HISTORICAL DATA REVIEW AND COMPILATION TECHNICAL MEMORANDUM ADDENDUM

ABANDONED MINING WASTES – TORCH LAKE NON-SUPERFUND SITE
CENTENNIAL MINE
HOUGHTON COUNTY, MICHIGAN
SITE ID# 31000096

MARCH 2024

PREPARED FOR:
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
REMEDIATION & REDEVELOPMENT DIVISION
CALUMET FIELD OFFICE
CALUMET, MICHIGAN

Mannik Smith GROUP

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Centennial Mine (Site ID: 31000096)
Houghton County, Michigan

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1.0 INTRODUCTION

The Mannik & Smith Group, Inc. (MSG) has prepared this *Historic Data Review and Compilation Technical Memorandum Addendum* (TM) as part of the Abandoned Mining Wastes – Torch Lake Non-Superfund Site (Project) Centennial Mine (Site ID # 31000096) (Site). This TM summarizes previous studies and investigations completed at the Site and the preliminary reconnaissance observations recorded in 2022 and 2023 on parcels to which access was granted. The TM findings could be considered in the development of a Sampling and Analysis Plan (SAP) for the Site if funding and property access permit. The TM was prepared in accordance with the *Indefinite Scope Indefinite Delivery (ISID) Discretionary Proposal for Site Investigation Activities* (29 July 2020) prepared by MSG in response to a request from the Michigan Department of Environment, Great Lakes, and Energy (EGLE), 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 Site is located at 58439 U.S. Highway 41 in Centennial, Calumet Township, Houghton County, Michigan. The Site is a part of the EGLE Abandoned Mining Wastes (AMW) Project EGLE AMW Project Web Page that is focused on the mining legacy issues that were not addressed as part of the U.S. Environmental Protection Agency (EPA) Torch Lake Superfund site. Depicted on ***Figure 1,*** *Project Location Map* is the Centennial Mine in addition to the other AMW Project areas and their respective former industrial operations.

The Site encompasses the mine and mine beneficiation facility operations dating back to 1896 until the cessation of commercial mining in the region. The Site consists of approximately 276 acres of land that incorporates multiple parcels and property owners. ***Figure 2****, Area Features Map* depicts the primary mining era buildings and structures and known historic operations based on available Sanborn Maps (***Appendix A****, Sanborn Maps*), Aerial Photographs (***Appendix B****, Aerial Photographs*), and/or other resources. ***Figure 2****, Area Features Map* also depicts the parcels and property owners that constitute the Site. Residential (single-family residences), commercial, vacant, and undeveloped forested lands border the Site.

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 were conducted from the mid-1860s to the 1960s, including the importation, reprocessing, and smelting of various scrap metals in the later years of operation.

The environmental legacy resulting from over 100 years of mining and reclamation led to Torch Lake and its western shoreline being designated as a Superfund site by the EPA Torch Lake Superfund Site Web Page. The EPA undertook cleanup activities to address some of the of the mining industry waste, while others were not addressed or left to recover through natural processes.

Beginning in 1896, the Centennial Mine property was operated as an industrial mining operation by the Centennial Mining Company, later succeeded by the Calumet & Hecla Corporation, for the production of copper until ceasing production in the late 1960s. Attempts to re-open the copper mining operations during the late 1970s failed due to the significant drop in the market for copper that has caused the property to remain unused. The property tax reverted to the State of Michigan for back property taxes (MDEQ 2014). ***Figure 2****, Area Features Map* depicts the parcels and property owners that currently constitute the Site.

The EPA Emergency Response Branch attempted to obtain access to the Site in 2012 to investigate abandoned drums and containers on the RAM Opportunities LLC (RAM) property. RAM denied EPA access to the drums, but provided EPA with data to show the drums contained nonhazardous material. RAM also stated the drums would be removed in spring 2013 (EPA 2012). No other known regulatory actions have been conducted at this Site.

2.0 OBJECTIVES AND SCOPE OF WORK

The overall goal of the AMW Project is to reduce risks associated with potential mining legacy environmental issues that were not previously addressed by the EPA. The overarching Project concerns involve groundwater, surface water, sediments, and "upland" media. Known or suspected problems which are being evaluated as part of the Project include: an unidentified, significant in-lake and/or terrestrial source of polychlorinated biphenyls (PCBs), 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. EGLE and other entities have undertaken studies that confirmed the remaining concerns at the Site involve groundwater, surface water, sediments, and "upland" media.

RRD staff directed development of this document to assimilate historic information in support of a potential SAP for undertaking site investigation (SI) activities at the Site. The primary focus of the SAP would be to ascertain the source, nature, and extent of contaminants in all affected environmental media (soil, groundwater, surface water, waste materials, and sediments) within the footprint.

3.0 APPLICABLE SCREENING CRITERIA

Evaluation of potential environmental and human health risks present at the Site 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.

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 (December 30, 2013).
  - Surface Soil;
  - Subsurface Soil;
  - Waste Materials;
  - RPM;
  - Groundwater; and,
  - Asbestos.

- 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;
  - RPM; and,
  - Waste Materials.

- EPA, National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR, Part 61, Subpart M).
  - Suspect Asbestos Containing Material (SACM).
- EPA Region 4, Ecological Risk Assessment Supplemental Guidance Screening Ecological Screening Values (ESVs) (March 2018).
  - Sediment; and,
  - Surface Water.
- DEQ – 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 EGLE drinking water and groundwater/surface water interface pathways criteria exceedances for metals are excluded from the groundwater evaluation. Similarly, the metals exceedances for soil criteria protective of the EGLE drinking water and groundwater/surface water interface pathways are also excluded. The rationale for this exclusion is that 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 EGLE drinking water and groundwater/surface water interface pathways criteria are ubiquitous at the Site and are predominantly the result of the presence of stamp sands. Stamp sands are not defined as a hazardous substance nor are they 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. 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 areas of the Site. 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 Site 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 are recommended to be incorporated into the sample design if future studies are planned. Doing so would enable identification of 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. The historical analytical and screening results are depicted on multiple figures summarized as follows:

Figure 3 Soil Analytical Results
Figure 4 Groundwater Analytical Results
Figure 5 RPM, Abandoned Container, and Waste Analytical Results

Figure 6 XRF Field Screening
Figure 7 Surface Water and Sediment Analytical Results
Figure 8 Preliminary Reconnaissance Observations 2022 and 2023

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 **Figure 6**, a quadrant style graphic was used to present the analytical results for the following parameter groups:

- PCBs, located in the upper left;
- Inorganics/Cyanide, located in the upper right;
- Volatile Organic Compounds (VOCs), located in the lower left; and,
- Semi-volatile Organic Compounds (SVOCs), located in the lower right.

Sample locations are labeled with field sample locations, sample date(s), and sample intervals, if known. Detections and/or exceedances are identified by the following colors:

- **Green Quadrant Fill** – This quadrant coloring represents sampling or screening results below the figure criteria for the indicated parameter group. Green fill may be derived from any of the historical investigations.
- **Red Quadrant Fill** – This quadrant coloring represents at least one exceedance of figure criteria for the indicated parameter group. A summary is presented in the corresponding callout box that includes the analyte(s) that exceeded criteria, the concentration(s), and a key indicating what criteria was exceeded.
- **Yellow Quadrant Fill** – A yellow quadrant fill indicates that a sample was analyzed for PCBs and no congeners were detected.
- **Light Blue Quadrant Fill** – A light blue quadrant fill means that a sample was analyzed for PCBs and at least one congener was detected. 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.
- **Unshaded Quadrants** – Unshaded quadrants mean that the indicated parameter group was not analyzed at the sample location.

5.0 KEY DOCUMENT REVIEW AND INTERPRETATION

The following is a summary of the key documents reviewed along with observations made during preliminary reconnaissance activities at the Site on properties to which EGLE was granted access:

- Equity Resource Environmental (ERE). Baseline Environmental Assessment (BEA). Centennial Copper Mine, 58439 U.S. Highway 41, Township of Calumet, Houghton County, Michigan. April 28, 2004.
- UP Engineers & Architects, Inc (UPEA). BEA for Centennial Mine Property, 58439 U.S. Highway 41, Calumet Township, Michigan 49913. Prepared for: North Houghton County Water & Sewage Authority, 25800 Red Jacket Road, Calumet, Michigan 49913. February 2007.
- STS. BEA. Centennial Mine Property, Section 12, Township 56 North, Range 33 West, Calumet Township, Michigan. August 14, 2008.
- MDEQ. Pre-CERCLIS Screening Assessment Report (PCS) for Centennial Mine, 58439 U.S. Highway 41, Calumet Township, Michigan. July 12, 2012.
- MDEQ. Site Inspection Report for Centennial Mine 58439 U.S. Highway 41 Calumet Township, Michigan 49913. U.S. EPA ID No.: MIN000510733. June 10, 2014.

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

ERE BEA, Centennial Copper Mine, 58439 U.S. Highway 41, Township of Calumet, Houghton County, Michigan. April 28, 2004.

ERE performed a BEA for a potential property transaction between Midwest Translating and Copper Mine, L.L.C. for tax parcel number 31-002-062-001-40 (ERE 2004c). The BEA outlined the findings of the completed Phase I ESA (ERE 2004a) and Phase II ESA (ERE 2004b). The Category N BEA concluded that the Site met "facility" definition based on known metals contamination in surface soils and groundwater. "The extent of known contamination is, therefore, considered to exist throughout the entire Subject Property, in association with the widespread deposition of mining generated sediments including tailings, mill sands, and waste rock debris, and within the groundwater potentially filling all existing subsurface mine associated openings."

"Since the contaminants are demonstrated to essentially exist throughout the Subject Property, they are subsequently subject to, and/or potentially affected by, the physical and chemical erosion, transportation, and deposition mechanisms associated with the Scales Creek and Slaughterhouse Creek drainage systems. The continued down-gradient and or/lateral migration of contaminants via the active hydraulic and sediment transport mechanisms has the potential to introduce additional, or redistribute pre-existing, contaminants within or beyond the Subject Property."

Coordinates associated with the Site were not provided; therefore, sample locations were digitized from a georectified figure located within the reports. Analytical results for soil, groundwater, and surface water are depicted on ***Figure 3****, Soil Analytical Results,* ***Figure 4,*** *Groundwater Analytical Results*, and ***Figure 7,*** *Surface Water and Sediment Analytical Results,* respectively.

UPEA BEA, Centennial Mine Property, 58439 U.S. Highway 41, Calumet Township, Michigan. February 2007.

UPEA performed a BEA for the North Houghton County Water & Sewage Authority, the purchaser of tax parcel number 31-002-062-001-40 (UPEA 2007). The BEA largely drew upon the ERE Phase I and II ESA, and BEA. UPEA did hand auger soil borings and collected three soil samples near previous ERE Phase II locations. The Category N BEA concluded that the Site met "facility" definition based on known metals contamination.

STS BEA, Centennial Mine Property, Section 12, Township 56 North, Range 33 West, Calumet Township, Michigan. August 14, 2008.

STS performed a BEA for the Upper Peninsula Power Company (UPPCO), the purchaser of the electrical substation portion of tax parcel number 31-002-062-001-40 (STS 2008b). The BEA outlined the findings of the completed Phase I ESA (STS 2007) and Phase II ESA (STS 2008a). The Category D BEA concluded that the Site met "facility" definition based on known metals contamination in soil and groundwater.

Coordinates associated with the Site were not provided; therefore, sample locations were digitized from a georectified figure located within the reports. Analytical results for soil and groundwater are depicted on ***Figure 3****, Soil Analytical Results and* ***Figure 4,*** *Groundwater Analytical Results*.

MDEQ Pre-CERCLIS Report for Centennial Mine, 58439 U.S. Highway 41, Calumet Township, Michigan. July 12, 2012.

The Pre-CERCLIS report provided the history of the Site and summarized the results of the ERE, STS, and various State of Michigan inspections. The Pre-CERCLIS report included a Factual Report dated May 25, 2012 that indicated the discharge of waste waters including mine dewatering, and the deposition of tailings and waste rock into the topographically depressed, central swamp and tailings pond area, combined with the potential for subsequent leaching, migration, and/or concentration of both naturally occurring and process-specific chemical analytes, likely occurred to a significant degree and impacted the soils/sediments, groundwater, and/or surface waters of the Site (MDEQ 2012).

The Pre-CERCLIS report reported that the Site reconnaissance revealed numerous containers, 55-gallon drums and a 250-gallon above ground storage tank in various stages of disrepair. Photographs documenting bulging, leaking, and

partially buried drums are included in the report. Multiple drums were observed partially buried in lowland areas of the Site submerged in water. Some of the drums reportedly contained lubricating oil and ferric sulfate. The report concluded that these abandoned drums and containers posed a direct contact exposure risk.

Due to the presence of known contaminants and waste materials left on the Site, the Pre-CERCLIS report recommended that additional assessment work be conducted to determine the potential hazards to the local population and environment posed by these and other potential contaminants in the soils and groundwater at the entire Site.

MDEQ Site Inspection Report for Centennial Mine 58439 U.S. Highway 41 Calumet Township, Michigan 49913. June 10, 2014.

Under a cooperative agreement with the EPA, EGLE Superfund staff conducted a Site Inspection (SI) at the Site. The SI included interviews with Site representatives; a reconnaissance inspection of the Site; the installation of groundwater monitoring wells; the collection of soil, groundwater, surface water, sediment, and blank samples; the collection of sample location coordinates; and the collection of photographs of samples, sample locations, and documented observations of Site conditions (MDEQ 2014). The findings of this SI indicated that significant quantities of waste were present; and shallow and subsurface soils, groundwater, and sediments had become contaminated with heavy metals, especially arsenic, chromium, copper, magnesium, and lead (MDEQ 2014).

Analytical results for soil, groundwater, and surface water are depicted on ***Figure 3****, Soil Analytical Results,* ***Figure 4,*** *Groundwater Analytical Results*, ***Figure 6,*** *XRF Field Screening*, and ***Figure 7,*** *Surface Water and Sediment Analytical Results,* respectively.

Preliminary Reconnaissance Observations 2022 and 2023

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 global positioning system during three Site visits. Site visits occurred on May 31, 2022, October 3 and 4, 2022, and June 21, 2023. A field team comprised of MSG and periodically EGLE personnel performed reconnaissance activities at the Site where written access was granted to EGLE. ***Table 1****, Preliminary Reconnaissance Observations 2022 and 2023* provides a summary of the key findings associated with the reconnaissance activities including SACM, RPM, abandoned containers, soil staining/stressed vegetation, potential PCB or mercury containing equipment, and household waste and debris.

Preliminary reconnaissance observation locations and descriptions are depicted on ***Figure 8****, Preliminary Reconnaissance Observations 2022 and 2023,* and could be used to evaluate the presence of existing contamination and determine where data gaps may be present. ***Appendix C****, Preliminary Reconnaissance Photographic Log – Abandoned Containers* provides photographs of abandoned container observations.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The evaluation and interpretation of analytical results and findings from previous key investigations and the preliminary Site reconnaissance were completed to create a baseline understanding of conditions at the Site. The Site features unmitigated mining era structures and waste in a mixed residential/non-residential area. The contaminants attributable to the Site include inorganic contaminants in environmental media in excess of Part 201 Residential and Non-Residential Cleanup Criteria. In addition, observations of abandoned containers were noted in EGLE files and observed during the preliminary reconnaissance on a parcel where access was not granted during recent Site reconnaissance.

It is recommended that access be obtained to the remaining parcel to allow for completion of the preliminary reconnaissance activities. Subsequently, if funding and access permit, the incorporation of these findings into a SAP

could minimize redundancies while also creating a more comprehensive approach for assessing potential environmental impacts across the Site if future investigation was conducted.

REFERENCES

1. Equity Resource Environmental (ERE). Phase I Environmental Site Assessment (ESA). Centennial Copper Mine, 58439 U.S. Highway 41, Township of Calumet, Houghton County, Michigan. March 30, 2004.
2. ERE. Phase II ESA. Centennial Copper Mine, 58439 U.S. Highway 41, Township of Calumet, Houghton County, Michigan. April 1, 2004.
3. ERE. Baseline Environmental Assessment (BEA). Centennial Copper Mine, 58439 U.S. Highway 41, Township of Calumet, Houghton County, Michigan. April 28, 2004.
4. UP Engineers & Architects, Inc (UPEA). BEA for Centennial Mine Property, 58439 U.S. Highway 41, Calumet Township, Michigan 49913. Prepared for: North Houghton County Water & Sewage Authority, 25800 Red Jacket Road, Calumet, Michigan 49913. February 2007.
5. STS. Phase I ESA. Former Centennial Mine Property, Highway U.S. 41, Calumet Township, Michigan. December 4, 2007.
6. STS. Phase II ESA. Former Centennial Mine Property, Highway U.S. 41, Calumet Township, Michigan. January 23, 2008.
7. STS. BEA. Centennial Mine Property, Section 12, Township 56 North, Range 33 West, Calumet Township, Michigan. August 14, 2008.
8. MDEQ. Pre-CERCLIS Screening Assessment Report (PCS) for Centennial Mine, 58439 U.S. Highway 41, Calumet Township, Michigan. July 12, 2012.
9. US Environmental Protection Agency (USEPA). Correspondence to MDEQ Re: Centennial Mine (ID 31000096) – Closure of Referral. October 2, 2012.
10. MDEQ. Site Inspection Report for Centennial Mine 58439 U.S. Highway 41 Calumet Township, Michigan 49913. U.S. EPA ID No.: MIN000510733. June 10, 2014.
11. Environmental Data Resources, Inc. (EDR). Aerial Photo Decade Package for Centennial Mine Site. Included photos: 1938, 1943, 1951, 1955, 1975, 1983, 1998, 2006, 2009, 2012, and 2016. November 19, 2020.
12. Sanborn Fire Insurance Maps. Centennial Copper Mining Company. Years Reviewed 1884, 1888, 1893, 1897, 1900, 1908, and 1917.

