PHASE I EVALUATION AND HISTORIC CONTEXT STUDY

POLYMET MINING CORPORATION NORTHMET PROJECT HOYT LAKES, ST. LOUIS COUNTY, MINNESOTA

SHPO File No. pending

Landscape Research Project No. 9-4

Submitted to:
Barr Engineering
4700 West 77th Street
Minneapolis, MN 55435-4803

Submitted by
Landscape Research LLC
1466 Hythe St.
St. Paul, MN 55108

FINAL REPORT

December 2007

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Principal Investigator:
Carole S. Zellie, M.A., M.S.

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Management Summary

Barr Engineering contracted with Landscape Research LLC to conduct a Phase I architectural history evaluation and historic context development for the proposed Northmet Project Area to be developed by the PolyMet Mining Inc. (PolyMet). Carole S. Zellie was the Principal Investigator and report author. The project will require completion of an Environmental Impact Statement (EIS) and a United States Army Corps of Engineers Section 404 wetland permit. The project must comply with Section 106 of the National Historic Preservation Act (NHPA, 16 USC 470) and its implementing regulations (36 CFR 800) and the National Environmental Protection Act (1969), and potential effects on historic resources must be evaluated.

PolyMet plans to excavate a polymetallic disseminated magmatic sulfide deposit and process the ore at the former LTV Steel Mining Company (LTVSMC) site which is located about 8 miles west of the deposit and about 5 miles north of the town of Hoyt Lakes in St. Louis County, Minnesota. The facilities of the former Erie Mining Company taconite processing plant will be used for processing the ore (Figure 1). A hydrometallurgical process will be used to extract copper, nickel, palladium, platinum, cobalt and gold from the ore. Project plans call for the excavation of up to 32,000 tons of ore per day, using open-pit mining methods after overburden and waste rock stripping and stockpiling. Ore would be transported from the mine site to the processing plant on the former Erie Mining Company Railroad (1957). A refurbished and modified processing plant built by the Erie Mining Company in 1957 and expanded in 1967 is proposed to process the ore. Flotation tailings and reactive residue from ore processing would be disposed of on top of the existing taconite tailings basin. Four areas of proposed activity include the plant area, tailings basins, a lease area, and three proposed railroad alternatives.

Following discussion with U.S. Army Corps of Engineers (USACE) and State Historic Preservation Office (SHPO) staff, it was determined that Phase I survey and historic context development were appropriate steps for evaluation of the resources that will be potentially affected by the project. The Areas of Potential Effect (APE) for architectural history are limited to the areas in which the proposed project might cause direct or indirect impacts. This includes demolition and new construction as well as impacts to qualities such as setting, feeling, and association. The APE includes the core of the former Erie Mining Company Concentration Plant (SL-HLC-018) where crushing, concentrating, and pelletizing processes were used to produce taconite pellets, the adjacent tailings basin north of the plant, and the Area 1 Shops (SL-HLC-017) and Area 2 Shops (SL-HLC-014) east of the plant site. Segments of the former Erie Mining Company Railroad mine and plant track (SL-HLC-015) are evaluated as part of the plant and shops complexes. Mining in the lease area does not impact resources associated with the plant's period of significance, 1954-1969.

The Phase I study inventoried 16 properties including plant buildings, the tailings basin, and the Erie Mining Company Railroad mine and plant track. The project area had no previously identified properties. Of the 16 properties, the Concentration Building (SL-HLC-008) and segments of the Erie Mining Company Railroad mine and plant track (SL-HLC-015) are recommended as eligible for listing on the NRHP. The Concentrator and other buildings will be demolished after mining is finished, as required under Minnesota State Law (Rule 6132-1300 E 4 c). Recordation of the Concentrator Building is recommended to further document its significance to the Erie Mining Company and to describe its role in engineering design and taconite production on the Mesabi Iron Range. Other key plant buildings and structures, including the coarse and fine crusher and conveyor and drive house, contribute to the integrity of the setting and should be included in recordation. Recordation should follow *Guidelines for*

Architectural and Engineering Documentation and the *Historic American Engineering Record Guidelines* (HAER) (Federal Register 21 July 2003:43159.

