatile Soil Inhalation Criteria
[7]=Residential Finite VSIC for 5 Meter Source Thickness
[8]=Residential Finite VSIC for 2 Meter Source Thickness
[9]=Residential Particulate Soil Inhalation Criteria
[10]=Residential Direct Contact Criteria
[11]*=Nonresidential Drinking Water Protection Criteria
[12]=Nonresidential Soil Volatilization to Indoor Air Inhalation
[13]=Nonresidential Infinite Source Volatile Soil Inhalation Criteria
[14]=Nonresidential Finite VSIC for 5 Meter Source Thickness
[15]=Nonresidential Finite VSIC for 2 Meter Source Thickness
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
[18]=Hazardous Waste Toxicity Screening Value
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only

Prepared for:
Michigan Department of Environmental Quality

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Figure 3a

Soil Sample Location Map - Quincy Stamp Mills
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0007\GIS\mxds\2017_QMCM_Data_TMEin_03a_QMCM_Soil_QStampMill_v20170221.mxd 1:24:22 PM 2/21/2017 KBrown

Image Source: MIS - Public Imagery

SS-01 9/10/2013
(0-10")
CYANIDE 0.26 J mg/kg [2]

SS-18 9/11/2013
(1-5")
TOTAL PCBS 6900 ug/kg [10,17]

SB-01 (54-55)
9/10/2013

SB-10 (48-60")
9/10/2013

SB-02 (55-76")
9/10/2013

SS-17 (0-8")
9/10/2013

SS-04 (0-8")
9/10/2013

SS-05 (0-6")
9/10/2013

SB-09 (29-41")
9/10/2013

MS-S1-13 9/12/2007
(surface)
ARSENIC 8.6 mg/kg [10]

MS-S1-12 (surface)
9/12/2007

SB-11 (26-38")
9/10/2013

SS-03 9/10/2013
(0-2")

CYANIDE	0.37 J mg/kg [2]
CYANIDE (DUP)	0.37 J mg/kg [2]
ARSENIC	11.6 mg/kg [10]
ARSENIC (DUP)	11.7 mg/kg [10]
COPPER	23200 mg/kg [10]
COPPER (DUP)	23300 mg/kg [10]
LEAD	1410 mg/kg [10,17]
LEAD (DUP)	1440 mg/kg [10,17]

SS-02 9/10/2013
(0-6")
COPPER (DUP) 31700 mg/kg [10]

SB-03 (68-89")
9/10/2013

MasonB-10 (surface)
9/6/2007

SB-04 (28-35")
9/10/2013

MTU Identified Mining Era Buildings and Structures
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Statewide Default Background Level
[2]*=Groundwater Surface Water Interface Protection Criteria
[3]=Soil Saturation Concentration Screening Levels
[4]*=Residential Drinking Water Protection Criteria
[5]=Residential Soil Volatilization to Indoor Air Inhalation Criteria (VSIC)
[6]=Residential Infinite Source Volatile Soil Inhalation Criteria
[7]=Residential Finite VSIC for 5 Meter Source Thickness
[8]=Residential Finite VSIC for 2 Meter Source Thickness
[9]=Residential Particulate Soil Inhalation Criteria
[10]=Residential Direct Contact Criteria
[11]*=Nonresidential Drinking Water Protection Criteria
[12]=Nonresidential Soil Volatilization to Indoor Air Inhalation
[13]=Nonresidential Infinite Source Volatile Soil Inhalation Criteria
[14]=Nonresidential Finite VSIC for 5 Meter Source Thickness
[15]=Nonresidential Finite VSIC for 2 Meter Source Thickness
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
[18]=Hazardous Waste Toxicity Screening Value
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only

Soil sample location with at least one exceedance

Soil sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures

QMCM Study Area Boundary

Notes:
- *J = estimated value*
- *mg/kg = milligrams per kilogram*
- *ug/kg = micrograms per kilogram*
- *# = result is from dilution run*
- *Sample depths shown in inches below ground surface.*
- *All 2013 samples were analyzed for metals, PCBs, SVOCs, VOCs, and pesticides except SS-18 which was analyzed for PCBs and SVOCs only*
- *All 2007 samples were analyzed for metals and PCBs*

N

0 250 Ft

Coordinate System: MIGeoRef(m)

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Figure 3b

Soil Sample Location Map - Quincy Reclamation Plant
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0070\GIS\mxds\2017_QMCM_Data_TMIFig_03b_QMCM_Soil_QRegrind_v20170221.mxd 1:42:11 PM 2/21/2017 KBrown

Image Source: MIS - Public Imagery

Barn Floor Drain (6")
10/1/1997

Brown House

White House

Barn

Mobile Home

Junk Pile

House

MONTGOMERY RD

Partially Buried Waste

Junk Pile

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Statewide Default Background Level
[2]*=Groundwater Surface Water Interface Protection Criteria
[3]=Soil Saturation Concentration Screening Levels
[4]*=Residential Drinking Water Protection Criteria
[5]=Residential Soil Volatilization to Indoor Air Inhalation Criteria (VSIC)
[6]=Residential Infinite Source Volatile Soil Inhalation Criteria
[7]=Residential Finite VSIC for 5 Meter Source Thickness
[8]=Residential Finite VSIC for 2 Meter Source Thickness
[9]=Residential Particulate Soil Inhalation Criteria
[10]=Residential Direct Contact Criteria
[11]*=Nonresidential Drinking Water Protection Criteria
[12]=Nonresidential Soil Volatilization to Indoor Air Inhalation
[13]=Nonresidential Infinite Source Volatile Soil Inhalation Criteria
[14]=Nonresidential Finite VSIC for 5 Meter Source Thickness
[15]=Nonresidential Finite VSIC for 2 Meter Source Thickness
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
[18]=Hazardous Waste Toxicity Screening Value
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only

Soil sample location with at least one exceedance

Soil sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Building Outline (from MDEQ CAD)

Debris / Junk Piles (from MDEQ CAD)

Cap Boundary (2005 NRCS)

QMCM Study Area Boundary

Notes:
- *mg/kg = milligrams per kilogram*
- *Sample depths shown in inches below ground surface (bgs)*
- *Sample was analyzed for metals, and VOCs*

N

0 150 Ft

Coordinate System: MIGeoRef(m)

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Figure 3c

Soil Sample Location Map - Furniture Stripping Dollar Bay Site
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0007\0\GIS\mxds\2017_QMCM_Data_TMI\Fig_03c_QMCM_Soil_FurnStrip_v20170221.mxd 1:26:02 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