FIGURES

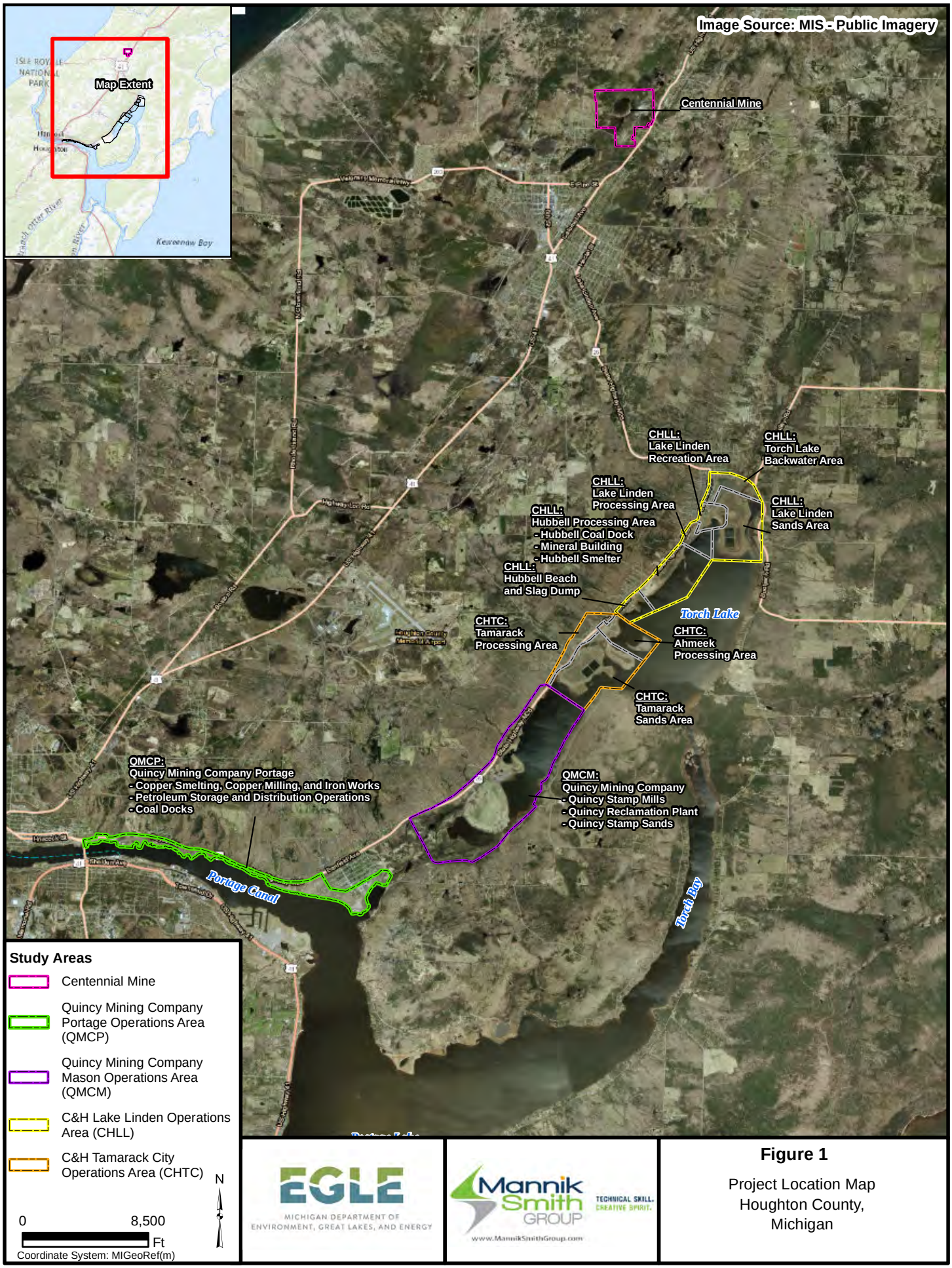

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Figure 1

Project Location Map
Houghton County,
Michigan

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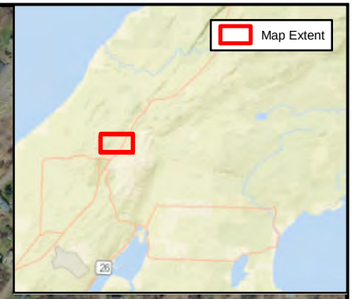
Image Source: MIS - Public Imagery



North Houghton County Sewer Authority
002-062-001-60

Ferrell Gas LP
002-062-001-52

Heltunen Rentals LLC
002-062-001-51

Charter Township of Calumet
002-062-001-48

Homer F Perreault
002-062-001-68

RAM Opportunities LLC
002-062-001-67

REL Machine Inc.
002-062-001-65

SW-06
SD-06
SW-1 (2004 BEA)
SW-05
SD-05
SD-04
SW-04
SS-09
SB-1 (2004 BEA)
SB-05
TMW-05
SS-1 (2007 BEA)
SS-10
GW-1
SB-06
TMW-06
SW-2 (2004 BEA)
SW-03
SD-03
SS-08
SS-3 (2007 BEA)
SB-3
SB-1 (2008 BEA)
SB-2 (2008 BEA)
Slag in Barrels
Oil Barrel - Sample I
Oil Barrel - Sample II
SB-04
TMW-04
Note: unknown locations, generic sample location is depicted
SS-07
SW-02
SD-02
SB-02
SS-06
TMW-02
SB-03
TMW-03
SW-01
SD-01
SB-2 (2004 BEA)
SS-03
SS-04
SS-2 (2007 BEA)
WASTE-01
SS-02
TMW-01
SS-05
SB-01
SS-01

1 Stamp Mill
2 Coal Storage Area
3 Scale House
4 Oil House
5 Dry House
6 Tailings/Dewatering Pond
7 No. 1 Shaft
8 No. 1 Rock House
9 No. 1 Engine House
10 No. 2 Shaft House
11 No. 3 Shaft House
12 No. 3 Hoist House
13 No. 3 Engine House
14 No. 3 Rock House
15 Mill Building
16 No. 4 Shaft House
17 No. 4 Rock House
18 No. 4 Engine House
19 Compressor
20 No. 4 Boiler House
21 Blacksmith/Machine Shop
22 Carpenter Shop
23 No. 6 Shaft House
24 No. 6 Rock House
25 No. 6 Engine House
26 No. 6 Boiler House
27 No. 6 Hoist House
28 Office/Employee Building
29 Vent Raise Building
30 Rock Bin
31 Slurry Tank(s)

Identified Mining Era Buildings and Structures

Historic Sample Locations -

- Groundwater
- Surface Soil
- Soil Boring
- Surface Water
- Sediment
- Waste
- Mining Era Buildings and Structures
- Approximate Site Boundary

Property Owner

- Charter Township of Calumet
- Ferrell Gas LP
- Heltunen Rentals, LLC
- Homer F. Perreault
- North Houghton County Sewer
- RAM Opportunities, LLC
- REL Machine Inc.

N

0 600 Ft

Coordinate System: MIGeoRef(m)

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Figure 2

Area Features Map
Centennial Mine
Houghton County, Michigan

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Image Source: MIS - Public Imagery

Map Extent

Identified Mining Era Buildings and Structures
1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

DATA SOURCES

Sample IDs	Date Range
1) **SS-/SB-...**	**October 2012**

-MDEQ. *Site Inspection Report for Centennial Mine* June 10, 2014.

2) **SB...**	**January 2007**

-STS. *Baseline Environmental Assessment.*

3) **SB...**	**March 2004**

-Equity Resource Environmental. *Baseline Environmental Assessment.*

4) **SS010507-...**	**January 2007**

-Equity Resource Environmental. *Calumet Township & North Houghton County Water & Sewage Authority Baseline Environmental Assessment.*

SS-09 10/9/2012
(0-6 in)
CYANIDE 0.13 J [2]

SS-10 10/9/2012
(0-6 in)
MERCURY 0.032 J- [18]

SB-3 3/22/2004 (2004 BEA)
(6-12 ft)
ARSENIC 12 [10]
COPPER 30,000 [10]

SS-07 10/9/2012
(0-12 in)
MERCURY 0.05 J- [18]
CYANIDE 0.16 J [2]

SS-06 10/9/2012
(0-12 in)
MERCURY 0.077 J- [18,19]

SB-03 10/9/2012
(22-36 in)

MERCURY	0.1 J	[18,19]
MERCURY (DUP)	0.095 J-	[18,19]
CYANIDE	0.19 J	[2]

SB-02 10/9/2012
(25-39 in)
MERCURY 0.071 J- [18,19]

SS-03 10/9/2012
(0-3 in)

ARSENIC	39.1 J-	[10,17]
ARSENIC (DUP)	33.5 J-	[10]
COPPER	751,000	[9,10,16,17]
COPPER (DUP)	802,000	[9,10,16,17]
MERCURY	0.32	[18,19]
MERCURY (DUP)	0.39	[18,19]
CYANIDE	0.47 J	[2]
CYANIDE (DUP)	0.66	[2]

SS-05 10/9/2012
(0-3 in)
MERCURY 0.27 [18,19]
CYANIDE 0.22 J [2]

SS-01 10/9/2012
(0-12 in)
MERCURY 0.21 [18,19]
CYANIDE 0.23 J [2]

SB-1 (2008 BEA) 1/7/2008
(8-10 ft)
MERCURY 0.066 [18]

SB-2 (2008 BEA) 1/8/2008
(4-6 ft)
MERCURY 0.061 [18]

SB-06 10/9/2012
SB-1 3/22/2004
SB-05 10/9/2012
SS010507-01 1/5/2007
SS-08 10/9/2012
SS010507-03 1/5/2007
SB-04 10/9/2012
SS-04 10/9/2012
SB-2 3/22/2004
SS-02 10/9/2012
SS010507-02 1/5/2007
SB-01 10/9/2012

EGLE 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
Media-Specific Volatilization to Indoor Air Interim Action Screening Levels (March 2021)
[18]=Soil Residential MSSL
[19]=Soil Non-Residential MSSL
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only
Evaluation based on EGLE Criteria at time of Project completion.

PCBs / VOCs — Inorganics / Cyanide / SVOCs

- At Least One Exceedance for Indicated Parameter Group
- No Exceedances for Indicated Parameter Group
- At Least One Detection of PCBs
- PCBs Not Detected
- Indicated Parameter Group Not Analyzed

Mining Era Buildings and Structures
Approximate Site Boundary

Notes:
- ft = Feet
- in = Inches
- J = Estimated value
- J- = Estimated value biased low
- PCBs = Polychlorinated Biphenyls
- VOCs = Volatile Organic Compounds
- SVOCs = Semi-Volatile Organic Compounds
- Results are in milligram per kilogram (mg/kg).

N
0 500 Ft
Coordinate System: MIGeoRef(m)

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Figure 3

Soil Analytical Results
Centennial Mine
Houghton County, Michigan

FILE: W:\Projects\Projects A-E\EGLE\0016\ENGAPPS\GIS\mxds\Fig3_HistoricSoil_v20220322.mxd 11:03:39 AM, 3/22/2022 AMiller

Image Source: MIS - Public Imagery

Map Extent

TMW-06
10/9/2012

TMW-05
10/10/2012

GW-1
3/22/2004

TMW-04
10/10/2012

TMW-03
10/9/2012

TMW-02
10/9/2012

TMW-2
1/9/2008

TMW-1
1/9/2008

TMW-01
10/10/2012

Identified Mining Era Buildings and Structures
1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

DATA SOURCES

Sample IDs	Date Range
1) **TMW-...**	**October 2012**

-MDEQ. *Site Inspection Report for Centennial Mine* June 10, 2014.

2) **TMW-...**	**January 2008**

-STS. *Baseline Environmental Assessment.*

3) **GW...**	**March 2004**

-Equity Resource Environmental. *Baseline Environmental Assessment.*

PCBs / VOCs — Inorganics / Cyanide / SVOCs

- At Least One Exceedance for Indicated Parameter Group
- No Exceedances for Indicated Parameter Group
- At Least One Detection of PCBs
- PCBs Not Detected
- Indicated Parameter Group Not Analyzed

Mining Era Buildings and Structures

Approximate Site Boundary

Notes:
- PCBs = Polychlorinated Biphenyls
- VOCs = Volatile Organic Compounds
- SVOCs = Semi-Volatile Organic Compounds

N

0 500 Ft

Coordinate System: MIGeoRef(m)

EGLE Part 201 Cleanup Criteria for Response Action
[1]*=Residential Drinking Water Criteria
[2]*=Nonresidential Drinking Water Criteria
[3]*=Groundwater Surface Water Interface Criteria
[4]=Residential Groundwater Vol to Indoor Air Inhalation
[5]=Nonresidential Groundwater Vol to Indoor Air Inhalation
[6]=Water Solubility
[7]=Flammability and Explosivity Screening Level

Volatilization to Indoor Air Interim Action Screening Levels (Aug 2017)
[8]=Shallow Groundwater Residential RIASL
[9]=Shallow Groundwater Non-Residential RIASL
[10]=Groundwater Residential RIASL
[11]=Groundwater Residential TSRIASL
[12]=Groundwater Non-Residential RIASL
[13]=Groundwater Non-Residential $RIASL_{12}$
[14]=Groundwater Non-Residential $TSRIASL_{12}$
* Exceedances of criteria 1, 2, and 3 are shown for organics only
Evaluation based on EGLE Criteria at time of Project completion.

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Figure 4

Groundwater Analytical Results
Centennial Mine
Houghton County, Michigan

FILE: W:\Projects\Projects A-E\EGLE\0016\ENGAPP\GIS\mxds\Fig4_HistoricGW_v20220321.mxd 3:16:50 PM, 3/21/2022 AMiller

Image Source: MIS - Public Imagery

Map Extent

Identified Mining Era Buildings and Structures
1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

Oil in Barrel - Sample II
6/6/2012

Rope Oil from 2 Barrels
(3-A, 3-B)
6/6/2012

Slag in Barrels
(S-1,S-2,S-3)
6/6/2012

Oil in Barrel - Sample I
6/6/2012

Slag in Barrels
(S-1,S-2,S-3) - TCLP
6/6/2012

WASTE-01
10/9/2012

DATA SOURCES

Sample IDs	Date Range
1) **TMW-...**	**October 2012**

-MDEQ. *Site Inspection Report for Centennial Mine* June 10, 2014.

2) **Oil/Slag/Rope Oil-... June 2012**

-EPA. *Centennial Mine - Closure of Referral.*

PCBs / VOCs — Inorganics / Cyanide / SVOCs

- At Least One Exceedance for Indicated Parameter Group
- No Exceedances for Indicated Parameter Group
- At Least One Detection of PCBs
- PCBs Not Detected
- Indicated Parameter Group Not Analyzed

Mining Era Buildings and Structures

Approximate Site Boundary

Notes:
- PCBs = Polychlorinated Biphenyls
- RPM = Residual Processing Material
- VOCs = Volatile Organic Compounds
- SVOCs = Semi-Volatile Organic Compounds

N

0 500 Ft

Coordinate System: MIGeoRef(m)

EGLE 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
Media-Specific Volatilization to Indoor Air Interim Action Screening Levels (March 2021)
[18]=Soil Residential MSSL
[19]=Soil Non-Residential MSSL
Title 40 CFR, Chapter 1, Section 261.20-24
[20]=Hazardous Waste Toxicity Screening Values
* Exceedances of criteria 2, 4, and 11 shown for organics and cyanide only
Evaluation based on EGLE Criteria at time of Project completion.

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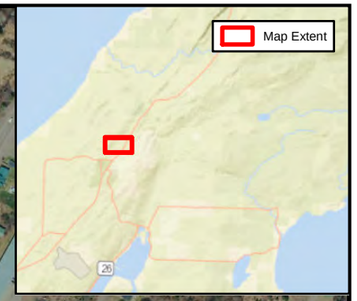
Figure 5

RPM, Abandoned Container, and Waste Analytical Results
Centennial Mine
Houghton County, Michigan

FILE - W:\Projects\Projects A-E\EGLE\E0016\ENGAPP\SIG\SIMXDS\Fig5_HistoricWaste_v20220321.mxd 3:47:04 PM, 3/21/2022 AMiller

Image Source: MIS - Public Imagery



Identified Mining Era Buildings and Structures
1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

DATA SOURCES

Sample IDs	Date Range
1) **XRF...**	**October 2012**

-MDEQ. *Site Inspection Report for Centennial Mine* June 10, 2014.

Locations Screened for Metals -
At least one exceedance of:

- Residential Soil Direct Contact Criteria
- Residential Particulate Soil Inhalation Criteria
- Nonresidential Soil Direct Contact Criteria
- Nonresidential Particulate Soil Inhalation Criteria
- Screening Location with No Exceedances
- Mining Era Buildings and Structures
- Approximate Site Boundary

N

0 500 Ft

Coordinate System: MIGeoRef(m)

EGLE Part 201 Cleanup Criteria for Response Action
[9]=Residential Particulate Soil Inhalaltion Criteria
[10]=Residential Direct Contact Criteria
[16]=Nonresidential Particulate Soil Inhalation Criteria
[17]=Nonresidential Direct Contact Criteria
Evaluation based on EGLE Criteria at time of Project completion.

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Figure 6

XRF Field Screening
Centennial Mine
Houghton County, Michigan

FILE: W:\Projects\Projects A-E\EGLE\E0016\ENGAPP\GIS\mxds\Fig6_XRF_FieldScreening_v20220321.mxd 4:04:33 PM 3/21/2022 AMiller

Image Source: MIS - Public Imagery

SD-03 10/10/2012
(0-6 in)

BARIUM	59.5 J	mg/kg [SED1]
BARIUM (DUP)	60.2 J	mg/kg [SED1]
COPPER	954 J	mg/kg [SED1,SED2,SED3]
COPPER (DUP)	938 J	mg/kg [SED1,SED2,SED3]
IRON	28,000	mg/kg [SED1]
IRON (DUP)	26,600	mg/kg [SED1]
MANGANESE	507 J	mg/kg [SED1]
MANGANESE (DUP)	475 J	mg/kg [SED1]
NICKEL	68.5 J	mg/kg [SED1,SED2,SED3]
NICKEL (DUP)	64.2 J	mg/kg [SED1,SED2,SED3]
SELENIUM	3.6	mg/kg [SED1]
SELENIUM (DUP)	3.5	mg/kg [SED1]
SILVER	2.8 J	mg/kg [SED1]
SILVER (DUP)	2.7 J	mg/kg [SED1]

SD-06 10/10/2012
(0-24 in)

ARSENIC	11	mg/kg [SED1,SED2]
BARIUM	71.7 J	mg/kg [SED1]
COPPER	1,630 J	mg/kg [SED1,SED2,SED3]
MANGANESE	731 J	mg/kg [SED1]
MERCURY	0.22	mg/kg [SED1,SED2]
SELENIUM	5.7	mg/kg [SED1]
SILVER	4.8 J	mg/kg [SED1]
ZINC	129 J	mg/kg [SED1,SED2]

SW-06 10/10/2012
(unknown depth)

COPPER	10.8 J	ug/l [GW03,SW01,SW02,SW06,SW07]
IRON	1,980 J	ug/l [GW01,GW02,SW01]
LEAD	2.5 J	ug/l [SW01]
MANGANESE	378	ug/l [GW01,GW02,SW01]
SILVER	0.7 J	ug/l [GW03,SW06,SW07]

SW-03 10/10/2012
(unknown depth)

COPPER	60.6	ug/l [GW03,SW01,SW02,SW06,SW07,SW08]
COPPER (DUP)	41.7	ug/l [GW03,SW01,SW02,SW06,SW07,SW08]
LEAD (DUP)	12.8	ug/l [GW01,GW02,SW01]
SELENIUM (DUP)	7.7 J	ug/l [SW01,SW06]
SILVER (DUP)	0.76 J	ug/l [GW03,SW06,SW07]

SW-1
3/22/2004

SW-04 10/10/2012
(unknown depth)

COPPER	7.3 J	ug/l [GW03,SW01,SW06,SW07]
IRON	902 J	ug/l [GW01,GW02]

SW-2 (2004 BEA) 3/22/2004
(unknown depth)

LEAD	3	ug/l [SW01]

SD-04 10/10/2012
(0-8 in)

BARIUM	102 J	mg/kg [SED1]
COPPER	53.6 J	mg/kg [SED1,SED2]
SILVER	1.4 J	mg/kg [SED1]

SD-02 10/10/2012
(1-4 in)

CHROMIUM	49.3 J	mg/kg [SED1,SED2]
COPPER	1,910 J	mg/kg [SED1,SED2,SED3]
IRON	47,600	mg/kg [SED1]
MANGANESE	491 J	mg/kg [SED1]
NICKEL	55.7 J	mg/kg [SED1,SED2,SED3]
SILVER	7.9 J	mg/kg [SED1]

SW-02 10/10/2012
(unknown depth)

COPPER	61.3	ug/l [GW03,SW01,SW02,SW06,SW07,SW08]

SD-05 10/10/2012
(0-8 in)

CHROMIUM	50.1 J	mg/kg [SED1,SED2]
COPPER	214 J	mg/kg [SED1,SED2,SED3]
IRON	29,000	mg/kg [SED1]
MANGANESE	461 J	mg/kg [SED1]
NICKEL	88.5 J	mg/kg [SED1,SED2,SED3]
SILVER	2.6 J	mg/kg [SED1]
ZINC	265 J	mg/kg [SED1,SED2]

SD-01 10/10/2012
(1-4 in)

BARIUM	36.5 J	mg/kg [SED1]
COPPER	374 J	mg/kg [SED1,SED2,SED3]
IRON	20,900	mg/kg [SED1]
NICKEL	31.6 J	mg/kg [SED1,SED2]
SELENIUM	3.3 J	mg/kg [SED1]
SILVER	2.2 J	mg/kg [SED1]
ZINC	151 J	mg/kg [SED1,SED2]

SW-05 10/10/2012
(unknown depth)

COPPER	6.4 J	ug/l [GW03,SW01,SW06]
IRON	807 J	ug/l [GW01,GW02]

SW-01 10/10/2012
(unknown depth)

COPPER	25.4	ug/l [GW03,SW01,SW02,SW06,SW07,SW08]
IRON	751 J	ug/l [GW01,GW02]
MANGANESE	138	ug/l [GW01,GW02,SW01]
ZINC	62.9 J+	ug/l [GW03,SW07]

Map Extent

Identified Mining Era Buildings and Structures
1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

DATA SOURCES

Sample IDs	Date Range
1) **SW/SD-0#...**	**October 2012**
-MDEQ. *Site Inspection Report for Centennial Mine*	
2) **SW-1/SW-2...**	**March 2004**
-Equity Resource Environmental. *Baseline Environmental Assessment.*	

PCBs / VOCs / Inorganics / Cyanide / SVOCs

- At Least One Exceedance for Indicated Parameter Group
- No Exceedances for Indicated Parameter Group
- At Least One Detection of PCBs
- PCBs Not Detected
- Indicated Parameter Group Not Analyzed

Mining Era Buildings and Structures
Approximate Site Boundary

Notes:
- in = Inches
- J = Estimated value
- J+ = Estimated value biased high
- ug/l = micrograms per liter
- mg/kg = milligrams per kilogram
- PCBs = Polychlorinated Biphenyls
- VOCs = Volatile Organic Compounds
- SVOCs = Semi-Volatile Organic Compounds

N
0 500 Ft
Coordinate System: MIGeoRef(m)

EGLE Part 201 Cleanup Criteria for Response Action
[SED1]=Sediment Ecological Screening Level (EPA Region IV)
[SED2]=Threshold Effect Concentration (TEC)
[SED3]=Probable Effect Concentration (PEC)
[GW01]=Residential Drinking Water Criteria
[GW02]=Nonresidential Drinking Water Criteria
[GW03]=Groundwater Surface Water Interface Criteria
[SW01]=Surface Water Ecological Screening Level - Chronic (EPA Region IV)
[SW02]=Surface Water Ecological Screening Level - Acute (EPA Region IV)
[SW03]=Surface Water Rule 57 HNV Drink
[SW04]=Surface Water Rule 57 HCV Drink
[SW05]=Surface Water Rule 57 WV
[SW06]=Aquatic Life Values Rule 57 FCV
[SW07]=Aquatic Life Values Rule 57 AMV
[SW08]=Aquatic Life Values Rule 57 FAV
Evaluation based on EGLE/EPA Criteria at time of Project completion.