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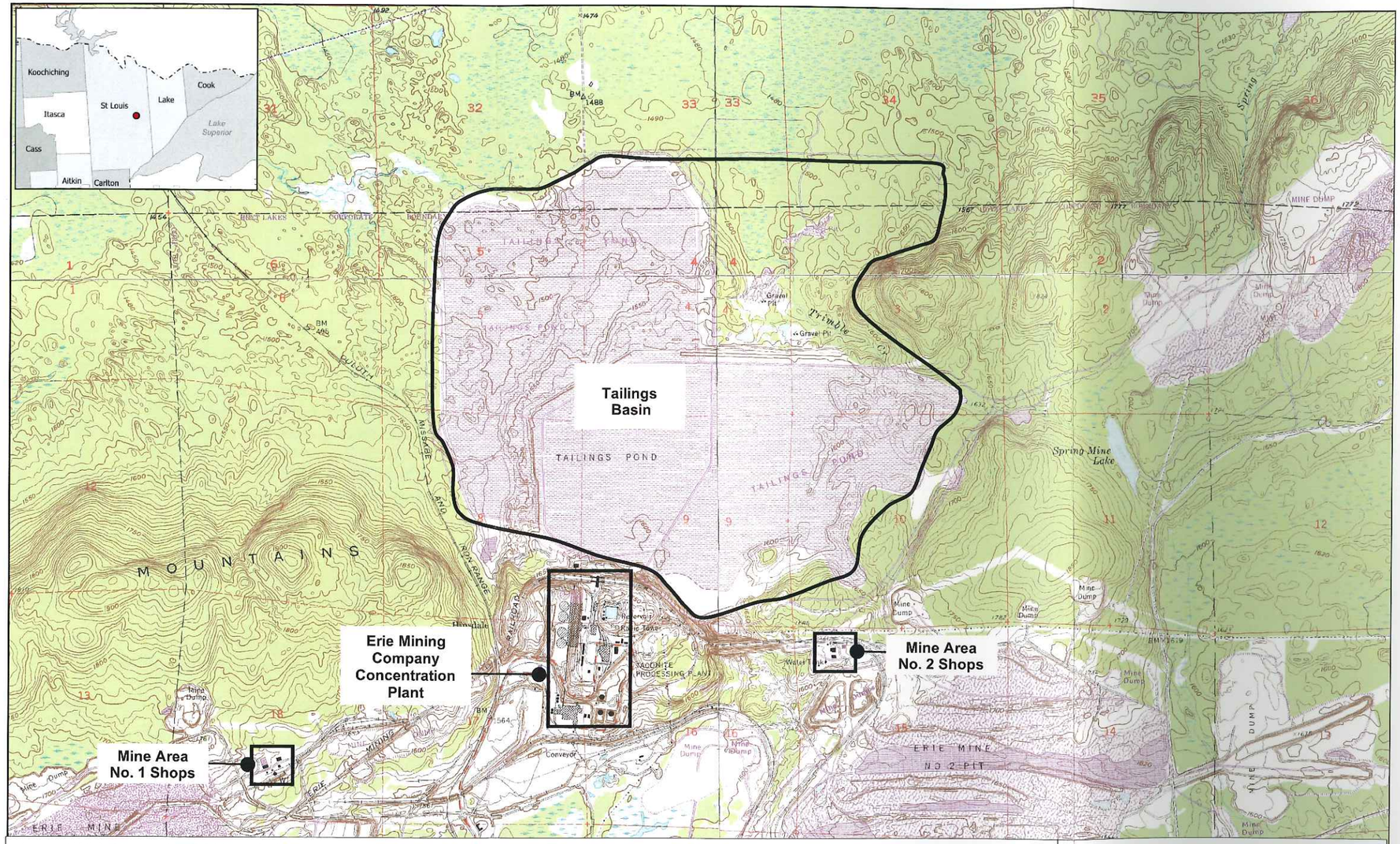