SB-02-5
12/1/2016

SB-01-2
11/30/2016

SB-09-10
12/1/2016

SB-08-2 5
12/1/2016

SB-03-7
11/30/2016

SB-10-15
12/1/2016

SB-07-2_5 11/30/2016
(2.5 ft)
METHYLENE CHLORIDE 130 J ug/kg [4,11]

SB-04-2 5
11/30/2016

SB-05-2 5
11/30/2016

SB-06-5
11/30/2016

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Statewide Default Background Level
[2]*=Groundwater Surface Water Interface Protection Criteria
[3]=Soil Saturation Concentration Screening Levels
[4]*=Residential Drinking Water Protection Criteria
[5]=Residential Soil Volatilization to Indoor Air Inhalation Criteria (VSIC)
[6]=Residential Infinite Source Volatile Soil Inhalation Criteria
[7]=Residential Finite VSIC for 5 Meter Source Thickness
[8]=Residential Finite VSIC for 2 Meter Source Thickness
[9]=Residential Particulate Soil Inhalation Criteria
[10]=Residential Direct Contact Criteria
[11]*=Nonresidential Drinking Water Protection Criteria
[12]=Nonresidential Soil Volatilization to Indoor Air Inhalation
[13]=Nonresidential Infinite Source Volatile Soil Inhalation Criteria
[14]=Nonresidential Finite VSIC for 5 Meter Source Thickness
[15]=Nonresidential Finite VSIC for 2 Meter Source Thickness
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
[18]=Hazardous Waste Toxicity Screening Value
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only

Soil sample location with at least one exceedance

Soil sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures

QMCM Study Area Boundary

Notes:
- *J = value is estimated*
- *ug/kg = micrograms per kilogram*
- *Sample depths shown in feet below ground surface.*
- *All soil samples were analyzed for PNAs, VOCs, PCBs and Michigan 10 Metals + Nickel*

N

0 500 Ft

Coordinate System: MIGeoRef(m)

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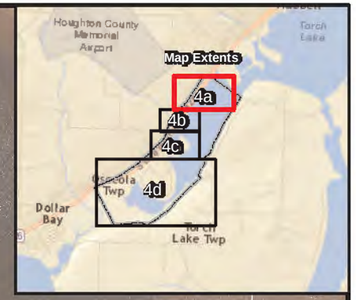
Figure 3d

Soil Sample Location Map - Quincy Stamp Sands
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0007\GIS\mxds\2017_QMCM_Data_TMI\Fin_03d_QMCM_Soil_QStampSands_v20170221.mxd 1:21:40 PM 2/21/2017 KBrown

Image Source: MIS - Public Imagery



TAM2-2

28

Locations Screened for Metals - At least one exceedance of:

- Residential Direct Contact Criteria
- Residential Particulate Soil Inhalation Criteria
- Non Residential Direct Contact Criteria
- Non Residential Particulate Soil Inhalation Criteria
- Screening locations with no exceedances
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- Xray Fluorescence screening results are from surface soils unless otherwise specified
- All locations labeled XRF-## are from 2013 all others are from 2007.

N

0 300 Ft

Coordinate System: MIGeoRef(m)

MTU Identified Mining Era Buildings and Structures
28. Quincy Dredge No. 1

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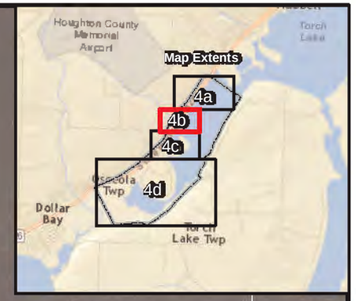
Figure 4a

Soil Screening Results Map - QMCM North
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0027\GIS\mxds\2017_QMCM_Data_TAMEin_04sel_QMCM_XRF_v20170221.mxd 1:51:05 PM 2/21/2017 KBrown

Image Source: MIS - Public Imagery



XRF-150 XRF-149 XRF-147 XRF-144 XRF-143 XRF-142 XRF-141 XRF-148 XRF-146 XRF-129 XRF-131 XRF-145 XRF-130 XRF-132 XRF-139 XRF-133 XRF-140 XRF-134 XRF-138 XRF-135 XRF-137 XRF-136

XRF-125 XRF-127 XRF-126 XRF-128 XRF-124 XRF-116 XRF-115 XRF-117 XRF-123 XRF-122 XRF-118 XRF-114 XRF-121 XRF-113 XRF-119 XRF-112 XRF-120 XRF-111 XRF-108 XRF-109 XRF-107 XRF-103 XRF-110 XRF-102 XRF-104 XRF-106 XRF-105

Quincy Creek

TM-S2-01

XRF-96 XRF-95 XRF-97 XRF-92 XRF-94 XRF-91 MASONB-2 XRF-93 XRF-90 XRF-89 XRF-98 XRF-99 XRF-100 MASONB-4 TM-S1-02 XRF-80 XRF-87 XRF-79 MASONB-3 XRF-81 XRF-84 XRF-88 XRF-78 XRF-86 XRF-82 XRF-83 XRF-85 XRF-77 TM-S1-01 XRF-73 XRF-76 XRF-75 XRF-69 XRF-74 XRF-68 XRF-70 XRF-71 XRF-65 MASONB-6 XRF-67 XRF-64 XRF-62 TM-S1-04 XRF-59 MASONB-8 XRF-63 XRF-66 XRF-72 XRF-60 XRF-37 XRF-61 XRF-38 MASONB-5 XRF-35 TM-S1-03 TM-S1-05 XRF-40 XRF-36 XRF-41 XRF-39 XRF-43 XRF-58 XRF-42 XRF-57 XRF-44 XRF-51 XRF-45 MASONB-7 XRF-49 XRF-46 XRF-56 XRF-50 XRF-52 XRF-47 XRF-53 XRF-48 XRF-55 XRF-54

MS-S1-02I MS-S1-01

Locations Screened for Metals - At least one exceedance of:

- Residential Direct Contact Criteria
- Residential Particulate Soil Inhalation Criteria
- Non Residential Direct Contact Criteria
- Non Residential Particulate Soil Inhalation Criteria
- Screening locations with no exceedances
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- *Xray Fluorescence screening results are from surface soils unless otherwise specified*
- *All locations labeled XRF-## are from 2013 all others are from 2007.*

N

0 200 Ft

Coordinate System: MIGeoRef(m)