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Figure 7

Surface Water and Sediment Analytical Results
Centennial Mine
Houghton County, Michigan

FILE: W:\Projects\Projects A-E\EGLE\0016\ENGAPP\SG\S\mxds\Fig7_HistoricSW_SED_v20220321.mxd 4:40:10 PM, 3/21/2022 AMiller

Image Source: MIS - Public Imagery

Identified Mining Era Buildings and Structures

1. Stamp Mill
2. Coal Storage Area
3. Scale House
4. Oil House
5. Dry House
6. Tailings/Dewatering Pond
7. No. 1 Shaft
8. No. 1 Rock House
9. No. 1 Engine House
10. No. 2 Shaft House
11. No. 3 Shaft House
12. No. 3 Hoist House
13. No. 3 Engine House
14. No. 3 Rock House
15. Mill Building
16. No. 4 Shaft House
17. No. 4 Rock House
18. No. 4 Engine House
19. Compressor
20. No. 4 Boiler House
21. Blacksmith/Machine Shop
22. Carpenter Shop
23. No. 6 Shaft House
24. No. 6 Rock House
25. No. 6 Engine House
26. No. 6 Boiler House
27. No. 6 Hoist House
28. Office/Employee Building
29. Vent Raise Building
30. Rock Bin
31. Slurry Tank(s)

Map Extent

0 300 Feet

Coordinate System: MIGeoRef(m)

Observation Features

- Abandoned Container
- Abandoned Container and Residual Process Material
- Abandoned Container, Residual Process Material, and Suspect Asbestos Containing Material
- Residual Process Material
- Residual Process Material and Suspect Asbestos Containing Material
- Suspect Asbestos Containing Material

Observation Features

- Residual Process Material
- Recon_Area_20230629
- Mining Era Buildings and Structures
- Approximate Site Boundary

23 - Indicates Observation Number

N

0 1,000 Feet

Coordinate System: MIGeoRef(m)

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Figure 8

Preliminary Reconnaissance Observations 2022 and 2023
Centennial Mine
Houghton County, Michigan

FILE - \\nsrfilesvr\MSGData\Projects\Projects A-E\EGLE\0016\ENGAPPS\GIS\mxds\Fig8_Prelim_Recon_Obs_2022_v20240311.mxd 4:06:49 PM 3/11/2024 ABertanelle

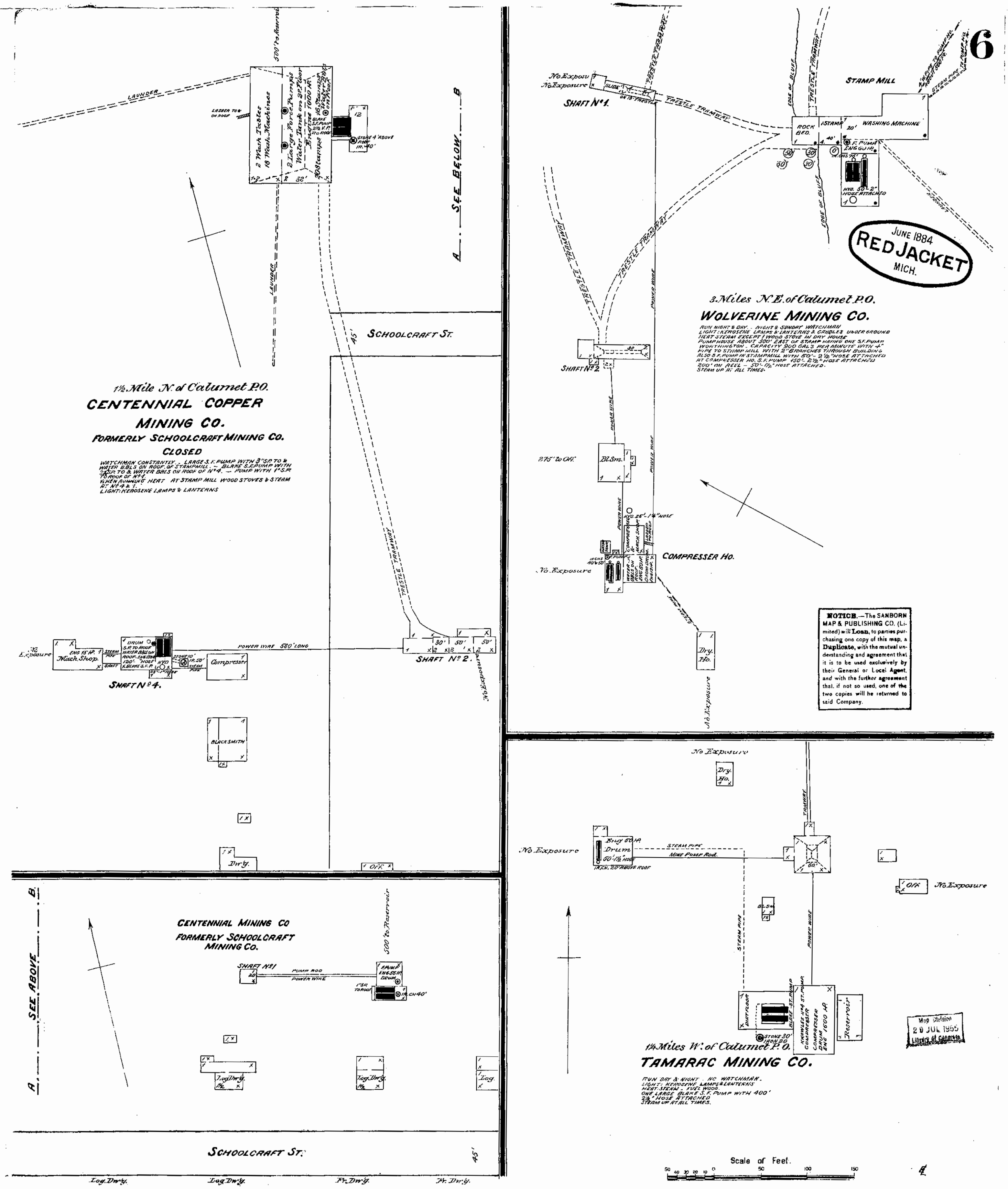
TABLES

Table 1
Preliminary Reconnaissance Observations 2022 and 2023
Centennial Mine Site
Centennial Mine
Houghton County, Michigan

Observation Number:	Description:
014	Dead pine trees at the end of a rock pile wall which has two concrete footings at the terminal end of wall pile.
015	Rusty colored surface water near wetland and old steel structure which is surrounded by barbed wire fence. Some sheen on water as well
016	Rusty empty 55-gal drum with holes from bullets. Near edge of pond
017	30x30 inch crates that have boxes in them. 7 boxes total, they resemble blasting boxes for mining, but not certain.
018	Three 1 inch steel pipes leading from property to pond. Unknown purpose or whether they are connected to anything or not.
019	3 55-gal drums, one is a carcass with holes, the other two are partially buried and could contain liquids. Three pipes and or hoses with insulation which potentially contains asbestos.
020	55-gal drum partially buried near edge of pond.
021	Asbestos containing building materials, siding, roofing, flooring, hose and pipe insulation, 3 tires, two 55-gal drum carcasses. Lots of wooden debris.
022	55-gal drum on side rusted with holes but could still contain material
023	Hoses, gaskets, and other materials suspect asbestos containing
024	11 Keweenaw copper 55-gal blue poly drums with water and soil in the ones that are open to atmosphere.
025	Approximately 500-gallon ast
026	55-gal drum carcass
027	3 55-gal drum carcasses with sheet metal partially buried. 2 inch steel pipe leading from ditch to drums also.
028	3 inch pipe soft with even spaced 1/2 inch perforations
031	Roof shingle pieces
032	Scrap pieces of white SACM
033	Coal scattered on ground surface
034	Rusty pieces of metal on ground surface- possibly from a drum
035	Remnant structure
036	Intact concrete foundation wall approx. 3.5 feet high and approx. 15 feet long. Stone wall and additional structure remnants located nearby. Located on mounded ground.
037	Possible drum remnant by old stone wall at observation 36.
038	Two pieces of a possible metal container of unknown origin. No contents.
039	2 empty can of spray paint and 1 empty container of mole/gopher killer
040	Estimated 800-900 square feet
041	Pile of poor rock (basalt) approx. 10-15 feet high.
042	Area of ground with apparent tailings, much appears to be covered with vegetation
043	Area of ground with thin cover of tailings at surface
044	Four abandoned tires
045	Tailings area
046	Abandoned oil filter
047	Large area with reddish tailings visible at surface. Portions are under water.
048	Partial drum remnant (empty, rusty, no visible markings); steel pipe sticking out of ground; valve controller on ground, steel pipe in ground. Origins unknown.
049	Rusty steel pipe on ground by rock pile and area of running water. Approximately 10 feet visible. Can't see north end
050	Shingle fragment in road.
051	Debris pile
052	15 abandoned 30 lb 1,1,1,2 tetrafluorethane tanks.
053	Rusted 55-gallon drum carcass.
054	Abanonded metal paint thinner container. Approximately 0.5 gallons.
055	Abandoned 1 gallon metal paint can.
056	Abandoned metal container. Approximately 0.5 gallons.
057	Abandoned container of joint compound. 5 gallons.
058	Abandoned piping. Approximately 10 feet total.
059	Electrical insulators.
060	Electrical lines. 40 feet total.
061	Abandoned discharge pipe. 10 feet.
062	Abandoned discharge pipes. 50 feet total.
063	Abandoned metal container.

APPENDIX A

SANBORN MAPS


6
1½ Mile N. of Calumet P.O.
CENTENNIAL COPPER MINING CO.
FORMERLY SCHOOLCRAFT MINING CO.
CLOSED
WATCHMAN CONSTANTLY. - LARGE S.F. PUMP WITH 3" S.P. TO & WATER B.BLS ON ROOF OF STAMPMILL. - BLAKE S.F. PUMP WITH 2" S.P. TO & WATER BBLS ON ROOF OF Nº4. - PUMP WITH 1" S.P. TO ROOF OF Nº1.
WHEN RUNNING HEAT AT STAMP MILL WOOD STOVES & STEAM AT Nº 4 & 1.
LIGHT: KEROSENE LAMPS & LANTERNS
LAUNDER
2 Wash Tables
18 Wash Machines
2 Large Force Pumps
Water Tank on 2d Floor
Engine 1000 H.
20 Stamps
SEE BELOW
Schoolcraft St.
Shaft Nº 4.
Mach. Shop.
Compressor
Blacksmith
Dry.
Off.
Shaft Nº 2.
Trestle Tramway
Power Wire 580' Long
CENTENNIAL MINING CO
FORMERLY SCHOOLCRAFT MINING CO.
Shaft Nº1
Pump Rod
Power Wire
500' to Reservoir
SEE ABOVE
Log Dwg.
Fr. Dwg.
3 Miles N.E. of Calumet P.O.
WOLVERINE MINING CO.
RUN NIGHT & DAY. - NIGHT & SUNDAY WATCHMAN
LIGHT: KEROSENE LAMPS & LANTERNS & CANDLES UNDERGROUND
HEAT STEAM EXCEPT 1 WOOD STOVE IN DRY HOUSE
PUMPHOUSE ABOUT 500' EAST OF STAMP HAVING ONE S.F. PUMP WORTHINGTON - CAPACITY 900 GAL'S PER MINUTE WITH 4" PIPE TO STAMP MILL WITH 2" BRANCHES THROUGH BUILDING
ALSO S.F. PUMP IN STAMPMILL WITH 50' - 2½" HOSE ATTACHED
AT COMPRESSER HO. S.F. PUMP 150' - 2½" HOSE ATTACHED
200' ON REEL - 50' - 1½" HOSE ATTACHED.
STEAM UP AT ALL TIMES.
Stamp Mill
Washing Machine
Rock Bed.
Shaft Nº1.
Shaft Nº2
Trestle Tramway
Edge of Bluff
Compresser Ho.
Bl.Sm.
Dry Ho.
No Exposure
JUNE 1884
RED JACKET
MICH.
NOTICE.—The SANBORN MAP & PUBLISHING CO. (Limited) will Loan, to parties purchasing one copy of this map, a Duplicate, with the mutual understanding and agreement that it is to be used exclusively by their General or Local Agent, and with the further agreement that, if not so used, one of the two copies will be returned to said Company.
Tramway
Steam Pipe
Mine Pump Rod
Power Wire
Off.
Dirt Floor
Blake St. Pump
Knowles Nº4 St. Pump
Compresser
Drum
Eng 1600 H.P.
Reservoir
Stone 30'
Iron 20
1¼ Miles W. of Calumet P.O.
TAMARAC MINING CO.
RUN DAY & NIGHT. NO WATCHMAN.
LIGHT: KEROSENE LAMPS & LANTERNS
HEAT: STEAM - FUEL WOOD.
ONE LARGE BLAKE S.F. PUMP WITH 400' 2½" HOSE ATTACHED
STEAM UP AT ALL TIMES.
Scale of Feet.
50 40 30 20 10 0 50 100 150
Map Division
20 JUL 1955
Library of Congress

11 SHEETS.

1

RED JACKET MICH.

SANBORN MAP & PUBLISHING CO., LIMITED
117 & 119 Broadway
NEW YORK

Population 5000.
7 Steam & No Hand Engine
3 Independent Hose Carts
Water Facilities SEE NOTE.

Prevailing Winds N.E. & S.W.

RED JACKET MICH.
JULY 1888.
SCALE 50 FT. TO AN INCH.

WATER WORKS. IN CONNECTION WITH HECLA & CALUMET MINING CO'S TOWER SYSTEM. IR. TOWER, 4' DIA. 100' HIGH. 1/4 MILE E. OF FRONT ST. PUMP'G WKS 1/2 MILE NE. OF COR PINE & " " CONSISTING OF 1 COMPOUND WORTHINGTON STEAM F. PUMP. & 1 LEVETT ST. F. PUMP COMBINED CAP. 3,000,000 GALS PER 24 HOURS 17" MAIN TO TOWER ALWAYS 34' (67,000 GALS) WATER IN TOWER. 12 D. HYDS. 7 LARGE FIRE CISTS. 2300' 2½" HOSE.

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S

Scott, 3
Seventh, 2 & 3
Sixth, 2 & 3

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Centennial Copper Mining Co., 6
Central Mining Co., 9
Commercial Hotel, 3
Conglomerate Mining Co., 7
Copper Falls Mining Co., 10