Source: USGS Quadrangles, 7.5 Minute Series: Allen,1981; Aurora 1984, Minnesota

PHASE I ARCHITECTURAL HISTORY RESOURCES INVENTORY

POLYMET MINING COMPANY, HOYT LAKES, MINNESOTA

0 1 2 MILES

N

LANDSCAPE RESEARCH LLC

Project Area APE
Architectural
History Resources

FIGURE 1
PROJECT LOCATION

1.0 INTRODUCTION

Barr Engineering contracted with Landscape Research LLC to conduct a Phase I architectural history evaluation and historic context development for the proposed Northmet Project Area to be developed by the PolyMet Mining Inc. (PolyMet). Carole S. Zellie was the Principal Investigator and report author. PolyMet plans to excavate a polymetallic disseminated magmatic sulfide deposit and process the ore at the former LTV Steel Mining Company (LTVSMC) site which is located about 8 miles west of the deposit and about 5 miles north of the town of Hoyt Lakes in St. Louis County, Minnesota (Figure 1). The facilities of the former Erie Mining Company taconite processing plant will be used for processing the ore. A hydrometallurgical process will be used to extract copper, nickel, palladium, platinum, cobalt and gold from the ore.

1.1 Project Description

Project plans call for the excavation of up to 32,000 tons of ore per day, using open-pit mining methods after overburden and waste rock stripping and stockpiling. Ore would be transported from the mine site to the processing plant on the former Erie Mining Company Railroad (1957). A refurbished and modified processing plant built by the Erie Mining Company in 1957 and expanded in 1967 is proposed to process the ore. Flotation tailings and reactive residue from ore processing would be disposed of on top of the existing taconite tailings basin. The idled processing plant and existing tailings basin were owned and operated by LTV Steel Mining Company (LTVSMC) prior to being purchased by Cliffs Erie. Mining operations, including stripping and stockpiling, drilling, blasting, loading, hauling, and processing of the ore, are expected to be conducted 24 hours per day, 365 days per year, over the 20-year life of the project. Proposed new buildings will house the production of cathode copper by solvent extraction and electrowinning.

There are four areas of proposed activity:

1. The processing facility ("the plant area" and the "Erie Mining Company Concentration Plant") is located in parts of Sections 3, 4, 5, 8, 9, 10, and 16, T59N, R14W.

2. The tailings basins are located in Parts of Sections 3, 4, 5, 8, 9, 10, and 16, T59N, R14W, and parts of Sections 32, 33, and 34, T60N, R14W.

3. The lease area is located in Sections 1, 2, 3, 9, 10, 11, and 12, T59N, R13W.

4. The three proposed railroad spur alternatives are located in parts of Sections 10, 16, 17, and 18, T59N, R13W and parts of Sections 9, 13, 14, 15, 16, 23, and 24, T59N, R14W.

The project will require completion of an Environmental Impact Statement (EIS) and a United States Army Corps of Engineers Section 404 wetland permit. The project must comply with Section 106 of the National Historic Preservation Act (NHPA, 16 USC 470) and its implementing regulations (36 CFR 800) and the National Environmental Protection Act (1969). These regulations state that that federal agencies and/or their designated applicants must take into account the potential effects of federally funded or regulated undertakings on historic properties, i.e. those listed in or eligible for listing in the National Register of Historic Places (NRHP).