MTU Identified Mining Era Buildings and Structures
1. *Quincy Stamp Mill No. 1*
2. *Quincy Stamp Mill No.1 - Washing/Classifying Floor*
3. *Quincy Stamp Mill No. 1 - Rock Bin*
4. *Quincy Stamp Mill No.1 - Mineral House*
5. *Quincy Stamp Mill No. 2*
6. *Quincy Stamp Mill No.2 - Washing/Classifying Floor*
7. *Quincy Stamp Mill No. 2 - Rock Bin*
8. *Quincy Pump House No. 1*
9. *Quincy Boiler House No. 1*
10. *Chimney*
11. *Store House*
12. *Concrete coal bin*
13. *Concrete chimney*
14. *Stone base*
15. *Quincy Pump House No. 2*
16. *Quincy Boiler House No. 2*
17. *Coal Shed*
18. *Quincy Coal Shed Dock*
19. *Quincy Dock*
20. *Quincy Carpenter*
21. *Blacksmith*
22. *Quincy Turbine (Power) House*
23. *Oil House - Underground*
24. *Quincy Boarding*
25. *Store House*
26. *Lumber*
27. *Assayers Laboratory*
29. *Quincy Dredge No. 2*

Site Features from MDEQ 2015 Site Inspection Report
A. *Former Foundation (Quincy Booster Pump Station)*
B. *Drum Removal Area*
C. *Brick Building Remains*
D. *Drum Removal Area*
E. *Arsenic Removal Area*
F. *Brick Foundation*
G. *Smokestack*

Prepared for:
Michigan Department of Environmental Quality

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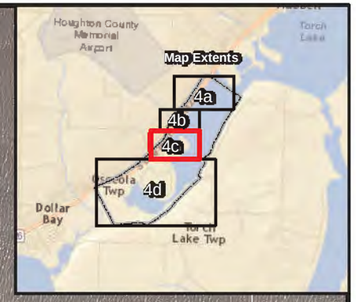
Figure 4b

Soil Screening Results Map - QMCM North Central
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0074\GIS\mxds\2017_QMCM_Data_TMEin_04sed_QMCM_XRF_v20170221.mxd 1:53:18 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery



MS-S1-03
29
MASONB-9
MS-S1-05
MS-S1-04
MS-S1-10
MS-S1-08
MS-S1-06
MS-S1-12
MS-S1-11
MS-S1-07
XRF-10
XRF-9
XRF-8
MS-S1-13
XRF-11
XRF-6
XRF-12
XRF-28
XRF-26
XRF-27
XRF-13
XRF-14
XRF-29
XRF-25
XRF-7
XRF-24
XRF-5
XRF-23
XRF-31
XRF-3
XRF-4
XRF-32
XRF-2
XRF-21
XRF-30
MASONB-12
MASONB-13
XRF-20
XRF-22
XRF-19
XRF-18
XRF-15
XRF-17
XRF-16
MASONB-10
MASONB-11
31
32
33
30
H
I
J

MTU Identified Mining Era Buildings and Structures
29. Quincy Dredge No. 2
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

Locations Screened for Metals - At least one exceedance of:

- Residential Direct Contact Criteria
- Residential Particulate Soil Inhalation Criteria
- Non Residential Direct Contact Criteria
- Non Residential Particulate Soil Inhalation Criteria
- Screening locations with no exceedances
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- Xray Fluorescence screening results are from surface soils unless otherwise specified
- All locations labeled XRF-## are from 2013 all others are from 2007.

N
0 200 Ft
Coordinate System: MIGeoRef(m)

Prepared for:
Michigan Department of Environmental Quality

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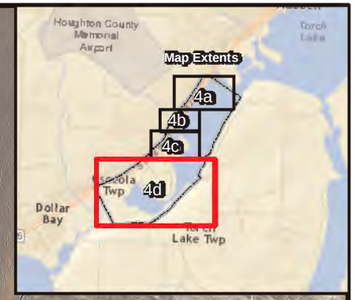
Figure 4c
Soil Screening Results Map - QMCM South Central
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0027\GIS\mxds\2017_QMCM_Data_TMI\Fin_Dset_QMCM_XRF_v20170222.mxd 1:32:22 PM 2/22/2017 KBrown

Image Source: MIS - Public Imagery



MS-S1-14

MS-S1-15

MS-S1-16

MS-S1-17

MS-S1-18

MS-S1-19

Dollar Bay Furniture Stripping Site

Locations Screened for Metals - At least one exceedance of:

- Residential Direct Contact Criteria
- Residential Particulate Soil Inhalation Criteria
- Non Residential Direct Contact Criteria
- Non Residential Particulate Soil Inhalation Criteria
- Screening locations with no exceedances
- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- Xray Fluorescence screening results are from surface soils unless otherwise specified
- All locations labeled XRF-## are from 2013 all others are from 2007.

N

0 600 Ft

Coordinate System: MIGeoRef(m)

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Figure 4d

Soil Screening Results Map - QMCM South
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0073\GIS\mxds\2017_QMCM_Data_TMEin_04sel_QMCM_XRF_v20170221.mxd 1:59:53 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

Quincy Creek

TMW-08
7.24-12.24 ft bgs
9/12/2013

TMW-05
11.32-16.32 ft bgs
9/11/2013

TMW-07
6.75-11.75 ft bgs
9/12/2013

TMW-06
3.06-8.06 ft bgs
9/12/2013

TMW-01
11.89-16.89 ft bgs
9/11/2013

TMW-02
6.25-11.25 ft bgs
9/11/2013

TMW-04
7.16-12.16 ft bgs
9/11/2013

TMW-03 9/11/2013
(6.99-11.99 ft bgs)

gamma-BHC (Lindane)	0.064 J ug/l [3]
DIBENZOFURAN	6.9 ug/l [3]
PHENANTHRENE	8.3 ug/l [3]

MTU Identified Mining Era Buildings and Structures

1. Quincy Stamp Mill No. 1
2. Quincy Stamp Mill No.1 - Washing/Classifying Floor
3. Quincy Stamp Mill No. 1 - Rock Bin
4. Quincy Stamp Mill No.1 - Mineral House
5. Quincy Stamp Mill No. 2
6. Quincy Stamp Mill No.2 - Washing/Classifying Floor
7. Quincy Stamp Mill No. 2 - Rock Bin
8. Quincy Pump House No. 1
9. Quincy Boiler House No. 1
10. Chimney
11. Store House
12. Concrete coal bin
13. Concrete chimney
14. Stone base
15. Quincy Pump House No. 2
16. Quincy Boiler House No. 2
17. Coal Shed
18. Quincy Coal Shed Dock
19. Quincy Dock
20. Quincy Carpenter
21. Blacksmith
22. Quincy Turbine (Power) House
23. Oil House - Underground
24. Quincy Boarding
25. Store House
26. Lumber
27. Assayers Laboratory
28. Quincy Dredge No. 1
29. Quincy Dredge No. 2
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report