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SHEET

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J

James, J., Bottling Works, 2

K

Kearsarge Mining Co., 6

L

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M

Masonic Building, 3

N

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O

Osceola Consol. Mining Co., 5

P

Peninsular Mining Co., 10
Phœnix Copper Co., 4
Public School, 2

R

Railroad Depot, 3
Ryan Block, 3

S

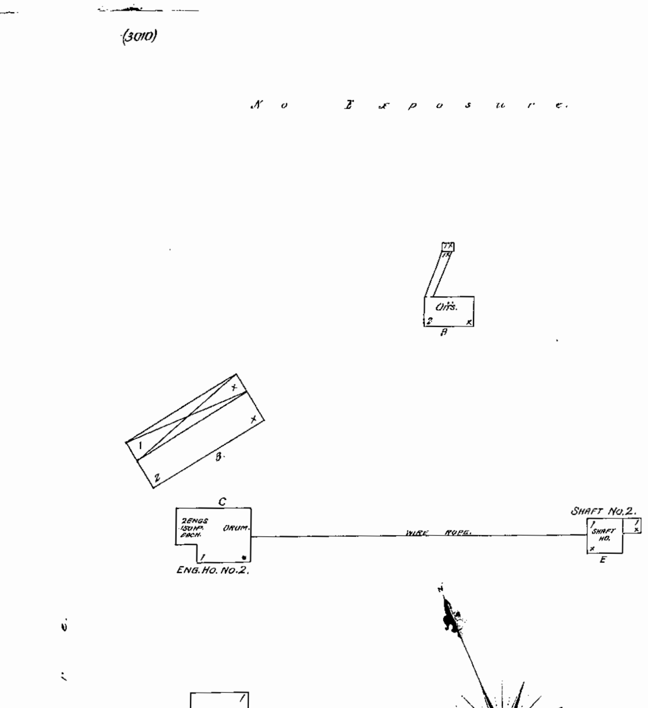
St. Claire Copper Co., 4

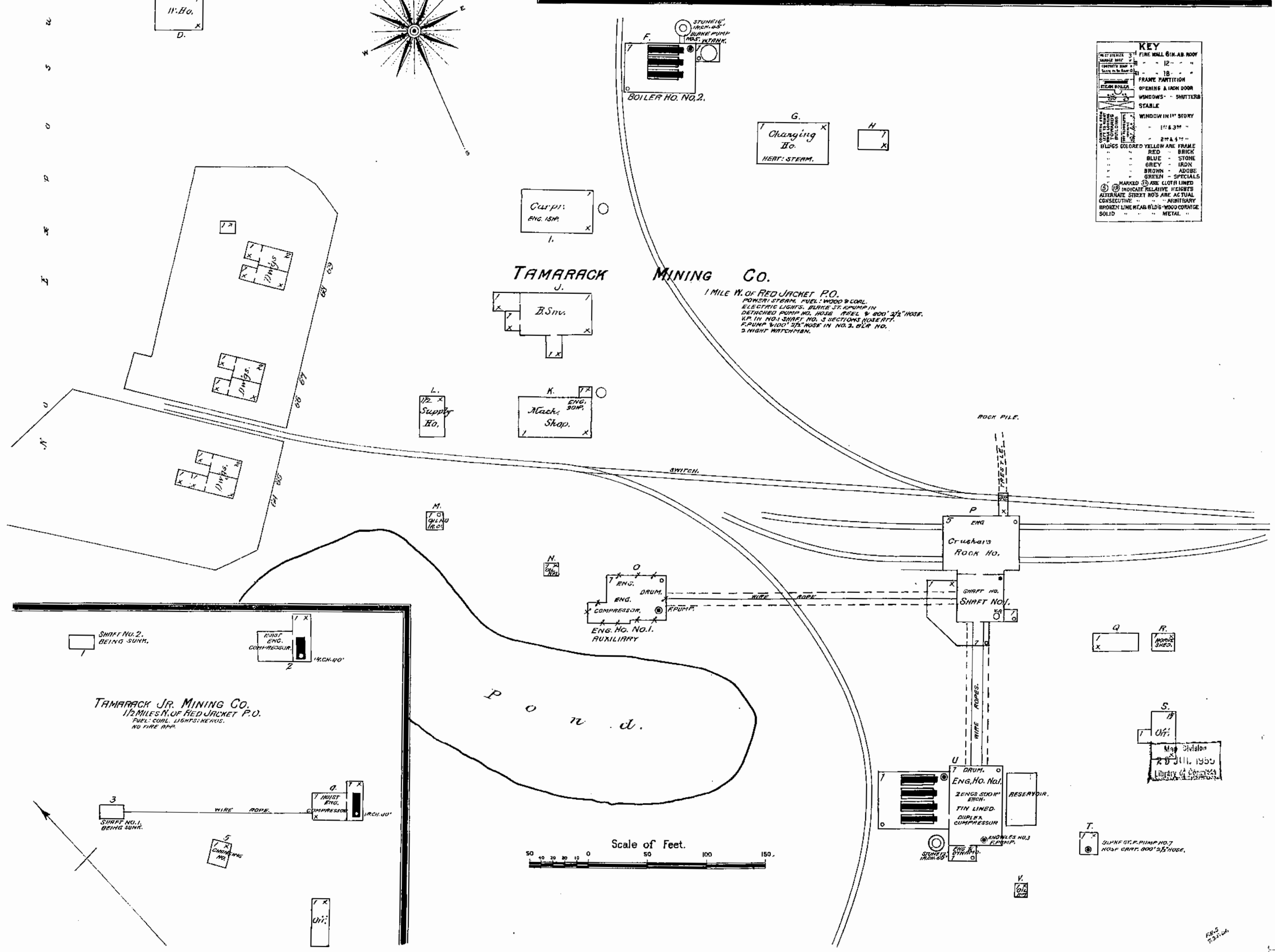
T

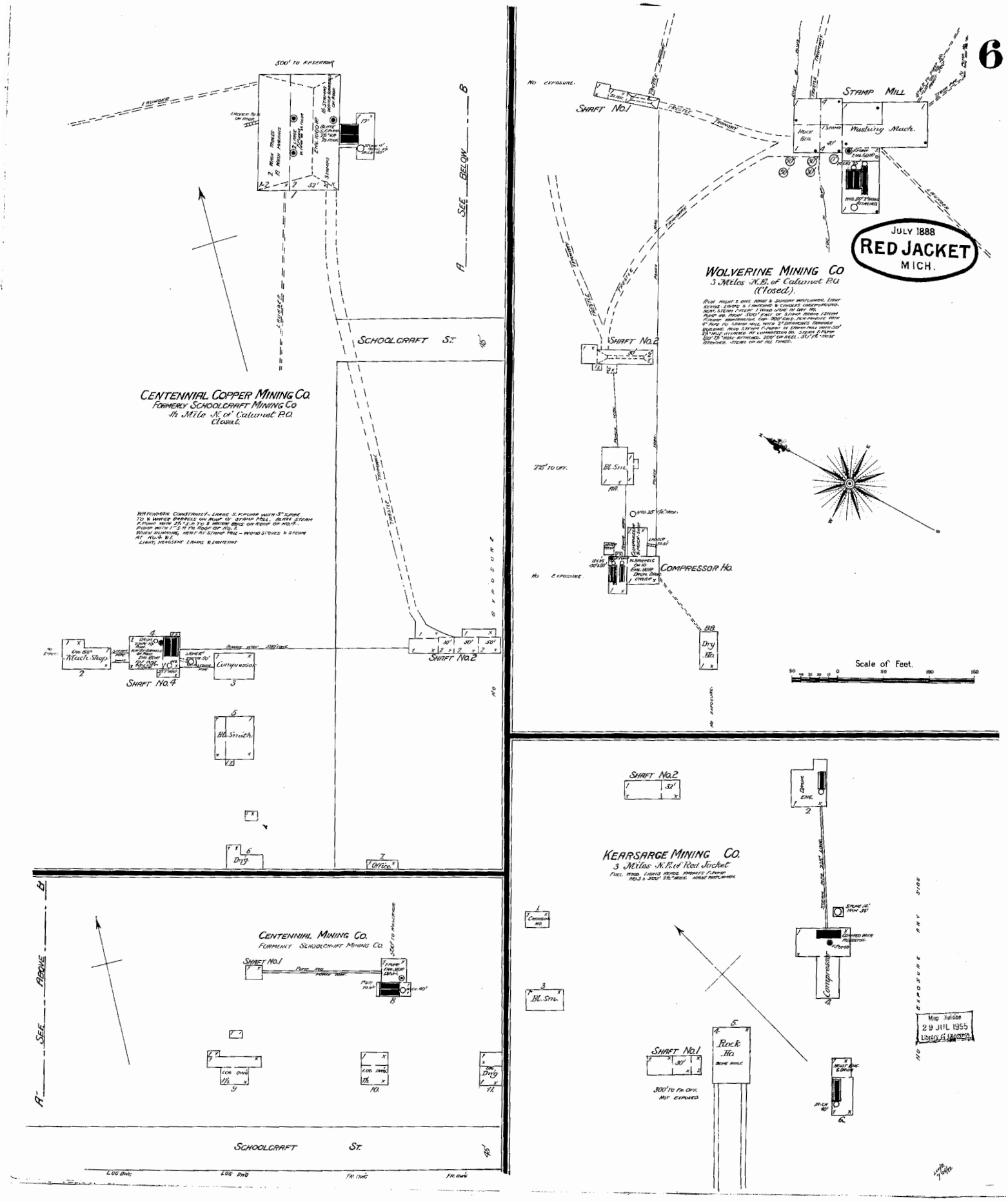
Tamarack Mining Co., 1
" Jr., Mining Co., 1
Town Hall, 2

W

Watson & Wall, "Allouez Store", 8
Wolverine Mining Co., 5






JULY 1888
RED JACKET
MICH.
CENTENNIAL COPPER MINING CO.
FORMERLY SCHOOLCRAFT MINING CO
1/4 MILE N. OF CALUMET P.O.
CLOSED.
WOLVERINE MINING CO
3 MILES N.E. of Calumet P.O.
(Closed).
KEARSARGE MINING CO.
3 MILES N.E. of Red Jacket
CENTENNIAL MINING CO.
FORMERLY SCHOOLCRAFT MINING CO.
SCHOOLCRAFT ST.
SHAFT No.1
SHAFT No.2
SHAFT No.4
STAMP MILL
COMPRESSOR Ho.
Mech. Shop
Blk. Smith
Dry
Office
Rock Ho.
Scale of Feet.
SEE ABOVE
SEE BELOW
NO EXPOSURE
Map Division
29 JUL 1955
Library of Congress

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" "YELLOW JACKET," see Sheet 6.

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" " "	400-524	*3
" " "	401-525	*2
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"	W. " "	5
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"	200-357	4
"	400-525	2
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"	400-525	2
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J	
Jacka Block,	4
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Jewell Hotel,	4
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Lyon, T., Lumber Yard,	8
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Masonic Hall,	5
Miller's Beer Depot,	4
M. R. R. R. Depot,	4
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New York Hotel,	2
O	
Osceola Consol. Mining Co.,	10 & 11
P	
Pabst Beer Depot,	4
Peninsular Mining Co.,	16
Phœnix Copper Co.,	14
Polish Church,	4
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Ryan Block,	4
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St. Claire Copper Co.,	14
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Tamarack Co-operative Association,	7
" Mining Co.,	7 & 11
" Jr., Mining Co.,	5
Torch Lake Brewing Co.'s Beer Depot,	9
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W	
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Wolverine Mining Co.,	12

* Indicates only one side of Street shown.

(6567)
17 SHEETS

Red Jacket

HOUGHTON CO. MICHIGAN

Sanborn-Perris Map Co. Limited
115 BROADWAY New York
SEPT. 1893

Scale 50 Ft. to an Inch

Population

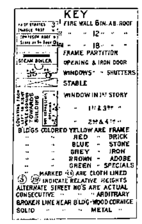
of Red Jacket, Blue Jacket, Yellow Jacket, Calumet, Calumet Village, Hecla, Newtown, Swedetown & Raymbault Town, combined

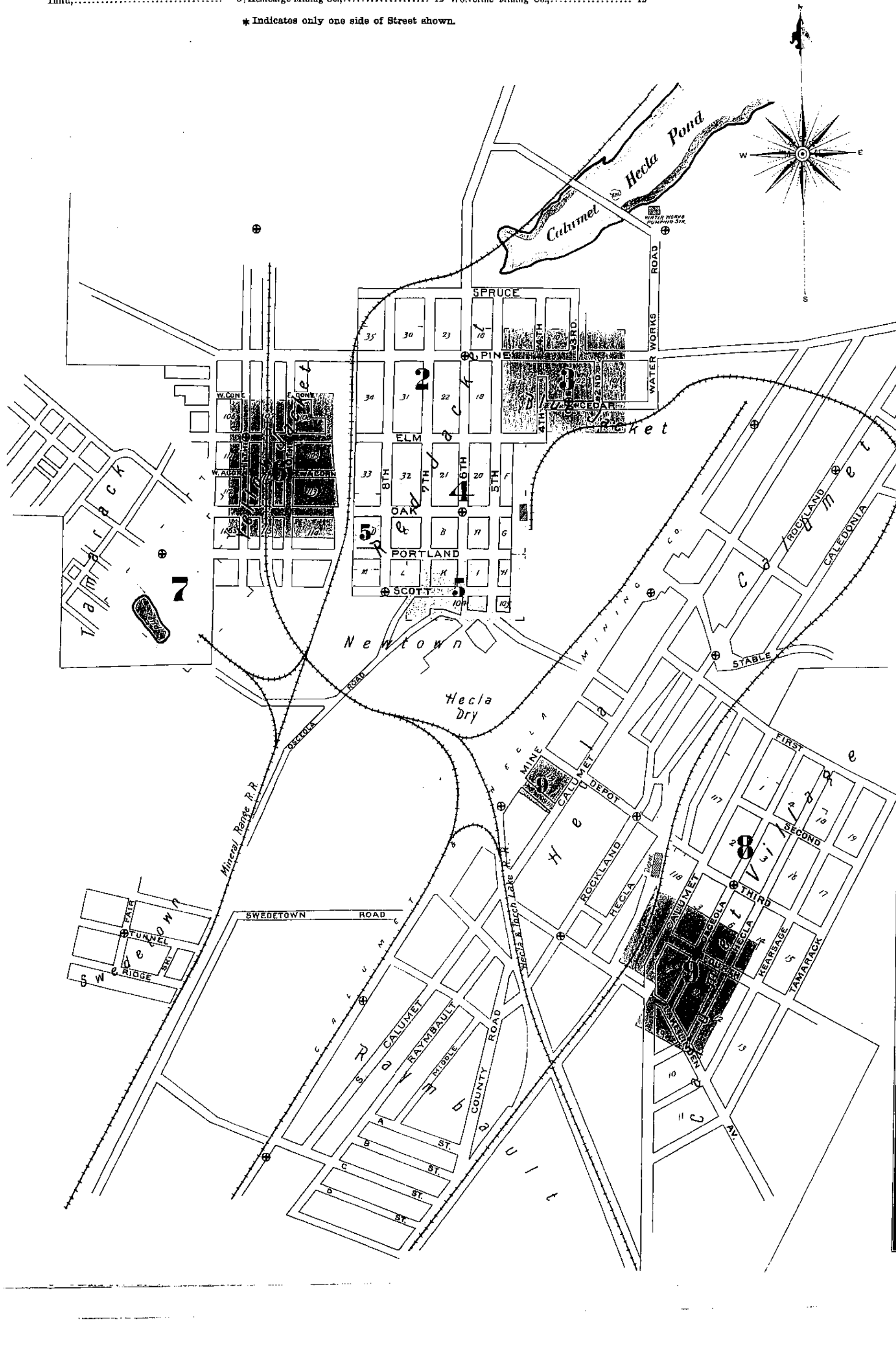
15,000.

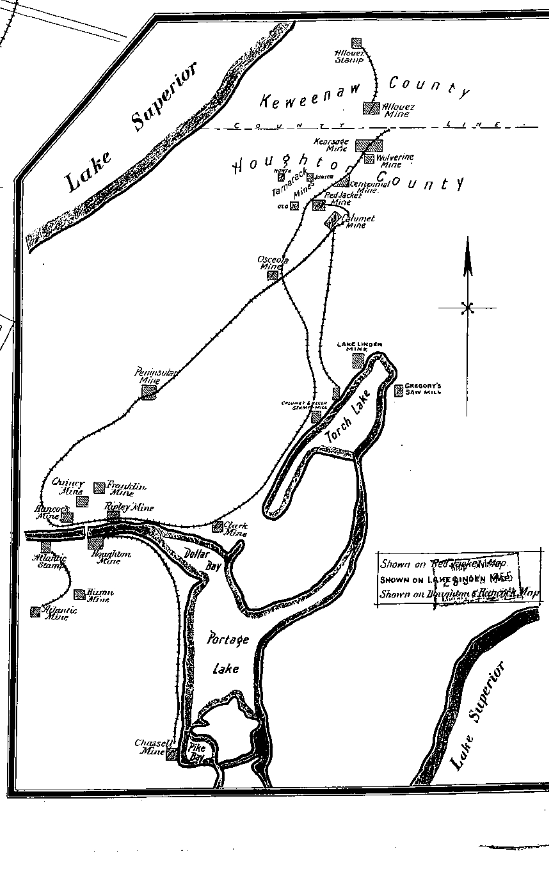
Prevailing Winds, N.E. & S.W. (Usually high)

WATER FACILITIES. Water for fire purposes is furnished by the Calumet & Hecla Mining Co. and pumped by 2 large Worthington Pumps from the Calumet & Hecla Pond. These pumps also furnish water for all boiler hos. on the C & H. location. Pressure as a rule is low, but is increased in case of fire. Pumps run night and day.

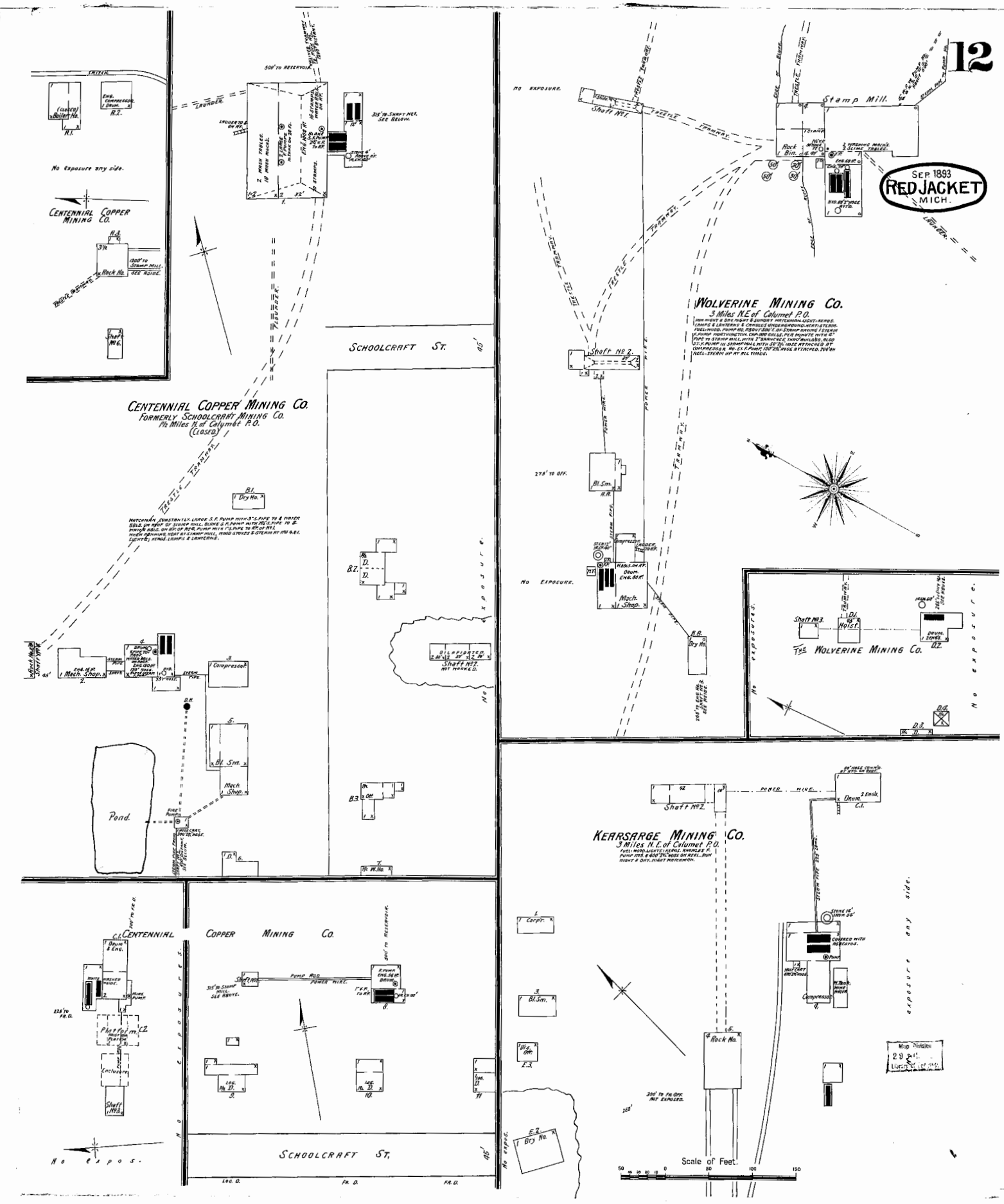
FIRE DEPARTMENT in Red Jacket Village consists of 17 Men including 2 Engineers, 2 Clapp & Jones Steam Fire Engines, 3 - 2 Wheel & 1 - 4 Wheel Hose Carts, 3000' 2½" Hose. The Calumet & Hecla Mining Co's Fire Equipment consisting of 3 Steamers and the Tamarack Mining Co's Steamer respond in case of need at fires in any location. Calumet & Hecla M. Co's Fire Alarm System, 20 Boxes shown on Index Plan ⊕







SEP. 1893
RED JACKET
MICH.



21 Sheets
(1636)

Insurance Maps of Red Jacket Houghton Co. Michigan

Sanborn-Perris Map Co. Limited
115 Broadway, New York

December 1897

Scale 50 ft. to an inch

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" " "	400-524	*3
" " "	401-525	*2
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Bosch & Co., Block,	3
" Brewing Co.'s Depot,	8 & 10
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Briggs, C., Store,	10
C	
Calumet Laundry,	10
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" Convent,	10
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Hermann Block,	5
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Klein, C., Bottling Works,	12
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* Indicates only one side of Street shown.