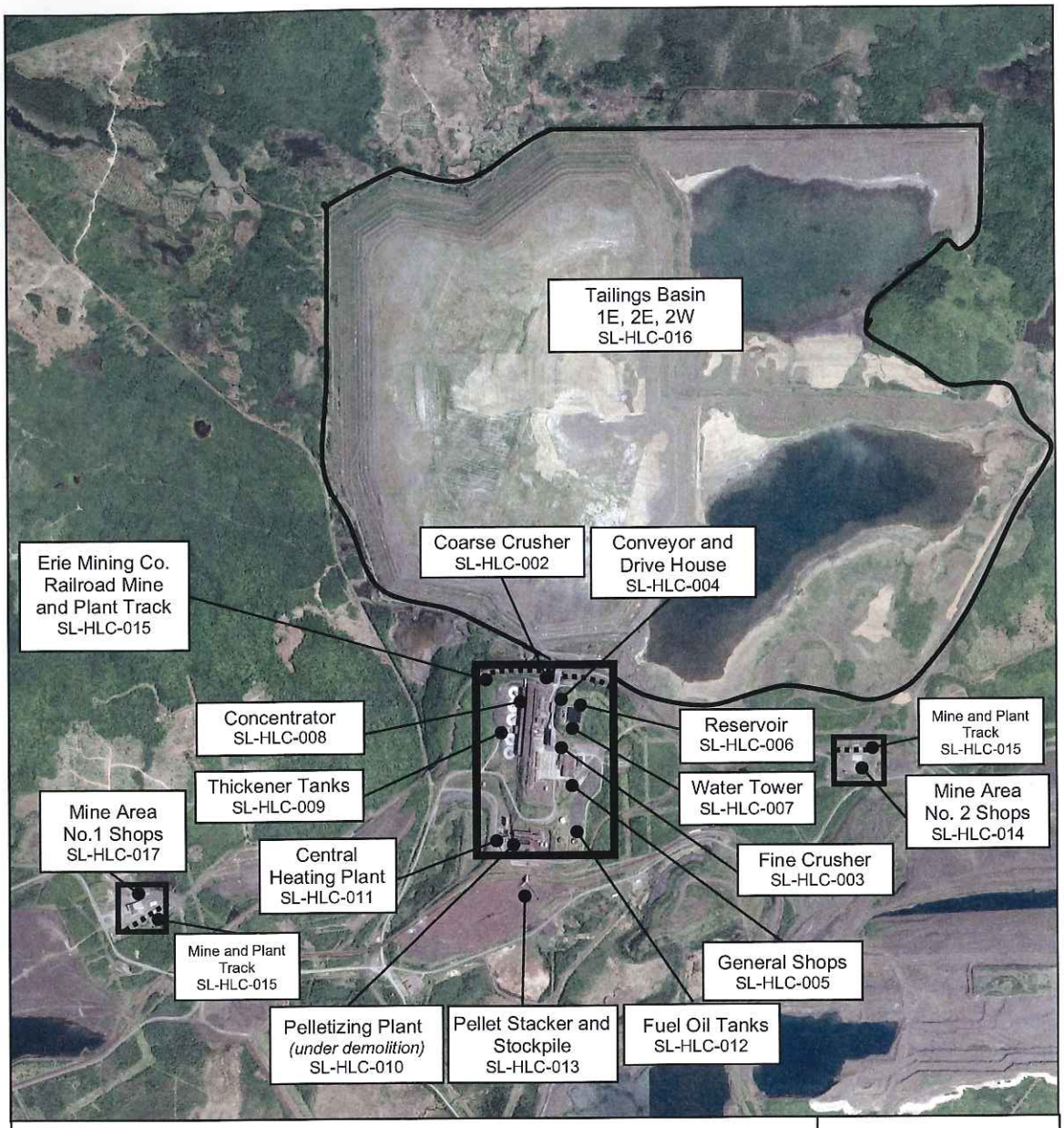
Following discussion with U.S. Army Corps of Engineers (USACE) and State Historic Preservation Office (SHPO) staff, it was determined that a Phase I survey and historic context development were appropriate steps for evaluation of the resources that will be potentially affected by the project (personal communication with D. Gimmestad, SHPO, and B. Johnson, USACE, 7/18/2007).

1.2 Phase I Architectural History Resources in the Project Area

It is proposed to use the existing taconite concentrator and other plant facilities for non-ferrous mineral processing. There will be minimal exterior and interior modifications to existing buildings. Upgraded or new stacks may be required by pollution control regulations on the Coarse Crusher (SL-HLC-002), Fine Crusher (SL-HLC-003) and Concentrator Buildings (SL-HLC-008). Solvent extraction will require construction of several new structures on the plant site adjacent to existing buildings (Figures 16 and 17). The former Erie Mining Company Railroad crosses part of the lease area in Sections 1, 2, 3, 9, 10, 11, and 12, T59N, R13W, and the former Duluth, Missabe & Iron Range Railway (DM&IR; now Canadian National [CN]) crosses Sections 8 and 17, T59N, R14W west of the plant area outside the APE. Mine areas adjacent to the plant will not be mined but Area 2 Shops (SL-HLC-014) will be refurbished (Figure 2). No modification is planned. A rail connection would be constructed to restore rail service to the plant at the east in Section 14, T59N, R14W.