A. Former Foundation (Quincy Booster Pump Station)
B. Drum Removal Area
C. Brick Building Remains
D. Drum Removal Area
E. Arsenic Removal Area
F. Brick Foundation
G. Smokestack
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

Groundwater sample location with at least one exceedance

Groundwater sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures

QMCM Study Area Boundary

Notes:

- *J = estimated value*
- *ug/l = micrograms per liter*
- *Sample depths shown in feet below ground surface (bgs).*
- *All samples analyzed for metals, PCBs, SVOCs, VOCs, and pesticides*

N

0 500 Ft

Coordinate System: MIGeoRef(m)

MDEQ Part 201 Cleanup Criteria for Response Action
[1]*=Residential Drinking Water Criteria
[2]*=Nonresidential Drinking Water Criteria
[3]*=Groundwater Surface Water Interface Criteria
[4]=Water Solubility
[5]=Residential Groundwater Vol to Indoor Air Inhalation
[6]=Nonresidential Groundwater Vol to Indoor Air Inhalation
[7]=Flammability and Explosivity Screening Level
* Exceedances of criteria 1, 2, and 3 are shown for organics only

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Figure 5a
Groundwater Sample Location Map -
Quincy Stamp Mills and Reclamation Plant
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0074\GIS\mxds\2017_QMCM_Data_TMEin_05a_QMCM_GW_Quincy_v20170221.mxd 1:2021 BM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

TMW-2
3.1-4.1 ft bgs
9/29/1997

MCW-7
3-7 ft bgs
7-11 ft bgs
11-15 ft bgs
15-19 ft bgs
9/30/1997

TMW-3
2.5-3.5 ft bgs
9/29/1997

Brown House

White House

TMW-8
5.3-6.3 ft bgs
9/30/1997

TMW-9
3.5-4.5 ft bgs
9/30/1997

Barn

Barn Floor Drain

TMW-6
5.5-6.5 ft bgs
9/30/1997

TMW-1
5.5-6.5 ft bgs
9/29/1997

BARN WELL
2/1/1994 (Sample: C94012848)
METHYLENE CHLORIDE 141 ug/l [1,2,3]
9/29/1997 - All non-detect

TMW-5
4.6-5.6 ft bgs
9/30/1997

TMW-4
5.5-6.5 ft bgs
9/29/1997

Mobile Home

Junk Pile

MCW-10
2.2-6.2 ft bgs
10/1/1997

House

MCW-11
4.5-6.5 ft bgs
10/1/1997

Partially Buried Waste

MCW-12
3-5 ft bgs
10/1/1997

Montreal Rd

Junk Pile

MDEQ Part 201 Cleanup Criteria for Response Action
[1]*=Residential Drinking Water Criteria
[2]*=Nonresidential Drinking Water Criteria
[3]*=Groundwater Surface Water Interface Criteria
[4]=Water Solubility
[5]=Residential Groundwater Vol to Indoor Air Inhalation
[6]=Nonresidential Groundwater Vol to Indoor Air Inhalation
[7]=Flammability and Explosivity Screening Level
* Exceedances of criteria 1, 2, and 3 are shown for organics only

Groundwater sample location with at least one exceedance

Groundwater sample location with no exceedances

Locations Analyzed for PCBs

No Detections

At Least One Detection

Building Outline (from MDEQ CAD)

Debris / Junk Piles (from MDEQ CAD)

Cap Boundary (2005 NRCS)

QMCM Study Area Boundary

Notes:
- *Sample depths shown in feet below ground surface (bgs).*
- *All samples analyzed for VOCs*
- *Barn Well, MCM-7, TMW-8, and TMW-9 were also analyzed for dissolved metals*
- *TMW-1, TMW-2, TMW-5, TMW-6, TMW-7 (11-15 ft), and TMW-7 (15-19 ft) were only field screened using a gas chromatograph and not sent to a laboratory for analysis.*

N

0 150 Ft

Coordinate System: MIGeoRef(m)

Prepared for:
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Figure 5b
Groundwater Sample Location Map -
Furniture Stripping Dollar Bay Site
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0007\GIS\mxds\2017_QMCM_Data_TMWs_05b_QMCM_GW_SumStrip_v20170221.mxd 1:20:27 PM, 2/21/2017, KBrown

Image Source: MIS - Public Imagery

TMW-02
13-18 ft bgs
12/1/2016

TMW-01
2-7 ft bgs
11/30/2016

TMW-09
13-18 ft bgs
12/1/2016

TMW-08
2.5-7.5 ft bgs
12/1/2016

TMW-03
5-10 ft bgs
11/30/2016

TMW-07
3-8 ft bgs
12/1/2016

TMW-04
2-7 ft bgs
11/30/2016

TMW-06
2-7 ft bgs
11/30/2016

TMW-05
2.5-7.5 ft bgs
11/30/2016

MDEQ Part 201 Cleanup Criteria for Response Action
[1]*=Residential Drinking Water Criteria
[2]*=Nonresidential Drinking Water Criteria
[3]*=Groundwater Surface Water Interface Criteria
[4]=Water Solubility
[5]=Residential Groundwater Vol to Indoor Air Inhalation
[6]=Nonresidential Groundwater Vol to Indoor Air Inhalation
[7]=Flammability and Explosivity Screening Level
* Exceedances of criteria 1, 2, and 3 are shown for organics only

- Groundwater sample location with at least one exceedance
- Groundwater sample location with no exceedances

Locations Analyzed for PCBs

- No Detections
- At Least One Detection

- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- *Sample depths shown in feet below ground surface.*
- *All soil samples were analyzed for PNAs, VOCs, Michigan 10 Metals + Nickel, Manganese, and Pesticides*

N

0 500 Ft

Coordinate System: MIGeoRef(m)

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Figure 5c

Groundwater Sample Location Map - Quincy Stamp Sands
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\stamp\Projects\MDEQ0072\GIS\mxds\2017_QMCM_Data_TMIEn_05c_QMCM_GW_QStampSands_v20170221.mxd 1:21:56 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

Quincy Creek

SW-01 9/10/2013
10-10 COPPER 4 J ug/l [4]