REPORT

Population 19000, Including Red Jacke, Laurium -formerly Calumet Village, Yellow Jacket, Blue Jacket, Calumet, Hecla, Newtown, Sweedetown and Raymbault Town, all combined within a radius of about 1½ Miles. Building in all of the above places, except Red Jacket & Laurium, are owned by, or on ground leased from the Calumet and Hecla Mining Co.

Prevailing Winds, N.W. & S.W. usually high.
Grades, Level or light. Streets Macadamized.

WATER FACILITIES. Water for fire purposes is furnished by the Calumet & Hecla Mining Co. from a pond North of Red Jacket. Pump Ho. with 3 force Pumps. - 1 Minnehaha, & 1 Worthington, Capacity 3 Million Galls. each, & 1 Worthington of 10 Million Galls. cap'y per 24 hrs. one or more of these pumps running all the time.

6 Worthington Duplex Fire Pumps, located at the different engine houses of the Calumet & Hecla Mining Co. Any or all pumps may be connected with the entire water system. Direct pressure from pumps, Pressure from Stand Pipe 55 lbs. 30" Suction Pipe to Pump Ho. 125 Triple Hydrants.

Red Jacket, Blue Jacket & Newtown are supplied by 2-16" Pipes entering the town from both North and East sides, reduced to 8" pipe in Red Jacket proper, and making a complete circuit. Calumet, Hecla, Laurium, Raymbault Town & Swedetown are supplied by branches from 16" W.P. running South on Mine St. reduced to 12" W.P. at Raymbault Town. Yellow Jacket is supplied from an independent 16" W.P. running around N.W. of Red Jacket.

FIRE DEPARTMENT Red Jacket:- 5 Fully paid Men. 17 Men employed near engine ho. paid a small yearly salary for attendance at fires, each having fire alarm bell in his room. 1 Clapp & Jones and 1 American Steam Fire Engine. 2 Hook & Ladder Trucks. 3 Hose Reels. 1 Hose Wagon. 3500 ft. 2½" Hose. 6 Horses.

Laurium:- Volunteer H. & L. Co. of 26 men. 1 Hook & Ladder Truck. 1 Hose Cart. 1000 ft. 2½" Hose.

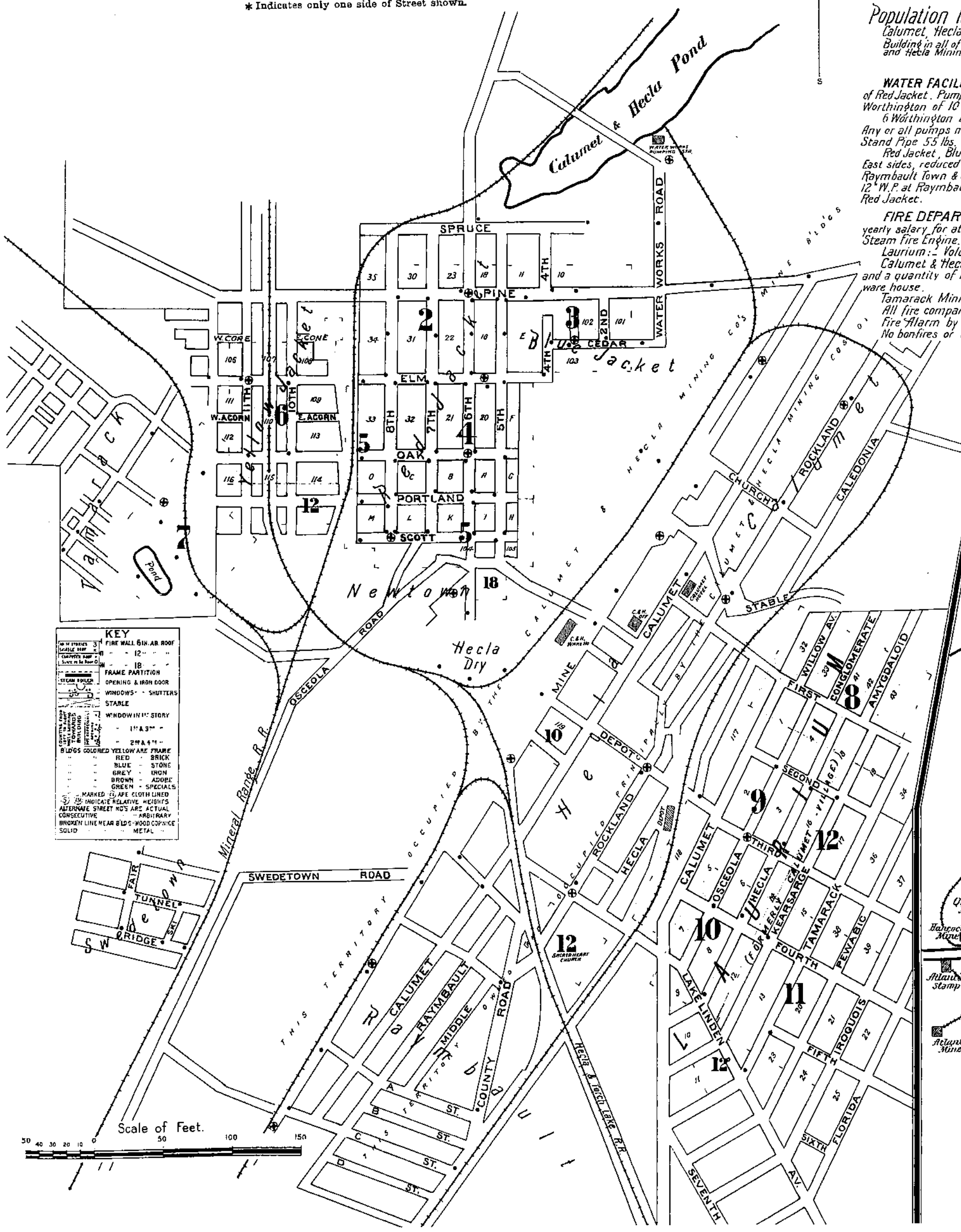
Calumet & Hecla Mining Co:- Volunteer Co's of employees. 3 Steam Fire Engine. A number of Hose Carts and a quantity of hose distributed throughout mine buildings, also reserve of unused hose always kept in ware house.

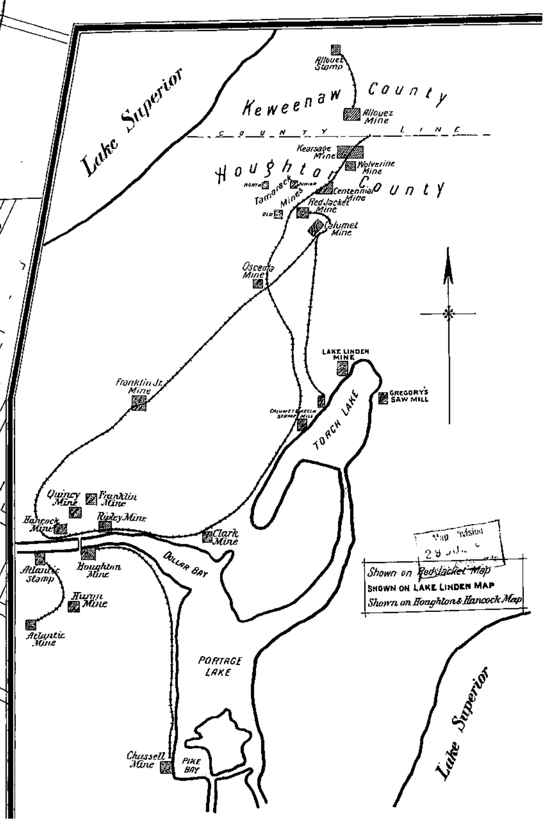
Tamarack Mining Co:- Volunteer Co. of employees. 18 Men. 1 Steam Fire Engine and Hose.

All fire companies respond to every alarm in any part of the district.

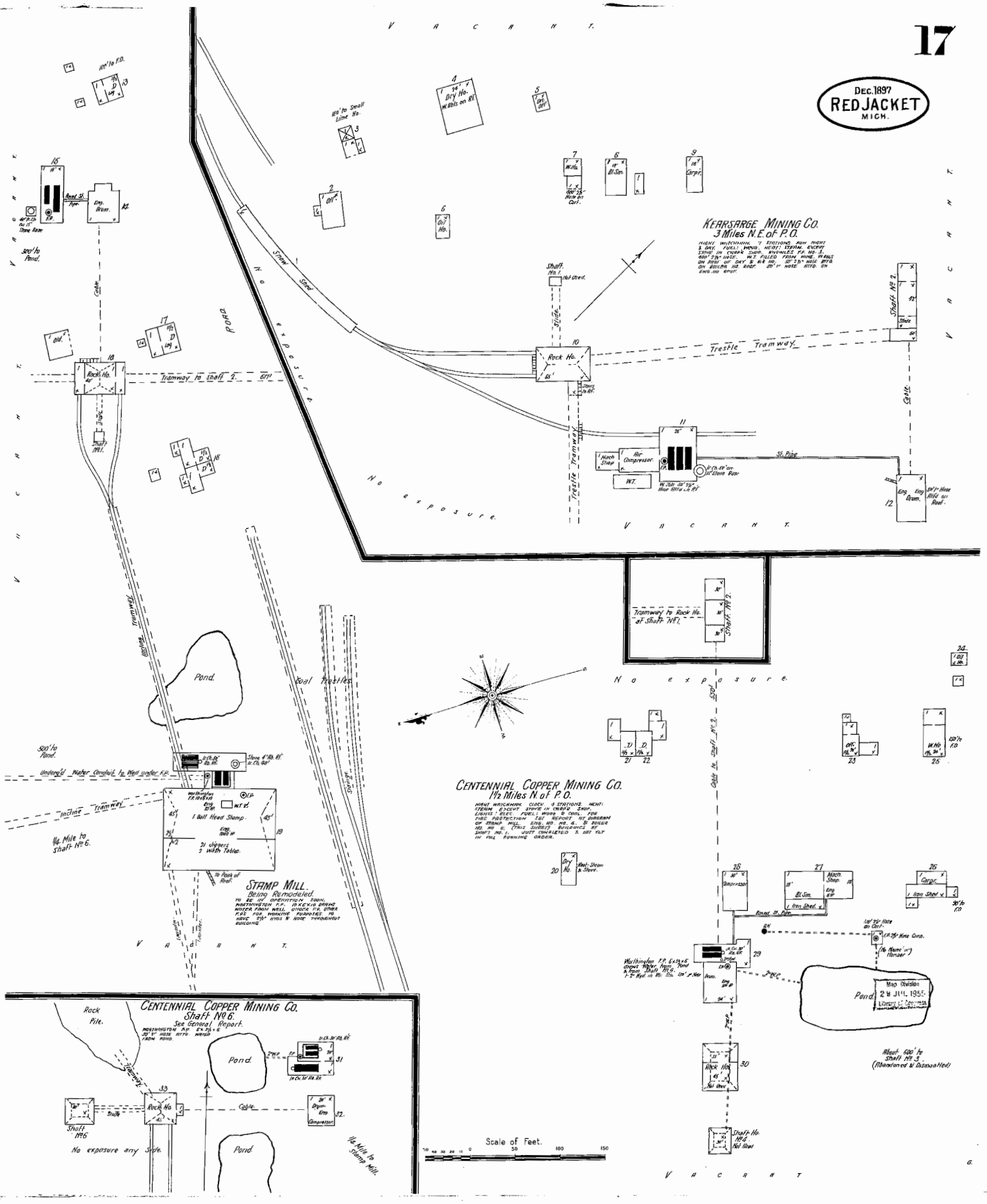
Fire Alarm by whistle, and 23 Gamewell Fire Alarm Boxes, shown on key map thus. ⊕

No bonfires or burning of rubbish outside of buildings allowed.





Dec. 1897
RED JACKET
MICH.



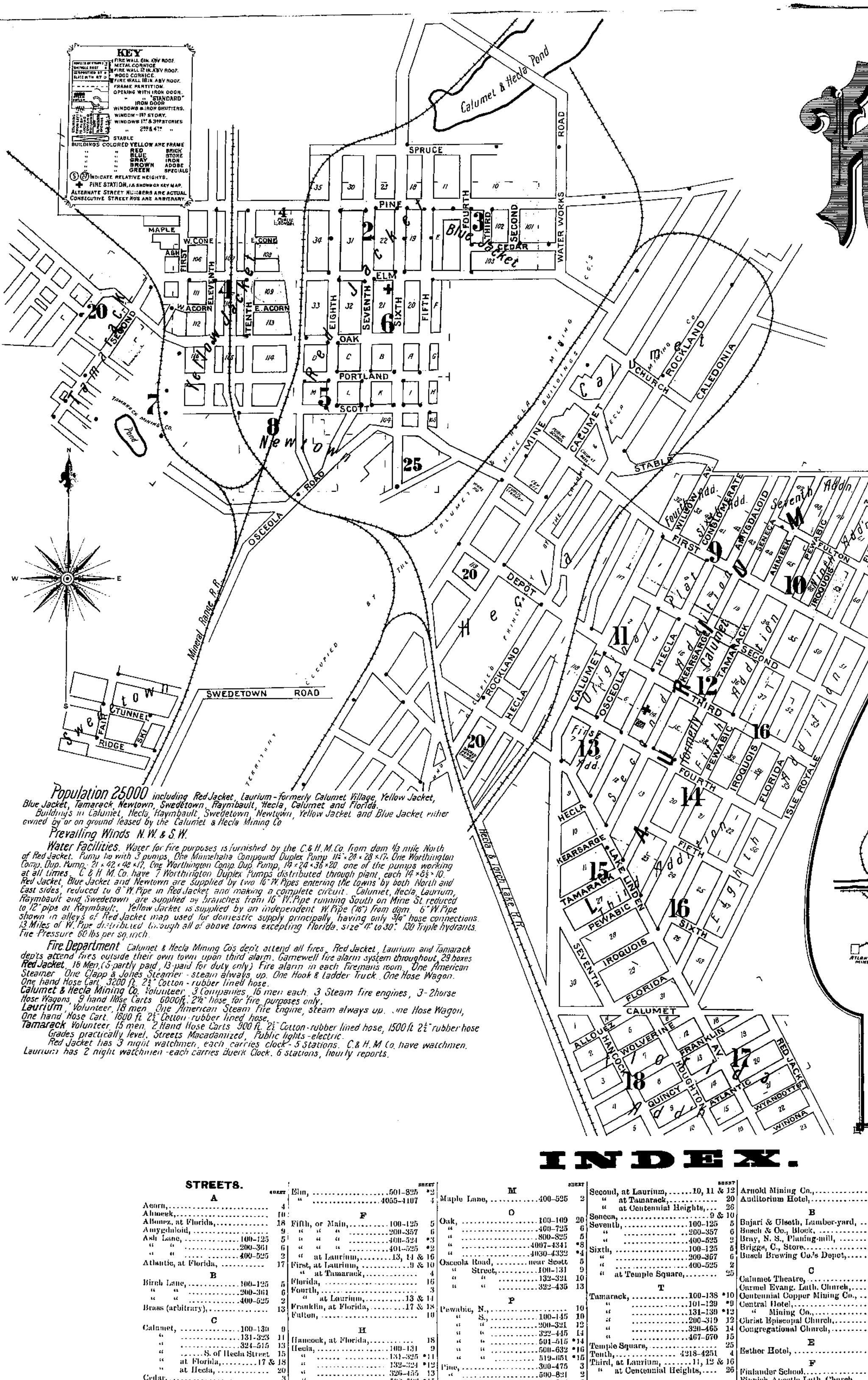
32 Sheets
(4181)

Red Jacket

Insurance Maps of Red Jacket, Houghton Co. and Laurium, Michigan

Sanborn-Perris Map Co. Limited
11 Broadway, New York
Scale 50 ft. to an Inch

Sept. 1900



Population 25000 including Red Jacket, Laurium - formerly Calumet Village, Yellow Jacket, Blue Jacket, Tamarack, Newtown, Swedetown, Raymbault, Hecla, Calumet and Florida.

Buildings in Calumet, Hecla, Raymbault, Swedetown, Newtown, Yellow Jacket and Blue Jacket either owned by or on ground leased by the Calumet & Hecla Mining Co.

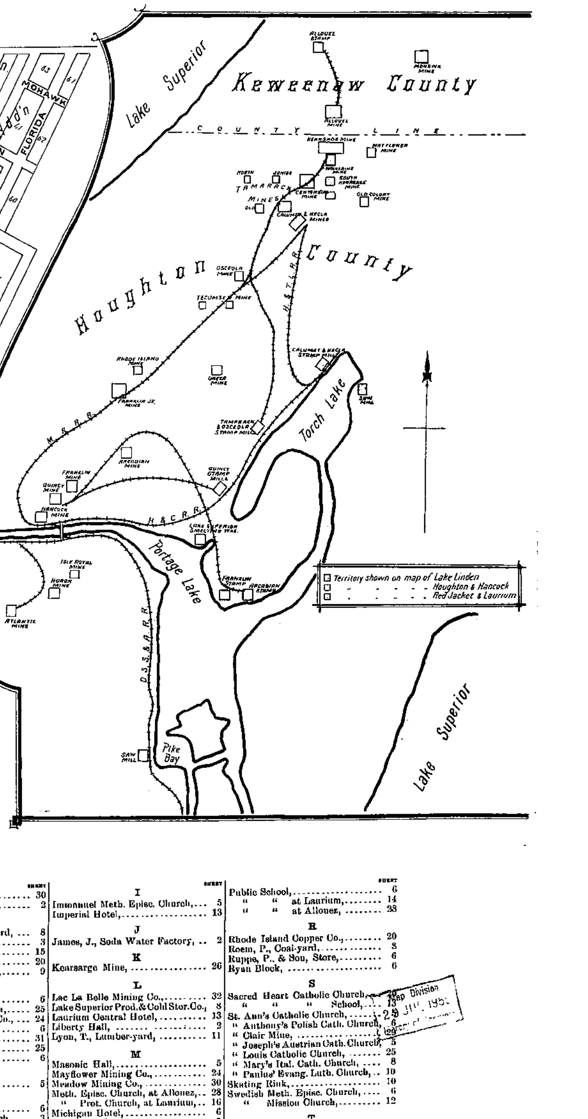
Prevailing Winds N.W. & S.W.

Water Facilities. Water for fire purposes is furnished by the C.& H. M. Co. from dam 1/3 mile North of Red Jacket. Pump ho with 3 pumps, One Minnehaha Compound Duplex Pump 11½ × 24 × 28 × 17. One Worthington Comp. Dup. Pump 21 × 42 × 48 × 17, One Worthington Comp. Dup. Pump, 14 × 24 × 36 × 20. one of the pumps working at all times. C & H M. Co. have 7 Worthington Duplex Pumps distributed through plant, each 14 × 8½ × 10. Red Jacket, Blue Jacket and Newtown are supplied by two 16" W. Pipes entering the towns by both North and East sides, reduced to 8" W. Pipe in Red Jacket and making a complete circuit. Calumet, Hecla, Laurium, Raymbault and Swedetown are supplied by branches from 16" W. Pipe running South on Mine St. reduced to 12" pipe at Raymbault. Yellow Jacket is supplied by an independent W. Pipe (16") from dam. 6" W. Pipe shown in alleys of Red Jacket map used for domestic supply principally, having only 3/4" hose connections. 13 Miles of W. Pipe distributed through all of above towns excepting Florida. size 4" to 30". 130 Triple hydrants. Fire Pressure 60 lbs per sq. inch.