1.3 Areas of Potential Effect (APE)

The Areas of Potential Effect (APE) for architectural history are limited to the areas in which the proposed project might cause direct or indirect impacts (Figure 2). This includes demolition and new construction as well as impacts to qualities such as setting, feeling, and association. The APE includes the core of the former Erie Mining Company Concentration Plant (SL-HLC-018) where crushing, concentrating, and pelletizing processes were used to produce taconite pellets, the adjacent tailings basin north of the plant, and the Area 1 Shops (SL-HLC-017) west of the plant site, and Area 2 Shops (SL-HLC-014) east of the plant site (Figures 1 and 2). Mining in the lease area does not impact resources associated with the plant's period of significance, 1954-1969. Segments of the former Erie Mining Company Railroad mine and plant track (SL-HLC-015) are evaluated as part of the plant complex constructed during 1954-1957.


Tailings Basin
1E, 2E, 2W
SL-HLC-016
Coarse Crusher
SL-HLC-002
Conveyor and
Drive House
SL-HLC-004
Erie Mining Co.
Railroad Mine
and Plant Track
SL-HLC-015
Concentrator
SL-HLC-008
Thickener Tanks
SL-HLC-009
Mine Area
No.1 Shops
SL-HLC-017
Central
Heating Plant
SL-HLC-011
Mine and Plant
Track
SL-HLC-015
Pelletizing Plant
(under demolition)
SL-HLC-010
Pellet Stacker and
Stockpile
SL-HLC-013
Fuel Oil Tanks
SL-HLC-012
Reservoir
SL-HLC-006
Water Tower
SL-HLC-007
Fine Crusher
SL-HLC-003
General Shops
SL-HLC-005
Mine and Plant
Track
SL-HLC-015
Mine Area
No. 2 Shops
SL-HLC-014
Source: 2003 Aerial View PolyMet Mining Corp.
PHASE I ARCHITECTURAL HISTORY RESOURCES INVENTORY
POLYMET MINING COMPANY, HOYT LAKES, MINNESOTA
0
2000
4000 FT
Project Area
and APE
SL-HLC-###
Inventoried
Property
LANDSCAPE RESEARCH LLC
FIGURE 2
N

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2.0 METHODS

2.1 Study Area and Objectives

The objective of the Phase I architectural history survey was to identify any historic properties that may be eligible for listing on the NRHP. Historic properties include standing buildings and structures, historic districts, objects, or other historic resources listed in or eligible for listing on the NRHP (36 CFR 60.4). Archaeological resources were evaluated in 2006 by C.A. Caine and G. E. Goltz of Soils Consulting and the results are reported separately. Accompanying historic context development assisted in evaluating properties for NRHP eligibility.

The Phase I survey area for architectural history is confined to the APE including the plant area, mine shops, and adjacent tailings basin, and includes segments of the former Erie Mining Company Railroad mine and plant track (Figure 2).

Historic context development for the former Erie Mining Company Hoyt Lakes Concentration Plant focused on the development of the plant in 1954-1957 and its expansion in 1967, and the relationship of the plant to Minnesota's early taconite industry. The architectural history survey followed standards in 300 CFR 36 and 36 CFR 61, *Guidelines for SHPO Architecture/History Projects* (SHPO 1993), and NRHP Bulletin 42, *Guidelines for Identifying, Evaluating, and Registering Historic Mining Sites* (rev. 1997).