SD-01 9/10/2013
0-6 SILVER 1.8 mg/kg [1]

SW-02 9/10/2013
8-8 COPPER 7.2 J ug/l [4]
8-8 COPPER (DUP) 7.5 J ug/l [4]

SD-02 9/10/2013
0-4 COPPER 292 mg/kg [1,2,3]
0-4 COPPER (DUP) 125 mg/kg [1,2]
0-4 SILVER 2 mg/kg [1]
0-4 SILVER (DUP) 1.7 mg/kg [1]

SW-05 9/10/2013
10-10 BARIUM 225 ug/l [4]
10-10 COPPER 18 J ug/l [4]

SD-05 9/10/2013
0-6 COPPER 161 mg/kg [1,2,3]
0-6 SILVER 1.6 J mg/kg [1]

SW-06 9/10/2013
6-6 COPPER 39.7 ug/l [4]
6-6 LEAD 13.8 ug/l [4]
6-6 ZINC 72.7 J ug/l [4]

SW-03 9/10/2013
6-6 COPPER 10.8 J ug/l [4]

SD-03 9/10/2013
0-6 COPPER 1110 mg/kg [1,2,3]
0-6 COPPER (DUP) 1130 mg/kg [1,2,3]
0-6 SILVER 2.3 mg/kg [1]
0-6 SILVER (DUP) 2.2 mg/kg [1]

SW-04 9/10/2013
18-18 COPPER 23.1 J ug/l [4]

SD-04 9/10/2013
0-6 COPPER 133 mg/kg [1,2]
0-6 SILVER 1.8 mg/kg [1]

Quincy Stamp Mill No 2
Quincy Turbine (Power) House
Quincy Boiler No 2
Quincy Stamp Mill No 1
Quincy Boiler No 1
Quincy Coal Shed and Dock
Quincy Shore Plant
Quincy Regrinding Plant

TL08-05 8/27/2008
TL08-045 8/27/2008
TL08-022 8/27/2008
TL08-065 8/28/2008
TL08-02 8/26/2008
TL08-041 8/26/2008
TL08-164 8/28/2008
TL08-09 8/26/2008
TL08-064 8/28/2008
TL08-04 8/26/2008
TL08-063 8/28/2008
TL08-050 8/26/2008
SPMD Site #5 4-4 ft bgs 11/18/2005
TL08-062 8/28/2008
TL08-018 8/26/2008
TL08-036 8/26/2008
TL08-061 8/28/2008
TL08-016 8/26/2008

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Sediment Ecological Screening Levels
[2]=Threshold Effect Concentration (TEC)
[3]=Probable Effect Concentration (PEC)
[4]=Surface Water Ecological Screening Levels
[5]=Surface Water Rule 57 HNV Drink
[6]=Surface Water Rule 57 HCV Drink
[7]=Surface Water Rule 57 WV

Sample location with at least one exceedance
Sample location with no exceedances

Locations Analyzed for PCBs
No Detections
At Least One Detection
Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures
QMCM Study Area Boundary

Notes:
- *J = estimated value*
- *mg/kg = milligrams per kilogram*
- *mg/l = milligrams per liter*
- *ug/l = micrograms per liter*
- *Sample depths shown in inches*
- *All 2013 samples analyzed for metals, PCBs, pesticides, VOCs, and SVOCs*
- *All 2008 samples were analyzed for PCBs*
- *The 2005 SPMD sample was analyzed for PCB congeners*

N
0 1,000 Ft
Coordinate System: MIGeoRef(m)

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Figure 6
Surface Water and Sediment Sample Location Map
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0073\GIS\mxds\2017_QMCM_Data_TMI\Fig_06_QMCM_SW_SED_v20170221.mxd 2:07:28 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

AS-1 9/10/2013
ASBESTOS-CHRYSOTILE 15 % [1%]

AS-2) 9/10/2013

AS-3) 9/10/2013

AS-4) 9/10/2013

AS-5) 9/10/2013

W-02 9/10/2013
0-6 LEAD 760 mg/kg [10]

W-01 9/10/2013
0-2 ARSENIC 16 mg/kg [10]
0-2 COPPER 270000 mg/kg [9,10,16,17]

Quincy Creek

MTU Identified Mining Era Buildings and Structures

1. Quincy Stamp Mill No. 1
2. Quincy Stamp Mill No.1 - Washing/Classifying Floor
3. Quincy Stamp Mill No. 1 - Rock Bin
4. Quincy Stamp Mill No.1 - Mineral House
5. Quincy Stamp Mill No. 2
6. Quincy Stamp Mill No.2 - Washing/Classifying Floor
7. Quincy Stamp Mill No. 2 - Rock Bin
8. Quincy Pump House No. 1
9. Quincy Boiler House No. 1
10. Chimney
11. Store House
12. Concrete coal bin
13. Concrete chimney
14. Stone base
15. Quincy Pump House No. 2
16. Quincy Boiler House No. 2
17. Coal Shed
18. Quincy Coal Shed Dock
19. Quincy Dock
20. Quincy Carpenter
21. Blacksmith
22. Quincy Turbine (Power) House
23. Oil House - Underground
24. Quincy Boarding
25. Store House
26. Lumber
27. Assayers Laboratory
28. Quincy Dredge No. 1
29. Quincy Dredge No. 2
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report

A. Former Foundation (Quincy Booster Pump Station)
B. Drum Removal Area
C. Brick Building Remains
D. Drum Removal Area
E. Arsenic Removal Area
F. Brick Foundation
G. Smokestack
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

MDEQ Part 201 Cleanup Criteria for Response Action
[1]=Statewide Default Background Level
[2]*=Groundwater Surface Water Interface Protection Criteria
[3]=Soil Saturation Concentration Screening Levels
[4]*=Residential Drinking Water Protection Criteria
[5]=Residential Soil Volatilization to Indoor Air Inhalation Criteria (VSIC)
[6]=Residential Infinite Source Volatile Soil Inhalation Criteria
[7]=Residential Finite VSIC for 5 Meter Source Thickness
[8]=Residential Finite VSIC for 2 Meter Source Thickness
[9]=Residential Particulate Soil Inhalation Criteria
[10]=Residential Direct Contact Criteria
[11]*=Nonresidential Drinking Water Protection Criteria
[12]=Nonresidential Soil Volatilization to Indoor Air Inhalation
[13]=Nonresidential Infinite Source Volatile Soil Inhalation Criteria
[14]=Nonresidential Finite VSIC for 5 Meter Source Thickness
[15]=Nonresidential Finite VSIC for 2 Meter Source Thickness
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
[18]=Hazardous Waste Toxicity Screening Value
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only