Fire Department Calumet & Hecla Mining Co's dep't attend all fires. Red Jacket, Laurium and Tamarack dep'ts attend fires outside their own town upon third alarm. Gamewell fire alarm system throughout, 29 boxes.
Red Jacket. 18 Men, (5-partly paid, 13-paid for duty only) Fire alarm in each Firemans room. One American Steamer. One Clapp & Jones Steamer - steam always up. One Hook & Ladder Truck. One Hose Wagon. One hand Hose Cart. 3200 ft. 2½" Cotton - rubber lined hose.
Calumet & Hecla Mining Co. Volunteer. 3 Companies, 16 men each. 3 Steam fire engines, 3 - 2horse Hose Wagons, 9 hand Hose Carts. 6000 ft. 2½" hose for fire purposes only.
Laurium, Volunteer, 18 men. One American Steam Fire Engine, steam always up. One Hose Wagon, One hand Hose Cart. 1600 ft. 2½" Cotton - rubber lined hose.
Tamarack Volunteer 15 men. 2 Hand Hose Carts 900 ft. 2½" Cotton - rubber lined hose, 1500 ft 2½" rubber hose.

Grades practically level. Streets Macadamized. Public lights - electric.

Red Jacket has 3 night watchmen, each carries clock - 5 Stations. C.& H. M Co. have watchmen. Laurium has 2 night watchmen - each carries Buerk Clock. 6 stations, hourly reports.



INDEX.

STREETS.

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Acorn, 4
Ahmeek, 10
Allouez, at Florida, 18
Amygdaloid, 9
Ash Lane, 100-125 5
" " 200-361 6
" " 400-525 2
Atlantic, at Florida, 17

B
Birch Lane, 100-125 5
" " 200-361 6
" " 400-525 2
Brass (arbitrary), 13

C
Calumet, 100-130 9
" 131-323 11
" 324-515 13
" S. of Hecla Street 15
" at Florida, 17 & 18
" at Hecla, 20
Cedar, 3
" Lane, 100-125 5
" " 200-357 6
" " 400-525 2
Cone, 4
Conglomerate, 9

D
Depot, at Hecla, 20

E
Eighth, 100-125 5
" 200-356 *6
" 201-365 *5
" 400-525 2
Eleventh, 4210-4219 8
" 4218-4251 4
Elm, 400-728 *6
" 401-475 *3
Elm, 501-825 *2
" 4055-4107 4

F
Fifth, or Main, 100-125 5
" " " 200-357 6
" " " 400-524 *3
" " " 401-525 *2
" at Laurium, 13, 14 & 16
First, at Laurium, 9 & 10
" at Tamarack, 4
Florida, 16
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" at Laurium, 13 & 14
Franklin, at Florida, 17 & 18
Fulton, 10

H
Hancock, at Florida, 18
Hecla, 100-131 9
" 131-325 *11
" 132-324 *12
" 326-455 13
" 500-526 *15
" 1566-1683 20
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I
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" S., 14 & 16

K
Kearsarge, 100-131 9
" 132-321 12
" 322-466 *14
" 323-461 *13
" 463-550 15

L
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Lead (arbitrary), 11

M
Maple Lane, 400-525 2

O
Oak, 100-109 20
" 400-725 6
" 800-825 5
" 4007-4341 *8
" 4030-4332 *4
Osceola Road, near Scott 5
" Street, 100-131 9
" " 132-321 10
" " 322-435 13

P
Pewabic, N., 10
" S., 100-145 10
" " 200-321 12
" " 322-445 14
" " 501-515 *14
" " 500-632 *16
" " 519-651 *15
Pine, 300-475 3
" 500-821 2
Portland, 400-728 *5
" 401-725 *6
" 800-825 5
" 4007-4309 8

Q
Quincy, at Florida, 17 & 18

R
Red Jacket, at Florida, 17
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Rockland, at Hecla, 20

S
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" 801-825 *5
" 3007-4040 8
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" at Centennial Heights, 26
Seneca, 9 & 10
Seventh, 100-125 5
" 200-357 6
" 400-525 2
Sixth, 100-125 5
" 200-357 6
" 400-525 2
" at Temple Square, 25

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" 101-129 *9
" 131-139 *12
" 200-319 12
" 320-465 14
" 467-570 15
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" at Centennial Heights, 26

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Wolverine, at Florida, 17 & 18

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A
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Allouez Mining Co., 27 & 28
" Store, 28
Arlington Hotel, 6
Armory Co. "E," 3rd Reg't, 25
Armstrong-Thielman Lumber Co., 8
Arnold Mining Co., 30
Auditorium Hotel, 2

B
Bajari & Ulseth, Lumber-yard, 8
Bosch & Co., Block, 3
Bray, N. S., Planing-mill, 15
Briggs, C., Store, 20
Busch Brewing Co.'s Depot, 9

C
Calumet Theatre, 6
Carmel Evang. Luth. Church, 25
Centennial Copper Mining Co., 24
Central Hotel, 6
" Mining Co., 31
Christ Episcopal Church, 25
Congregational Church, 6

E
Esther Hotel, 5

F
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Finnish Apostle Luth. Church, 3
" Nat'l Luth. Church, 5
First Baptist Church, 12
" Presbyterian Church, 25
Florida School, 16
Franklin, Jr., Mining Co., 19

G
Garfield School, 11
German Lutheran Church, 5
" Ref. Lutheran Church, 11
Grant School, 4

H
Haas Brewing Co.'s Depot, 8
Hennes Block, 5
Hermann Block, 5
Humboldt Mining Co., 30

I
Immanuel Meth. Episc. Church, 5
Imperial Hotel, 13

J
James, J., Soda Water Factory, 2

K
Kearsarge Mine, 26

L
Lac La Belle Mining Co., 32
Lake Superior Prod. & Cold Stor. Co., 8
Laurium Central Hotel, 13
Liberty Hall, 2
Lyon, T., Lumber-yard, 11

M
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Mayflower Mining Co., 24
Meadow Mining Co., 30
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" Prot. Church, at Laurium, 16
Michigan Hotel, 6
M. R. R. R. Depot, 5
" " Roundhouse, 8
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N
News Printing, 2
Norwegian Lutheran Church, 6

O
Old Colony Copper Co., 24
" Finnish Apostle Church, 3
Oneca Copper Mining Co., 20
Osceola Cons. Min'g Co., 21, 22, 23 & 26

P
Pabst Brewing Co.'s Beer Depot, 8
Phœnix Consol. Copper Co., 29
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" " at Laurium, 14
" " at Allouez, 28

R
Rhode Island Copper Co., 20
Roem, P., Coal-yard, 8
Ruppe, P., & Son, Store, 6
Ryan Block, 6

S
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" " " School, 13
St. Ann's Catholic Church, 25
" Anthony's Polish Cath. Church, 6
" Clair Mine, 29
" Joseph's Austrian Cath. Church, 5
" Louis Catholic Church, 25
" Mary's Ital. Cath. Church, 8
" Paulus' Evang. Luth. Church, 10
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Swedish Meth. Episc. Church, 6
" Mission Church, 12

T
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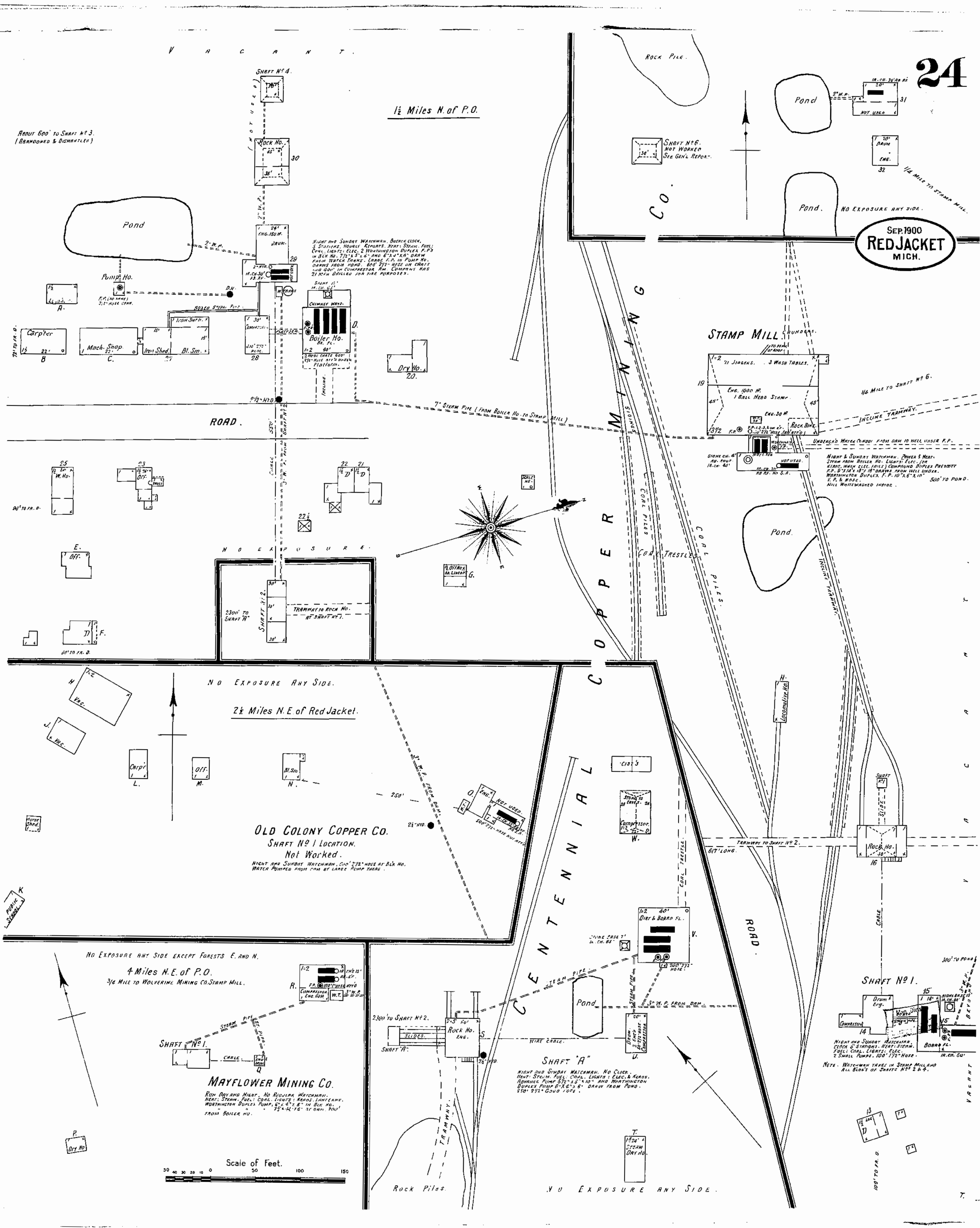
" Jr., Shaft, 23
" Meth. Episc. Church, 20
" Mining Co., 7, 20 & 23
Tecumseh Copper Co., 25
Town Hall, at Laurium, 12

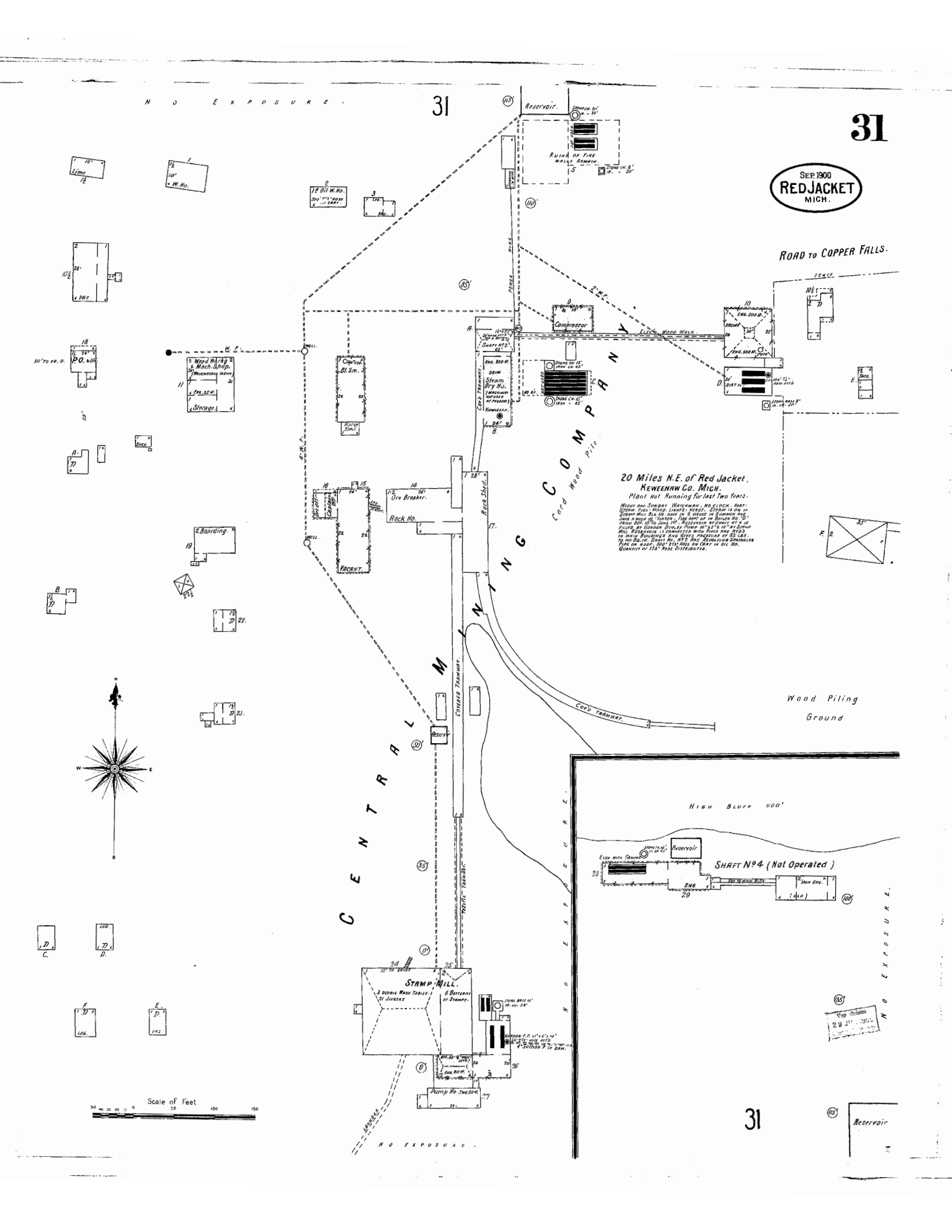
V
Village Hall, 6

W
Webster School, 8
Wertin & Son, Store, 3
Wolverine Copper Mining Co., 25 & 28

Y
Y. M. C. A. Building, 25

* Indicates only one side of Street shown.


24
SEP. 1900
RED JACKET
MICH.
VACANT.
1½ Miles N. of P.O.
About 600' to Shaft No 3. (Abandoned & Dismantled)
Shaft No 4.
Rock Ho.
Pond
Pump Ho.
Carpter
Mach. Shop
Iron Shed
Bl. Sm.
Boiler Ho.
Dry Ho.
ROAD.
7" Steam Pipe (From Boiler Ho. to Stamp Mill)
Shaft No 6. Not Worked. See Gen'l Report.
Rock Pile.
Pond.
No Exposure any side.
1/4 Mile to Stamp Mill.
STAMP MILL.
1/4 Mile to Shaft No 6.
Incline Tramway.
Coal Piles.
Coal Trestles.
Incline Tramway.
COPPER MINING CO.
NO EXPOSURE.
Shaft No 2.
Tramway to Rock Ho. at Shaft No 1.
2300' to Shaft "A"
No Exposure any side.
2½ Miles N.E. of Red Jacket.
Carpr.
Off.
Bl. Sm.
OLD COLONY COPPER CO.
Shaft No 1 Location.
Not Worked.
Public School
Locomotive Ho.
Compressor.
Tramway to Shaft No 2.
Rock Ho.
ROAD.
No Exposure any side except Forests E. and N.
4 Miles N.E. of P.O.
3/4 Mile to Wolverine Mining Co. Stamp Mill.
Shaft No 1.
MAYFLOWER MINING CO.
CENTENNIAL
Pond
Shaft "A"
Tramway.
Rock Piles.
No Exposure any side.
Dry Ho.
Shaft No 1.
Scale of Feet.
50 40 30 20 10 0 50 100 150
VACANT


31
SEP. 1900
RED JACKET
MICH.
ROAD TO COPPER FALLS.
NO EXPOSURE.
Reservoir.
RUINS OF FIRE WALLS REMAIN.
Compressor
Steam Dry Hs.
Rock Ho.
Rock Shed.
Ore Breaker.
Boarding.
Wood Work'g & Mech. Shop.
Storage.
P.O.
Resort
VACANT.
Cord Wood Pile
CENTRAL MINING COMPANY
20 Miles N.E. of Red Jacket.
KEWEENAW CO. MICH.
Plant Not Running for last Two Years.
Wood Piling Ground
HIGH BLUFF 600'
SHAFT No 4 (Not Operated)
STAMP MILL.
3 DOUBLE WOOD TABLES.
21 JIGGERS.
6 BATTERIES OF STAMPS.
Pump No. 5 Eng. 50 H.
Scale of Feet.
Reservoir

38 Sheets
(37)

INSURANCE MAPS of Red Jacket and Laurium

HOUGHTON COUNTY

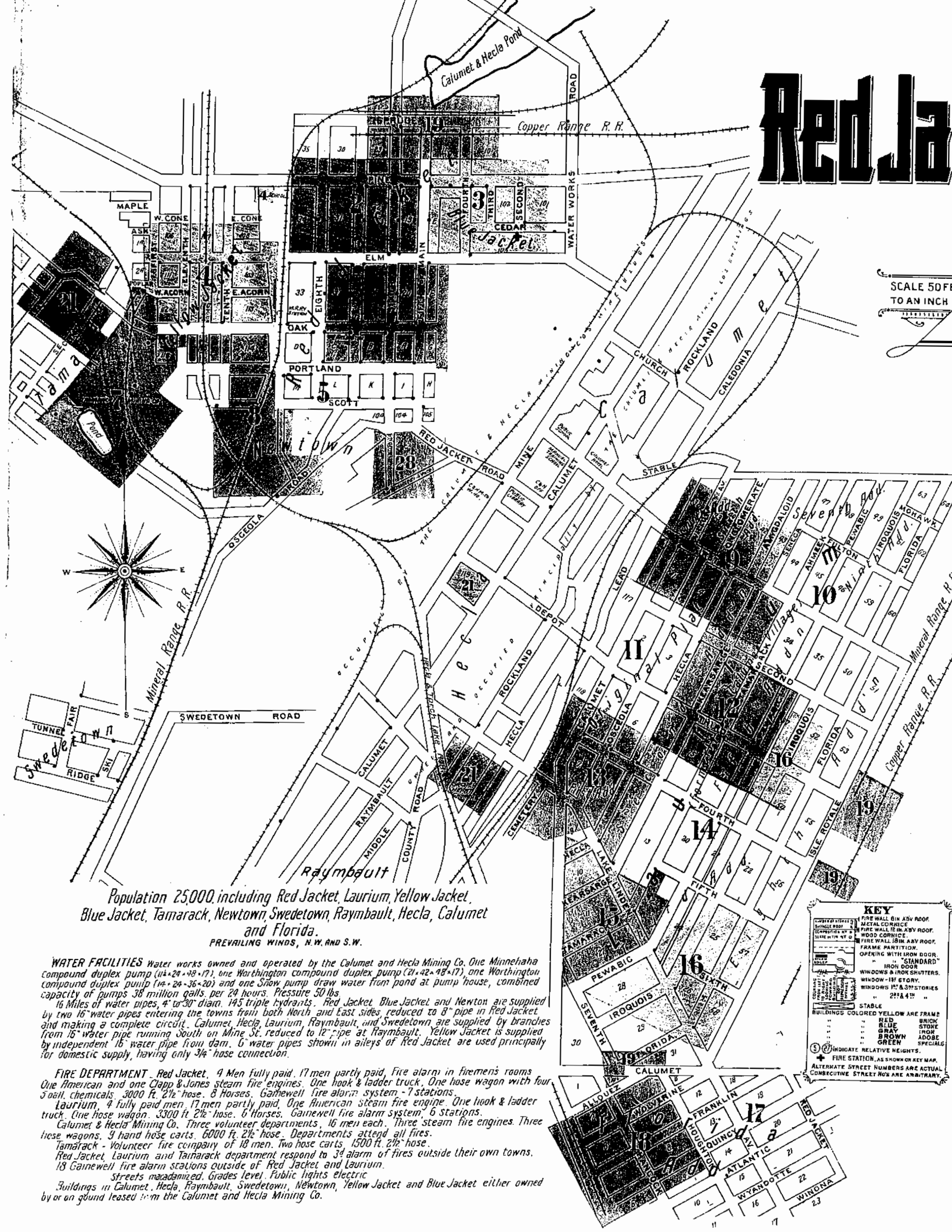
MICHIGAN

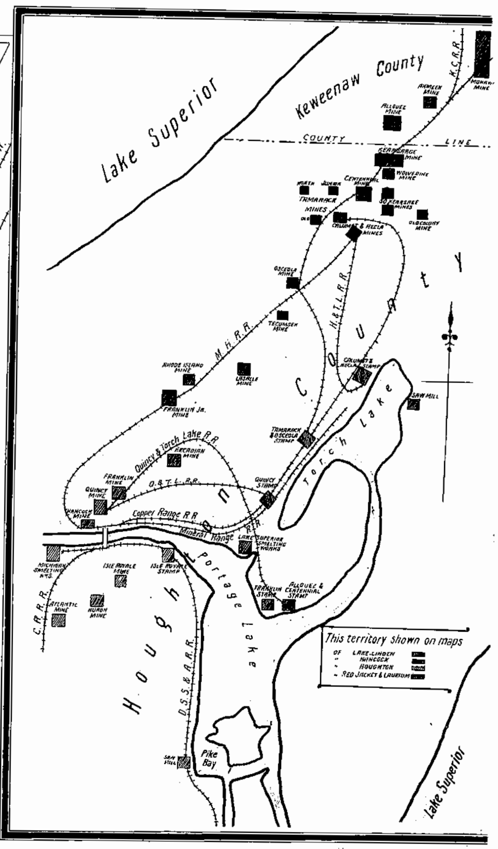
SCALE 50 FEET TO AN INCH

SANBORN MAP COMPANY

11 BROADWAY NEW YORK

MAY 1908





Population 25,000, including Red Jacket, Laurium, Yellow Jacket, Blue Jacket, Tamarack, Newtown, Swedetown, Raymbault, Hecla, Calumet and Florida.