Bulletin 42 provided a background for evaluation of mining landscape features. The bulletin and related background research discuss how taconite processing is represented by the system of ore pits, plant buildings, railroads, and the water and power supply that comprise the plant site. According to the Bulletin,

> Mining landscapes can be characterized and distinguished by historic patterns of land use such as strip-mining, hydraulic mining, or open-pit mining; the spatial organization or layout of the landscape; characteristic natural and cultural landforms such as mine waste rock dumps, mill tailing flows, and canyons; roads and pathways; vegetation patterns related to land use such as secondary growth of plants on mine waste rock dumps; distinctive buildings and structures such as headframes or cyanide mills or coal tipples; clusters of buildings and structures such as those at mines or urban settlements; and small-scale features such as mine claim markers or fences. In most cases, mining landscapes will be defined as historic districts for the purposes of National Register nomination (Noble and Spude 1997:14).

In discussing areas of significance, the Bulletin also describes the multi-component, engineer-designed plants associated with developments such as Mesabi Iron Range taconite production. Of particular significance to the Erie Mining Company plant, the Bulletin notes that deterioration of individual aspects of a complete mining system may not eliminate overall integrity. It states, however, "the integrity of mining properties will frequently hinge not so much on the condition of the extant buildings, but rather on the degree to which the overall mining system remains intact and visible" (Noble and Spude 1997:21).

2.2 Evaluation

According to 36 CFR 60.4, buildings, structures, and sites; groups of buildings, structures or sites forming historic districts, landscapes, and individual objects are all included in the Register if they

meet the criteria specified in the National Register's Criteria for Evaluation. NRHP Bulletin 42 provided assistance in applying the NRHP criteria to each property to determine potential eligibility for National Register listing:

Criterion A
Association with the events that have made a significant contribution to the broad patterns of our history;

Criterion B
Association with the lives of persons significant in our past;

Criterion C
Embodiment of the distinctive characteristics of a type, period, or method of construction; representation of the work of a master; possession of high artistic values; or representation of a significant and distinguishable entity whose components may lack individual distinction;

Criterion D
Potential to yield information important to prehistory or history.

The Phase I evaluation of the significance of the Erie Mining Company Concentration Plant and other buildings was based on information from the applicable historic context(s) and assessment of historic integrity for each component property. As identified by the National Park Service, the seven aspects of integrity to be considered when evaluating the ability of a property to convey its significance are location, design, setting, materials, workmanship, feeling, and association (36 CFR Part 60).

2.3 Preliminary Literature Search

The Phase I survey was preceded by a literature search at the Minnesota Historical Society Library and the University of Minnesota. The purpose of this initial research was to identify any previous cultural resource surveys undertaken in the project area and the vicinity, and to identify appropriate historic contexts for evaluating property significance. Project staff obtained project data from Barr Engineering and PolyMet staff, including maps and aerial photographs of the project area. A search of SHPO files included examination of previous cultural resource surveys conducted within one mile of the project area, including any properties previously listed on the NRHP.

2.4 Field Methods

On July 13, 2007, a site visit site included a tour of the extensive plant archives and a review of maps, plans, and historical photographs. The visit also included a pedestrian survey of the Concentrator Building interior and visual reconnaissance of the plant site and project areas. The site tour was guided by PolyMet staff. Buildings, structures, mine areas, mine stockpiles, and tailings basins were photographed.

Buildings and Structures

Primary buildings and structures on the plant site within the APE were documented on a Minnesota-Architecture History Inventory Form. Determination of building construction dates relied on records and information supplied by the PolyMet Mining Company and published sources such as *Skillings Mining Review*. The SHPO provided identification numbers for inventoried properties.

Railroad Resources

A windshield survey of railroad resources within the APE was conducted at the Phase I level. The resources include segments the former Erie Mining Company Railroad mine and plant track. Maps and aerial views from project construction in ca. 1954-1957 were consulted to observe changes to the roadbed. The DM&IR Railway line (now CN) is outside the APE.