Sample location with at least one exceedance

Sample location with no exceedances

Cap Boundary (2005 NRCS)

Mining Era Buildings and Structures

QMCM Study Area Boundary

Notes:
- mg/kg = milligrams per kilogram
- Sample depths shown in inches below ground surface.
- All 2013 waste samples analyzed for metals, and SVOCs.
- All 2007 samples were analyzed for metals and PCBs

N

0 500 Ft

Coordinate System: MIGeoRef(m)

Prepared for:
Michigan Department of Environmental Quality

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Figure 7

Asbestos and Waste Sample Location Map
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\temp\Projects\MDEQ0007\GIS\mxds\2017_QMCM_Data_TMEin_07_QMCM_Misc_v2017i0221.mxd 1:43:35 PM, 2/21/2017 KBrown

Image Source: ESRI World Imagery

LAKE SUPERIOR

LAKE SUPERIOR

SPMD Site #8 11/17/05
Parameter Result
TOTAL PCBS 10

SPMD Site #3 11/18/05
Parameter Result
TOTAL PCBS 74

SPMD Site #2 11/18/05
Parameter Result
TOTAL PCBS 22

SPMD Site #4 11/18/05
Parameter Result
TOTAL PCBS 150

SPMD Site #5 11/18/05
Parameter Result
TOTAL PCBS 23

Torch Lake (TL)

SPMD Site #7 11/18/05
Parameter Result
TOTAL PCBS 21

SPMD Site #1 11/18/05
Parameter Result
TOTAL PCBS 77

SPMD Site #6 11/18/05
Parameter Result
TOTAL PCBS 62

Portage Lake

SPMD Site #9 11/17/05
Parameter Result
TOTAL PCBS 25

Keweenaw Bay

Huron Bay (HB)

SPMD Site #10 11/18/05
Parameter Result
TOTAL PCBS 23

Map Extent

L'Anse Reservation

PCB Congener Data for Walleye in Torch Lake

Sample ID	Collection Date	Length (cm)	Weight (g)	Total PCB+ (Congeners) (ppm)
2000096-S10	5/3/2000	43.4	760	0.040
2000096-S11	5/3/2000	46	1000	0.030
2000096-S12	5/3/2000	46.7	900	0.036
2000096-S13	5/3/2000	47	940	0.020
2000096-S14	5/3/2000	47.8	980	0.046
2000096-S15	5/3/2000	52.1	1180	0.373
2000096-S16	5/3/2000	54.1	1480	0.183
2000096-S17	5/3/2000	55.9	1640	0.184
2000096-S18	5/3/2000	55.4	1930	0.039
2000096-S19	5/3/2000	54.1	1621	0.029
2007257-S21	4/25/2007	39.37	520	0.011
2007257-S22	4/25/2007	39.116	620	0.051
2007257-S23	4/25/2007	44.196	680	0.016
2007257-S24	4/25/2007	45.212	860	0.010
2007257-S25	4/25/2007	45.212	710	0.026
2007257-S26	4/25/2007	47.752	1060	0.125
2007257-S27	4/25/2007	50.038	900	0.021
2007257-S28	4/25/2007	52.82	1350	0.077
2007257-S29	4/25/2007	53.832	1180	0.052
2007257-S30	4/25/2007	54.61	1760	0.235
2007257-S31	4/25/2007	54.61	1710	0.039
2007257-S32	4/25/2007	57.912	1770	0.469
2007257-S33	4/25/2007	54.864	1550	0.212
2007257-S34	4/25/2007	58.928	1980	0.206
2007257-S35	4/25/2007	59.69	1920	0.176
2007257-S36	4/25/2007	60.198	1840	0.161
2007257-S37	4/25/2007	61.722	2180	0.271
2007257-S38	4/25/2007	61.722	2180	0.183
2007257-S39	4/25/2007	63.246	2100	0.346
2007257-S40	4/25/2007	63.246	2570	0.206
2013257-S10	5/23/2013	52.4	1480	0.101
2013257-S11	5/23/2013	53	1720	0.007
2013257-S12	5/23/2013	55.8	1640	0.170
2013257-S13	5/23/2013	56	1780	0.131
2013257-S14	5/23/2013	56.2	1960	0.071
2013401-S13	8/1/2013	40.7	700	0.001
2013401-S14	8/1/2013	41.6	750	0.002
2013401-S15	8/1/2013	41.8	780	0.001
2013401-S16	8/1/2013	44	940	0.021
2013401-S17	8/1/2013	58.1	1960	0.426

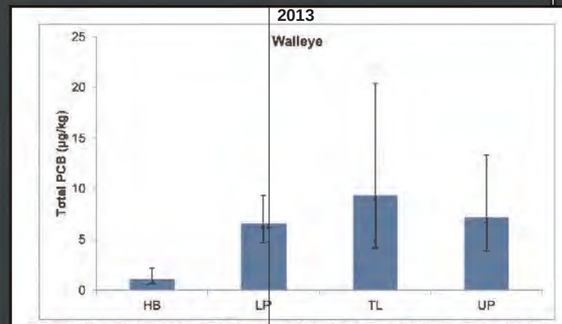

Figure 4. Estimated mean total PCB in walleye from Huron Bay (HB), Lower Peninsula lakes (LP), Torch Lake (TL), and Upper Peninsula lakes (UP). Values are least squares means and confidence limits estimated with the GLM using lipid content as a covariate (Length was not a significant covariate).

Source: MDEQ, Water Resources Division. January 2016

Semi-Permeable Membrane Device (SPMD)

Fish (Generalized Location)

Study Area Boundaries

- All SPMD results presented in ug/l
- ug/l = micrograms per liter
- Walleye PCB data downloaded from the MDEQ Fish Contaminant Monitoring Program Online Database on January 17, 2017.
- Figure 4 (bar chart) from MDEQ Water Resources Division. *Staff Report, Status of Fish Contaminant Levels in the Torch Lake Area of Concern 2013.* Jan 2016

N

0 3 Mi

Coordinate System: MIGeoRef(m)

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Figure 8

SPMD and Fish Tissue Sampling Locations
Quincy Mining Mason Operations Area
Houghton and Baraga Counties, Michigan