PREVAILING WINDS, N.W. AND S.W.

WATER FACILITIES Water works owned and operated by the Calumet and Hecla Mining Co. One Minnehaha compound duplex pump (11½×24×48×17), one Worthington compound duplex pump (21×42×48×17), one Worthington compound duplex pump (14×24×36×20) and one Snow pump draw water from pond at pump house, combined capacity of pumps 38 million galls. per 24 hours. Pressure 50 lbs.

16 Miles of water pipes, 4" to 30" diam. 145 triple hydrants. Red Jacket, Blue Jacket and Newton are supplied by two 16" water pipes entering the towns from both North and East sides, reduced to 8" pipe in Red Jacket and making a complete circuit. Calumet, Hecla, Laurium, Raymbault, and Swedetown are supplied by branches from 16" water pipe running South on Mine St. reduced to 12" pipe at Raymbault. Yellow Jacket is supplied by independent 16" water pipe from dam. 6" water pipes shown in alleys of Red Jacket are used principally for domestic supply, having only 3/4" hose connection.

FIRE DEPARTMENT. Red Jacket. 4 Men fully paid. 17 men partly paid. Fire alarm in firemen's rooms. One American and one Clapp & Jones steam fire engines. One hook & ladder truck. One hose wagon with four 5 gall. chemicals. 3000 ft. 2½" hose. 8 Horses. Gamewell fire alarm system - 7 stations.

Laurium. 4 fully paid men. 17 men partly paid. One American steam fire engine. One hook & ladder truck. One hose wagon. 3300 ft 2½" hose. 6 Horses. Gamewell fire alarm system, 6 stations.

Calumet & Hecla Mining Co. Three volunteer departments, 16 men each. Three steam fire engines. Three hose wagons. 9 hand hose carts. 6000 ft. 2½" hose. Departments attend all fires.

Tamarack - Volunteer fire company of 18 men. Two hose carts. 1500 ft. 2½" hose.

Red Jacket, Laurium and Tamarack department respond to 3d alarm of fires outside their own towns.

18 Gamewell fire alarm stations outside of Red Jacket and Laurium.

Streets macadamized. Grades level. Public lights electric.

Buildings in Calumet, Hecla, Raymbault, Swedetown, Newtown, Yellow Jacket and Blue Jacket either owned by or on ground leased from the Calumet and Hecla Mining Co.

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" Lane,		2, 5 & 6
Atlantic, at Florida,		17 & 18
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Birch Lane,		2, 5 & 6
C		
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"	1036-1040	*21
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" " "	1714-1755	11
" " "	1756-1777	13
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" Lane,		2, 5 & 6
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" W.,	4311-4349	*4
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"	200-338	*6
"	201-341	*5
"	400-513	2
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"	500-594	*3
"	501-815	*2
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"	200-341	6
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"	519-530	19
" N. S., at Laurium, Iroquois to Pewabic		*14
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" W. S., " " Tamarack to Iroquois		*10
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"	500-525	3
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"	near Spruce	19
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" " "	321-436	13
" " "	500-519	15
"	1566-1577	21
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" " "	319-448	14
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" " " " "	300-318	*13
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" " "	323-432	13
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" " "	200-323	12
" " "	324-445	14
" " "	500-632	*16
" " "	501-517	*14
" " "	519-647	*15
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"	500-815	2
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"	400-519	2
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"	400-519	2
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" " "	500-514	*15
" " "	501-513	*14
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SPECIALS.

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" Store,	29
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" Mary's Italian Catholic Church,	8
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" M. E. Church,	21
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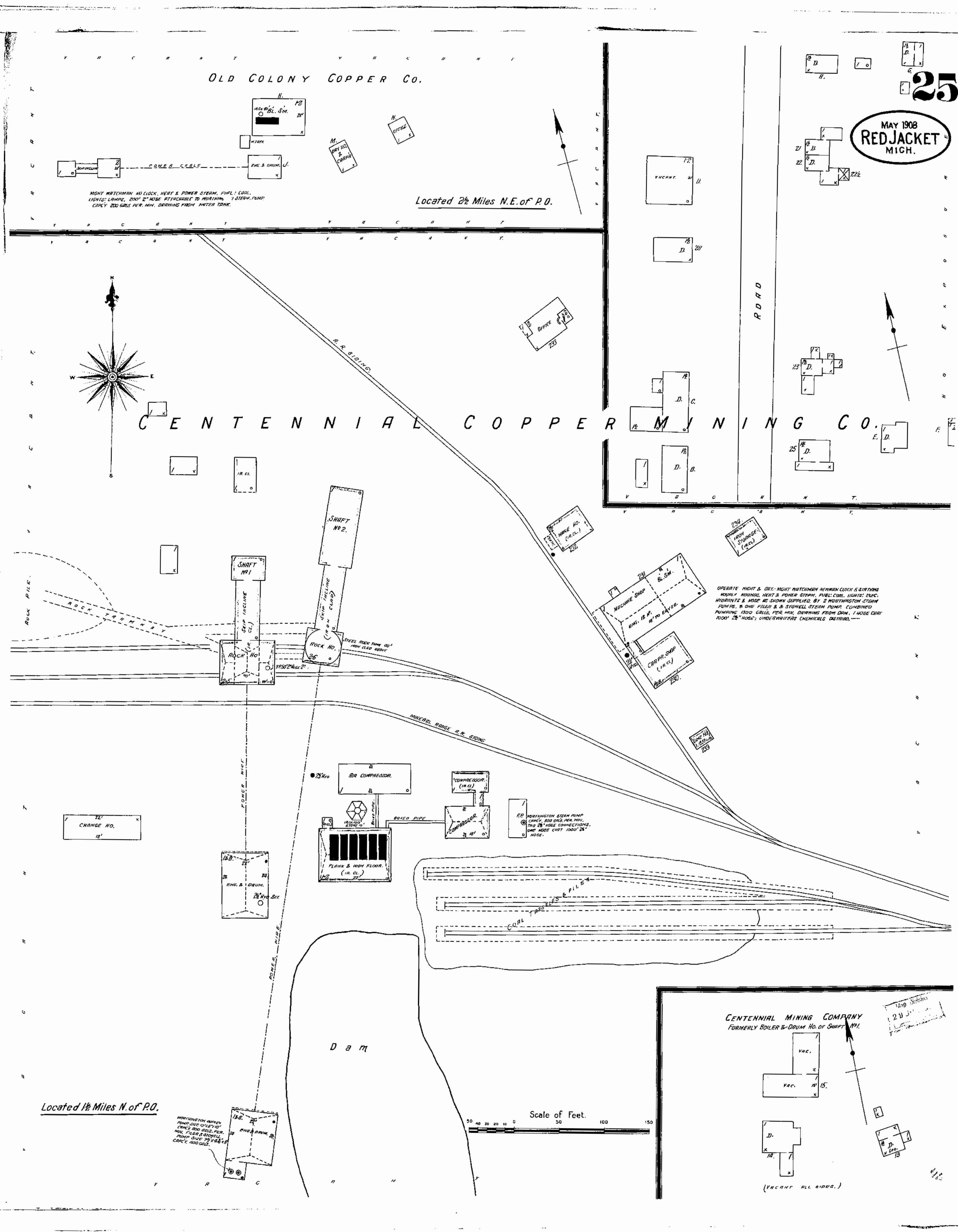
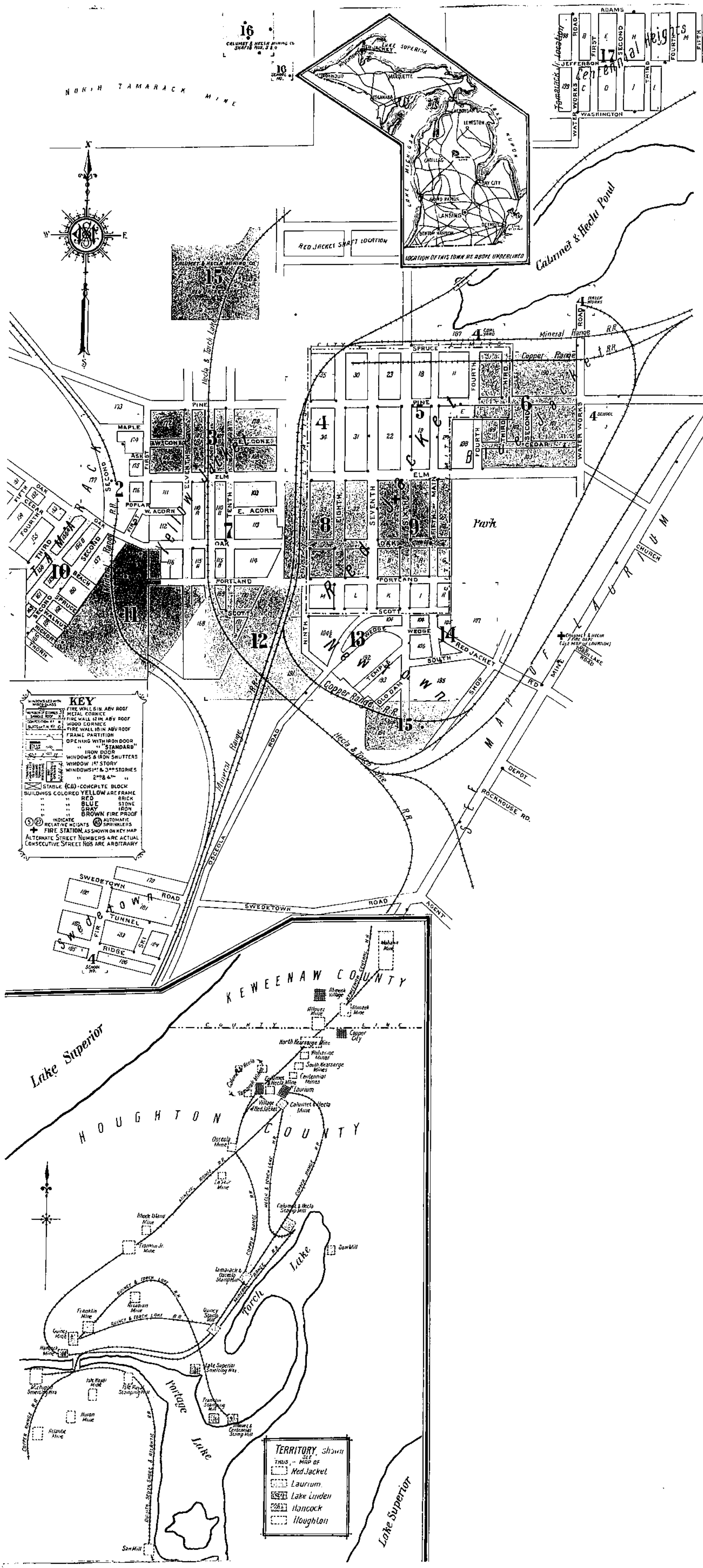
Wilmers Hall,	2
Wolverine Copper Mining Co.,	28
" Public School,	28
Y	
Y. M. C. A. Buildings,	5 & 28

* Indicates only one side of Street shown.


25
MAY 1908
RED JACKET
MICH.
OLD COLONY COPPER CO.
BL. SM.
ENG. & DRUM.
SKIP INCLINE
POWER CABLE
W. TANK
OFFICE
DRY HO. & CARP.
NIGHT WATCHMAN NO CLOCK, HEAT & POWER STEAM. FUEL: COAL. LIGHTS: LAMPS, 200' 2" HOSE ATTACHABLE TO WORTHING 1 STEAM. PUMP CAPCY 200 GALS PER. MIN. DRAWING FROM WATER TANK.
Located 2½ Miles N.E. of P.O.
VACANT
ROAD
R.R. SIDING
OFFICE
CENTENNIAL COPPER MINING CO.
SHAFT No 2.
SHAFT No 1
SKIP INCLINE
ROCK HO.
ROCK NO.
ROCK PILE
ROCK TRAMWAY
STEEL ROCK TANK
MINERAL RANGE R.R. SIDING
IRON STORAGE (IR.CL.)
MACHINE SHOP
BL. SM.
CARP. SHOP (IR.CL.)
OPERATE NIGHT & DAY.-NIGHT WATCHMAN NEWMAN CLOCK 5 STATIONS HOURLY ROUNDS. HEAT & POWER STEAM. FUEL: COAL. LIGHTS: ELEC. HYDRANTS & HOSE AS SHOWN SUPPLIED BY 2 WORTHINGTON STEAM PUMPS, & ONE FILER & STOWELL STEAM PUMP. COMBINED PUMPING 1300 GALLS. PER. MIN. DRAWING FROM DAM. 1 HOSE CART 1000' 2½" HOSE; UNDERWRITERS CHEMICALS DISTRIBD.
AIR COMPRESSOR.
COMPRESSOR.
BOXED PIPE
PLANK & IRON FLOOR. (IR. CL.)
CHANGE HO.
ENG. & DRUM.
POWER WIRE
COAL TRESTLES & PILES
Dam
ENG. & DRUM.
Located 1½ Miles N. of P.O.
Scale of Feet.
CENTENNIAL MINING COMPANY
FORMERLY BOILER & DRUM HO. OF SHAFT No 1.
VAC.
(VACANT ALL SIDES.)



32 Sheets
(1962)

INSURANCE MAPS of RED JACKET (CALUMET P.O.) MICHIGAN

HOUGHTON CO.

Including the Sub-Div'n of CENTENNIAL HEIGHTS

and the mining locations of

BLUE JACKET,
YELLOW JACKET,
TAMARACK and
NEWTOWN

and outlying mines, mine locations and towns of

AHMEEK and
COPPER CITY.

SANBORN MAP COMPANY
11 BROADWAY, NEW YORK
JULY, 1917

Population 15,000

PREVAILING WINDS, NORTH WEST & SOUTH WEST-

WATER FACILITIES:

RED JACKET and Mine Locations of YELLOW JACKET, BLUE JACKET, NEWTOWN and SWEDETOWN: Water works owned by the Calumet & Hecla Mining Co. Water mains in the Village of Red Jacket owned by the municipality.

Pond Water Works - Paulding Kemble Co. force pump, cap'y 4½ million galls, one Worthington force pump, cap'y 3 million galls, one Worthington force pump, cap'y 10 million galls. and one Snow force pump cap'y 15½ million galls. per 24 hours. Used for fire protection only. Water supply from pond.

Lake Superior Water Works - One Worthington force pump cap'y one million galls, one Snow force pump cap'y two million galls, & one I.P. Morris centrifugal force pump cap'y three million galls per 24 hours. Used for domestic purposes only. Water suply from Lake Superior. Mains of this system not shown on detail sheets.

In case of emergency both systems can be connected by a valve and water from Lake Superior Water Works may be used for Pond system.

Mileage of mains not obtainable, sizes vary from 3" to 36" in outlying mine locations. 71 hydrants. Fire pressure can be maintained at 125 lbs. Average daily consumption, not known.

TAMARACK Mine Location and CENTENNIAL HEIGHTS.

Two Norberg cross compound force pumps (21-28-6-42) cap'y one million galls. each per 24 hours. Water supply from Lake Superior, 10" main to boiler house Nº 2 (Sheet Nº 11). Two stand pipes combined cap'y 370,000 galls. which gives domestic pressure of 30 lbs. For fire purposes a pressure of 150 lbs can be maintained by two Prescott force pumps (18-10-16 and 14-7-12). Mileage of mains not known, sizes from 4" to 10". Average daily consumption not known.

FIRE DEPARTMENT

RED JACKET 17 partly paid men, 8 horses. One hose wagon, one hook & ladder truck, 146 ft. of ladders. One America steam fire engine Nº 2. 3000 ft. 2½" hose.

TAMARACK 21 partly paid men. One hose wagon. One hose sleigh. 1000 ft. 2½" hose.

Fire Departments of Calumet & Hecla Mining Co. and village of Laurium respond to third alarm.

Gamewell fire alarm system 13 boxes and five auxiliary boxes on Tamarack location.

General alarm by mine whistles.

Grades level. Streets in Red Jacket paved with brick, concrete or creosote blocks, except Spruce St. and 3d, 4th, 5th, 7th and 8th Sts. north of Pine St. Public lights electric.