Mine Stockpiles and Tailings Basin

Although the plant area is surrounded by mine stockpiles of various types, there are no stripping, lean ore, or and waste rock stockpiles within the plant APE, or within the APE at the Mine Area 1 Shops (SL-HLC-017) or Mine Area 2 Shops (SL-HLC-014). The stockpiles outside the APE adjacent to Mine Area 1 and 2 have been greatly expanded since 1959 (Figure 10). Mine expansion and additional stockpiles are documented in aerial photographs. The pellet stockpile (SL-HLC-010) and tailings basin (SL-HLC-016) were recorded on inventory forms.

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3.0 BACKGROUND RESEARCH

3.1 Introduction

The preliminary literature search described in 2.3 was undertaken prior to the Phase I survey to identify previous cultural resource surveys in the project area and to suggest appropriate historic contexts for evaluating the Erie Mining Company Concentration Plant properties and surrounding mining landscape.

Additional information about plant construction was obtained from PolyMet, including review of a building construction records and plans in the former Erie Mining Company (now PolyMet) administration building. USGS topographic quadrangles (1949-1984), historic mining maps including Leith (1911) and Great Northern Ore Properties (1953, 1959) were consulted to identify historic and architectural resources within the project area. Contemporary aerial photographs were compared with photographs taken during the 1954-1957 plant construction.

Erie Mining Company publications and mining industry periodicals such as *Mining Magazine* and *Skillings Mining Review* were consulted at the University of Minnesota and the Minnesota Historical Society. This material provided information about plant construction and the development of the 20th-century taconite industry. Other published works consulted for this study included E. W. Davis, *Pioneering with Taconite* (1964) and a variety of dissertations and articles prepared by mining engineers and economic geographers. They include F. Witzig, *A Geographic Study of the Taconite Industry of Northeastern Minnesota* (1957) and R. Martin, *Design of Mining, Crushing, and Concentrating Facilities of Semi Taconite Ores of the Mesabi Range* (1971).

The SHPO has identified Minnesota's iron industry as a state historic context (Minnesota's Iron Ore Industry, 1880s-1945), and the *Mesabi Iron Range Historic Contexts* (Zellie 2005) describes the pattern of Mesabi mining and community development. These documents, along with publications on national and international iron mining development, assisted in preparation of an historic context for the Erie Mining Company Concentration Plant.

3.2 Previously Identified Properties

The Longyear Diamond Drill Site north of Hoyt Lakes in Section 33, T59N, R14W was listed on the NRHP in 1977 (SL-HLC-001). The DM&IR (formerly D&IR) Railway line from Two Harbors to Tower was opened in 1886-1888 and is considered eligible for listing on the NRHP under Criterion A for its significance in the areas of Commerce and Transportation and within Minnesota's Iron Range Historic Context (E. Abel to D. Gimmestad letter, 12/05/04. On file, Minnesota Department of Transportation S.P. No. 38-090-01). The drill site and DM&IR properties are outside the APE. The *Cultural Resources Assessment for the Environmental Impact Statement Scoping Document, PolyMet Mining Corporation Northmet Project, Hoyt Lakes, St. Louis County* (Ketz 2004) was the only previous architectural history study of the project area.

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4.0 HISTORIC CONTEXT
The Erie Mining Company Concentration Plant at Hoyt Lakes, Minnesota, 1954-1969

4.1 Introduction

The Erie Mining Company Mining Company Concentration Plant opened at Hoyt Lakes, Minnesota in 1957 and was the state's second large-scale commercial taconite plant. In operation between 1957 and 2001, the plant was exemplary of the planning, plant design, and manufacturing processes that characterized the Mesabi Iron Range taconite industry after World War II. Although the taconite industry on the eastern Mesabi was part of a regional culture of mining expertise, an extensive mining district had not been established in this area. At Erie, as at other early plants, the crushing, grinding, magnetic separation and pelletization requirements of the taconite industry demanded the engineering of completely new or varied procedures to introduce power, acquire and control a water supply, and create methods of transportation and waste disposal. This was in addition to the construction of communities to house a new labor force (Witzig 1959:91-92).