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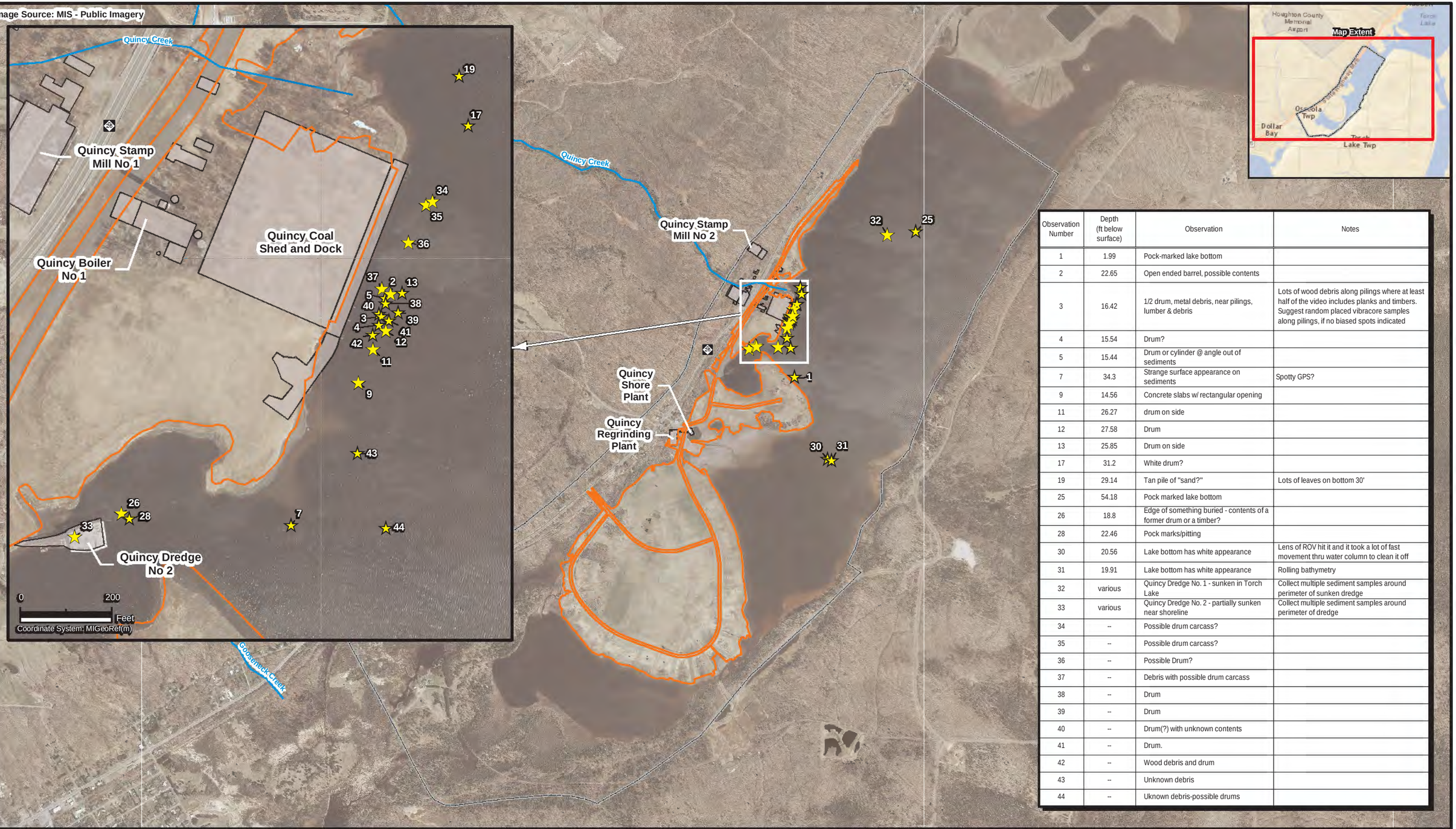
Image Source: MIS - Public Imagery



Observation Number	Depth (ft below surface)	Observation	Notes
1	1.99	Pock-marked lake bottom	
2	22.65	Open ended barrel, possible contents	
3	16.42	1/2 drum, metal debris, near pilings, lumber & debris	Lots of wood debris along pilings where at least half of the video includes planks and timbers. Suggest random placed vibracore samples along pilings, if no biased spots indicated
4	15.54	Drum?	
5	15.44	Drum or cylinder @ angle out of sediments	
7	34.3	Strange surface appearance on sediments	Spotty GPS?
9	14.56	Concrete slabs w/ rectangular opening	
11	26.27	drum on side	
12	27.58	Drum	
13	25.85	Drum on side	
17	31.2	White drum?	
19	29.14	Tan pile of "sand?"	Lots of leaves on bottom 30'
25	54.18	Pock marked lake bottom	
26	18.8	Edge of something buried - contents of a former drum or a timber?	
28	22.46	Pock marks/pitting	
30	20.56	Lake bottom has white appearance	Lens of ROV hit it and it took a lot of fast movement thru water column to clean it off
31	19.91	Lake bottom has white appearance	Rolling bathymetry
32	various	Quincy Dredge No. 1 - sunken in Torch Lake	Collect multiple sediment samples around perimeter of sunken dredge
33	various	Quincy Dredge No. 2 - partially sunken near shoreline	Collect multiple sediment samples around perimeter of dredge
34	--	Possible drum carcass?	
35	--	Possible drum carcass?	
36	--	Possible Drum?	
37	--	Debris with possible drum carcass	
38	--	Drum	
39	--	Drum	
40	--	Drum(?) with unknown contents	
41	--	Drum.	
42	--	Wood debris and drum	
43	--	Unknown debris	
44	--	Uknown debris-possible drums	

ROV Video Observation / Recommended Sediment Sampling Location

Cap Boundary (2005 NRCS)

QMCM Study Area Boundary

Mining Era Buildings and Structures

N

0 1,500 Ft

Coordinate System: MIGeoRef(m)

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Figure 9

ROV Video Observation Location Map July 2016
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

File: C:\temp\Projects\MDEQ0076\GIS\mxds\2017_QMCM_Data_TMEin_09_QMCM_ROV_Observations_v20170221.mxd 1:33:39 PM, 2/21/2017 KBrown

Image Source: MIS - Public Imagery

Quincy Creek

19
MASON WELL NO. 2
WELL ID: 31000000306

MASON WELL NO. 1
WELL ID: 31000000305

0 250 Feet
Coordinate System: MIGeoRef(m)