Streets in Mine locations macadamized -

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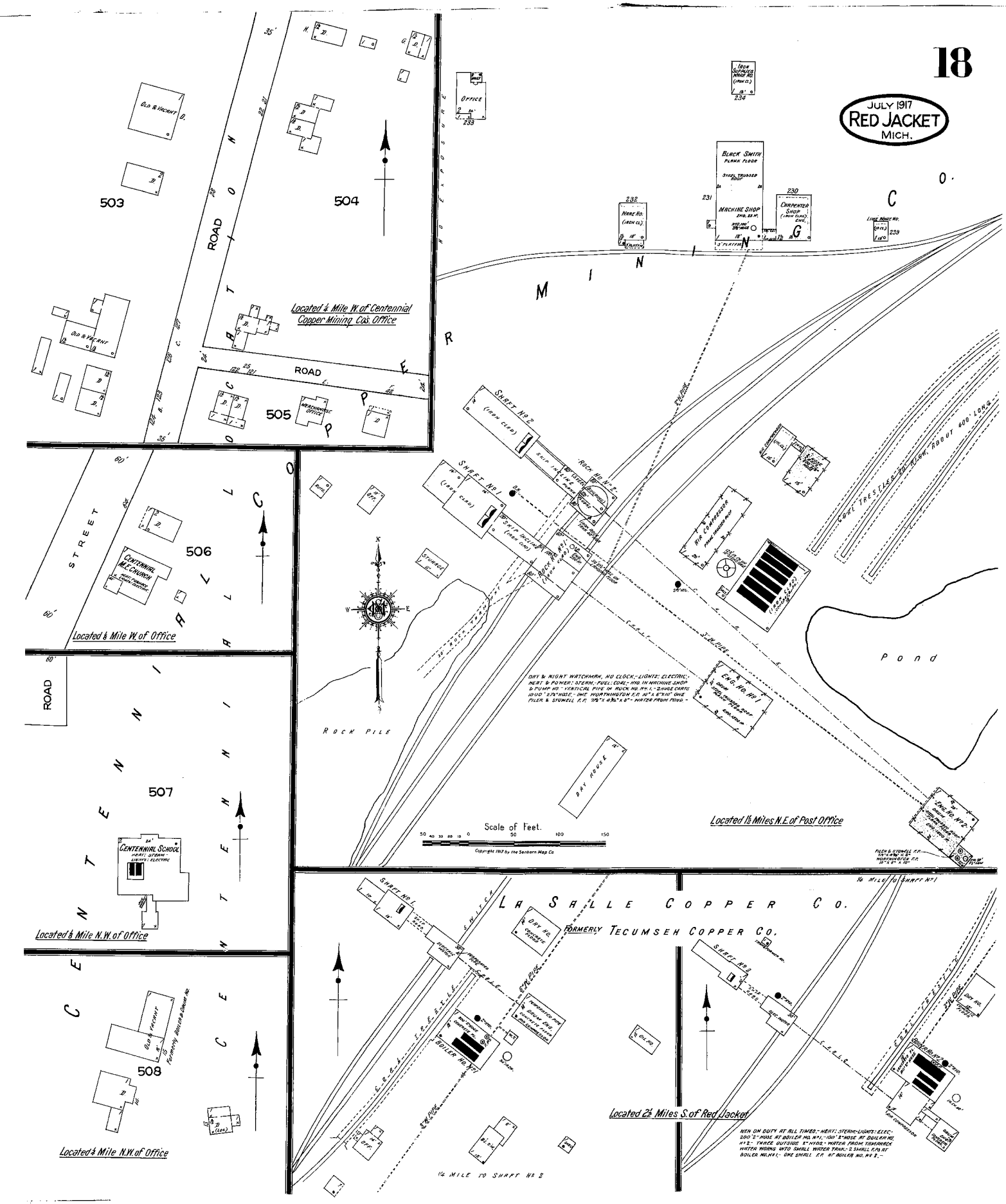
* Indicates only one side of Street shown.

JULY 1917
RED JACKET
MICH.



APPENDIX B

AERIAL PHOTOGRAPHS

Centennial Mine Site

58439 U.S. Highway 41

Allouez, MI 49805

Inquiry Number: 6274484.1

November 19, 2020

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

11/19/20

Site Name:

Centennial Mine Site
58439 U.S. Highway 41
Allouez, MI 49805
EDR Inquiry # 6274484.1

Client Name:

The Mannik & Smith Group, Inc
200 Michigan Street
Hancock, MI 49930
Contact: Jeffrey S. Binkley

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2016	1"=750'	Flight Year: 2016	USDA/NAIP
2012	1"=750'	Flight Year: 2012	USDA/NAIP
2009	1"=750'	Flight Year: 2009	USDA/NAIP
2006	1"=750'	Flight Year: 2006	USDA/NAIP
1998	1"=750'	Acquisition Date: April 26, 1998	USGS/DOQQ
1983	1"=1000'	Flight Date: October 31, 1983	USGS
1975	1"=750'	Flight Date: August 12, 1975	USGS
1955	1"=750'	Flight Date: October 09, 1955	USGS
1951	1"=750'	Flight Date: May 10, 1951	USGS
1943	1"=750'	Flight Date: October 08, 1943	USGS
1938	1"=750'	Flight Date: June 05, 1938	USGS

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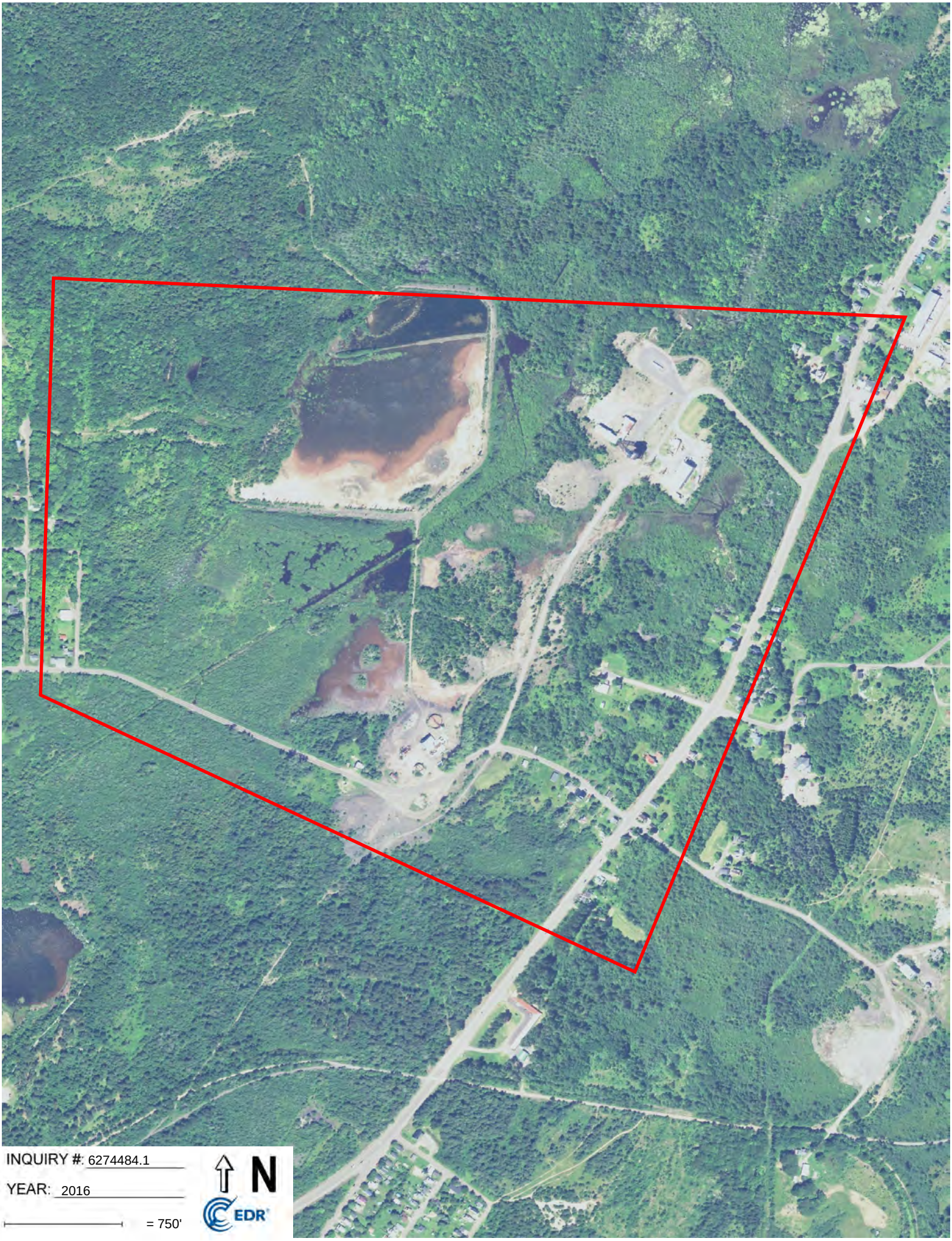
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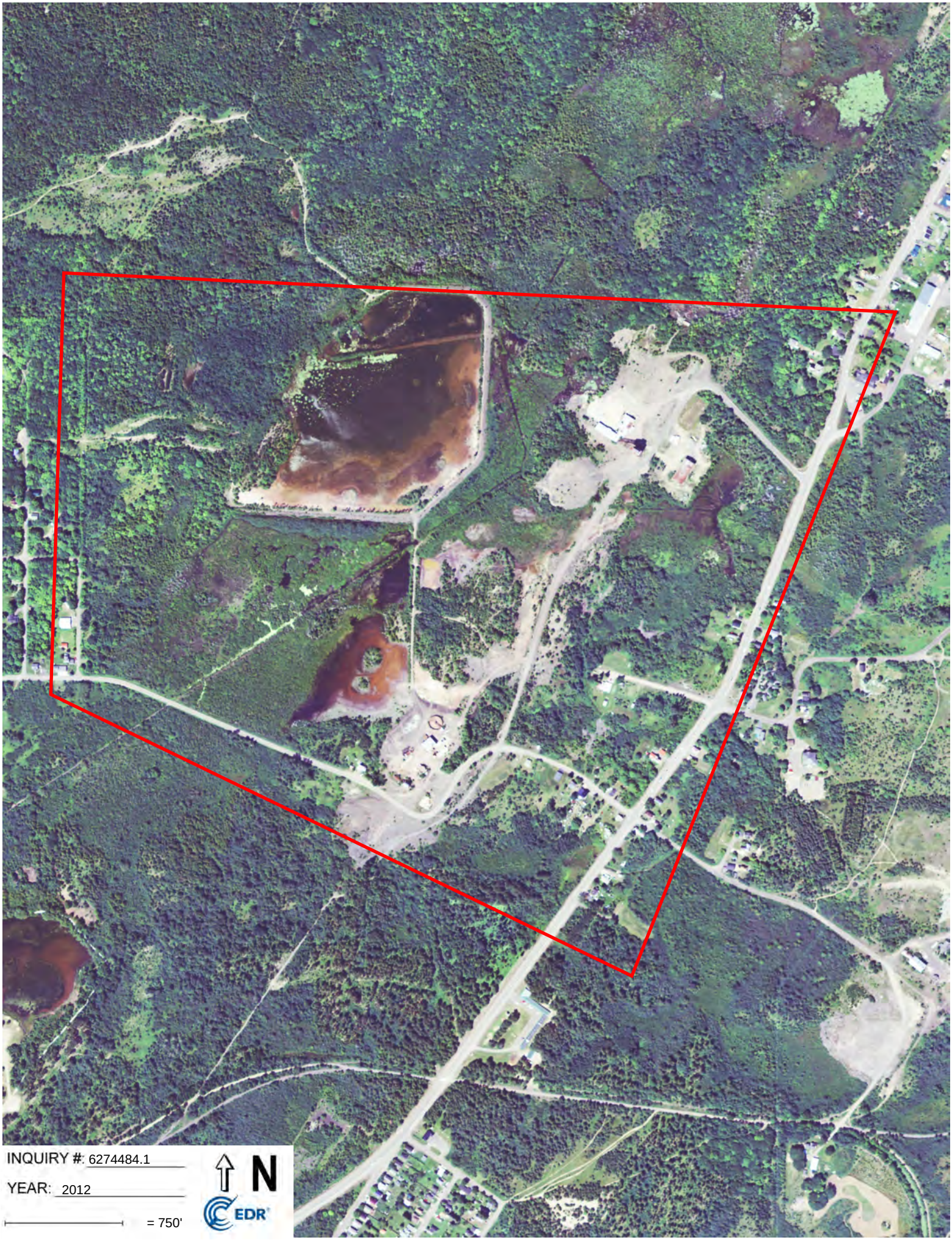
EDR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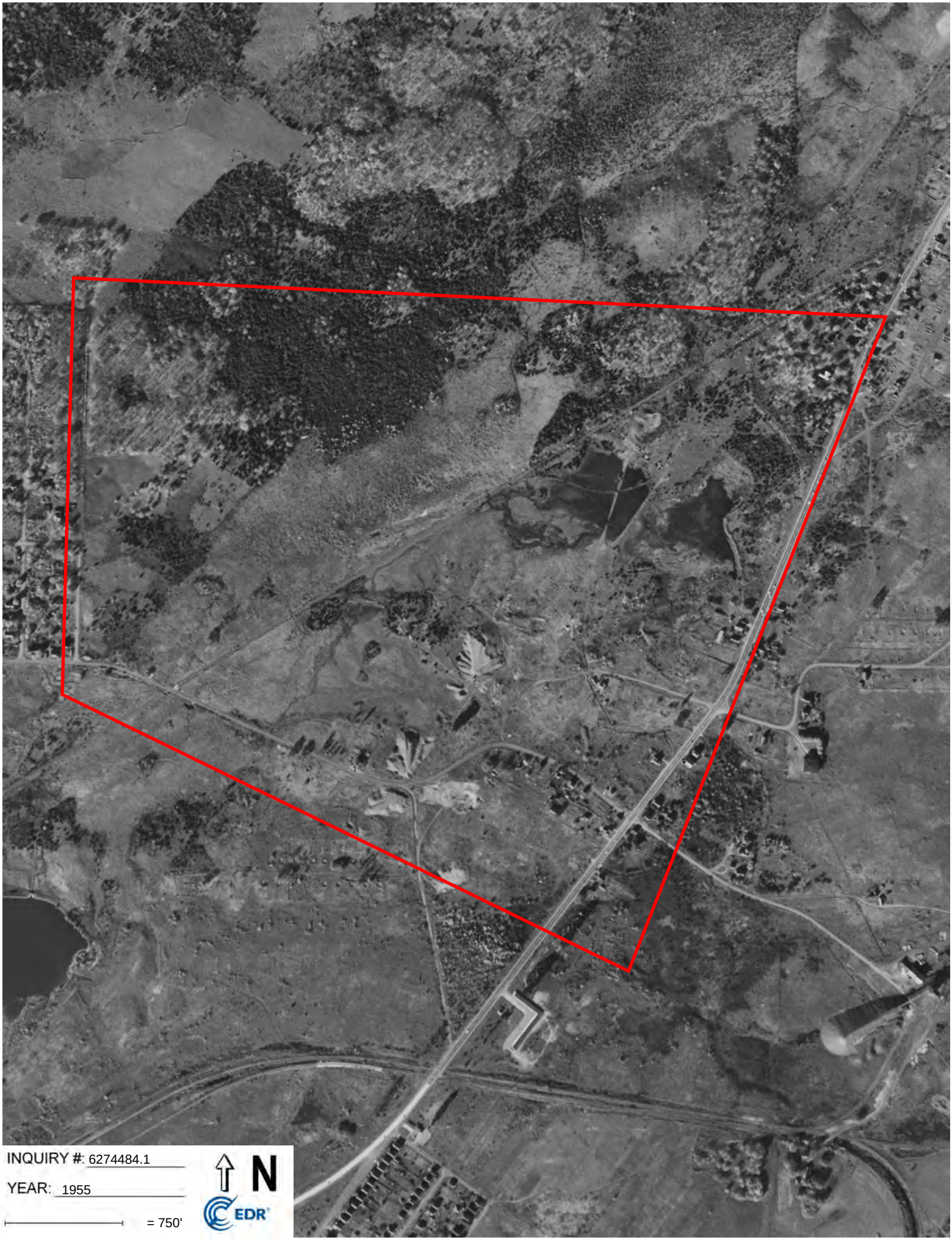
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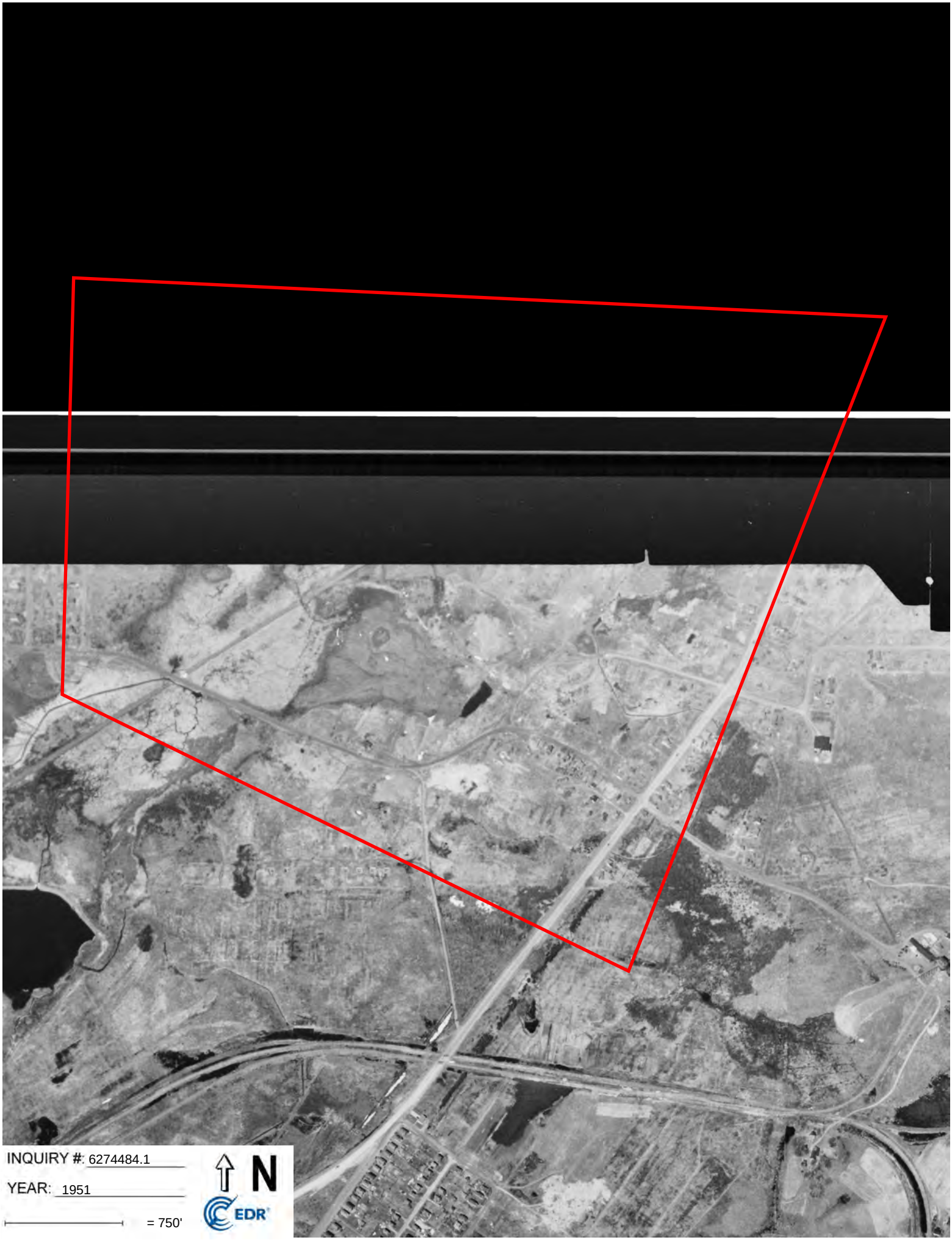
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EDR


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YEAR: 1943
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EDR


INQUIRY #: 6274484.1
YEAR: 1938
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EDR

APPENDIX C

PRELIMINARY RECONNAISSANCE PHOTOGRAPHIC LOG – ABANDONED CONTAINERS

Photo 1: Observation #16

Photo 2: Observation #16

Photo 3: Observation #19

Photo 4: Observation #19

Photo 5: Observation #19

Photo 6: Observation #20

Photo 7: Observation #20

Photo 8: Observation #21

Photo 9: Observation #21

Photo 10: Observation #21

Photo 11: Observation #21

Photo 12: Observation #21

Photo 13: Observation #22

Photo 14: Observation #24

Photo 15: Observation #24

Photo 16: Observation #25

Photo 17: Observation #26

Photo 18: Observation #27

Photo 19: Observation #27

Photo 20: Observation #27

Photo 21: Observation #34

Photo 22: Observation #37

Photo 23: Observation #38

Photo 24: Observation #39

Photo 25: Observation #48

Photo 26: Observation #51

Photo 27: Observation #52

Photo 28: Observation #53

Photo 29: Observation #54.

Photo 30: Observation #55

Photo 31: Observation #56

Photo 32: Observation #57

Photo 33: Observation #63