Observation Number	Observation - October 2016
1	SACM
2	SACM, Possible Thermal Insulation
3	Suspect Tailings
4	SACM, Counter Top
5	SACM
6	Crushed Drum
7	SACM, Rolled Roofing On Coal Bin
8	Conveyor Belt Roll
9	Conveyor Belt Roll
10	SACM, Roofing
11	SACM, Roofing
12	SACM, Roofing
13	Crushed Drum
14	Empty 5-Gallon Can
16	Drum Carcasses and Paint Cans
17	SACM, Wire Wrap
18	SACM, Wire Wrap
19	Well No. 2

MTU Identified Mining Era Buildings and Structures
1. Quincy Stamp Mill No. 1
2. Quincy Stamp Mill No.1 - Washing/Classifying Floor
3. Quincy Stamp Mill No. 1 - Rock Bin
4. Quincy Stamp Mill No.1 - Mineral House
5. Quincy Stamp Mill No. 2
6. Quincy Stamp Mill No.2 - Washing/Classifying Floor
7. Quincy Stamp Mill No. 2 - Rock Bin
8. Quincy Pump House No. 1
9. Quincy Boiler House No. 1
10. Chimney
11. Store House
12. Concrete coal bin
13. Concrete chimney
14. Stone base
15. Quincy Pump House No. 2
16. Quincy Boiler House No. 2
17. Coal Shed
18. Quincy Coal Shed Dock
19. Quincy Dock
20. Quincy Carpenter
21. Blacksmith
22. Quincy Turbine (Power) House
23. Oil House - Underground
24. Quincy Boarding
25. Store House
26. Lumber
27. Assayers Laboratory
28. Quincy Dredge No. 1
29. Quincy Dredge No. 2
30. Quincy Regrinding Plant
31. Substation
32. Transport
33. Quincy Shore Plant

Site Features from MDEQ 2015 Site Inspection Report
A. Former Foundation (Quincy Booster Pump Station)
B. Drum Removal Area
C. Brick Building Remains
D. Drum Removal Area
E. Arsenic Removal Area
F. Brick Foundation
G. Smokestack
H. Former Water Intake
I. Old Transformer Pad
J. Hydrant

Observation Features - October 2016
- Suspect Asbestos Containing Material (SACM)
- Residual Process Material (RPM)
- Abandoned Containers
- Potable Well

- Cap Boundary (2005 NRCS)
- Mining Era Buildings and Structures
- QMCM Study Area Boundary

Notes:
- Mason Well No. 1 coordinates obtained from Wellogic

N
0 500 Ft
Coordinate System: MIGeoRef(m)

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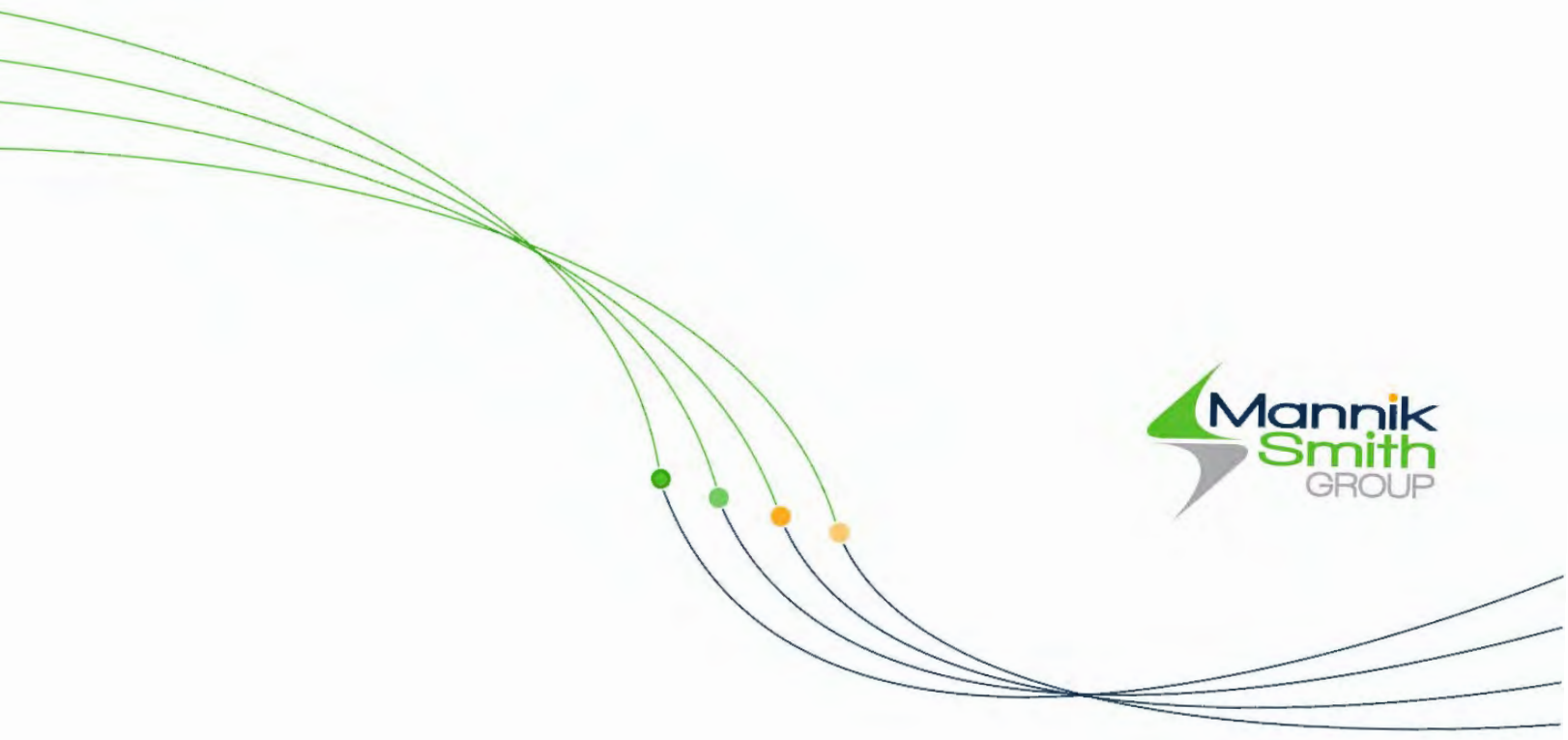
Figure 10

Preliminary Reconnaissance Observations October 2016
Quincy Mining Company Mason Operations Area
Mason, Houghton County, Michigan

FILE: C:\Users\Projects\MDEQ0072\GIS\mxds\2017_QMCM_Data_TMEin_10_QMCM_Prelim_Recon_Observations_v20170221.mxd 1:3,344 PM, 2/21/2017, KBrown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