Since the late 19th-century, Minnesota's Mesabi Iron Range has provided the majority of the U. S. output of iron ore. Early 20th-century mining relied largely high-grade hematite deposits of the central and western Mesabi, although beneficiation of lower-grade ore was also employed. Experimentation with magnetic concentration of lower-grade taconite ore on the eastern Mesabi supported the first commercial production of taconite pellets after World War II and post-war expansion depleted iron reserves. The intensive taconite process required three tons of crude to produce one ton of pellets and was accomplished with year-round, 24-hour plant operation (Witzig 1959:110-111). Because taconite mining requires moving three times as much ore for an equivalent tonnage of product, the scale of taconite operations dwarfed that of most other direct-shipping mining operations (*Engineering and Mining Journal* [*EMJ*] 1955:89).

The construction of the Erie Mining Company's Hoyt Lakes taconite plant under the management of Pickands Mather & Company followed years of experimentation with methods for commercial taconite production from the enormous reserves of the Biwabik formation of the eastern Mesabi Iron Range. Described as "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken" (*Iron News*, June 1957:3), Erie was one of two firms that led the investment in commercial taconite production. The E. W. Davis Works at Reserve Mining Company (now Northshore Mining Company) began pellet production in 1955, and Erie (later LTVSMC) began production in 1957 (*EMJ* Dec. 1956:77). Reserve's ore was mined at Babbitt and shipped 47 miles to the Silver Bay plant for concentration and shipment. At Erie, a single plant carried out all of the crushing, concentrating and agglomerating processes.

The 74-mile Erie Mining Company Railroad transported finished pellets from the plant to dock facilities at Taconite Harbor, 81 miles northeast of Duluth. The pellets were shipped across the Great Lakes to steel mills in Cleveland, Buffalo, and other locations. The harbor facilities constructed between 1954 and 1956 included a 30-ft.-deep harbor and a 2,434-ft.-long concrete dock. In 1957, Erie Mining Company completed a power plant at Taconite Harbor to supply the harbor facilities and the plant. The 61-mile transmission system reached from the power plant to the processing facility and also served Hoyt Lakes, the company's mining community planned for 4,000 to 5,000 residents (EMC 1969:93; *Iron News*, Feb.-March 1958:3-5).

The plant flowsheet at Erie that followed the ore from mine to the pelletizer was "very similar" to that at Reserve (Martin 1971:23-24). In 1967-1968, Erie added additional grinding and screening capacity and by 1969 achieved an annual pellet production of 10.3 million tons. Erie, unlike the other plants,

utilized shaft furnaces that were intended to provide lower capital and operating costs. Plant operation increasingly relied on computer modeling, including open pit mine optimization models (Martin 1971:36). With the addition of three new plants—the Fairlane Plant of Eveleth Taconite Company (1965), Butler Pellet Company Plant at Cooley (1967), and the National Steel Pellet Company Plant at Keewatin (1967)—Minnesota's iron ore production reached a total of 24 million tons in 1967. National Steel used a new pelletizing concept provided by the "Midland Ross 'heat-fast' process based on a circular grate," but it was not successful and was replaced in 1969 with a grate-kiln system (Martin 1971:25). In 1968, U. S. Steel began operation of the Minntac Plant at Mountain Iron. This was the only taconite mine using all-rail haulage, and the pelletizing process was the grate-kiln system (Martin 1971:25). By 1971, yearly pellet production at Minntac reached about 12 million tons. Economic and political factors as well as technical factors related to ore reserves, transport costs, taxes, fuel costs, and plant design have affected every aspect of the international steel industry, and Minnesota's taconite production peaked in the early 1980s before entering a period of decline.

Erie Mining Company was acquired by LTV Steel Corporation in the 1980s and management was provided by Cleveland Cliffs Inc. In 2000 LTV Steel Corporation and its LTVSMC subsidiary entered bankruptcy, and the plant closed in 2001. In October 2001 LTV Steel Corporation sold the LTVSMC plant, mines, railroad and appurtenances to Cleveland Cliffs Inc. In 2003 PolyMet and Cleveland Cliffs Inc. entered an option agreement for portions of the plant, tailings basin, mining equipment service facility, and water and rail system usage agreements. The Pelletizing Building, pellet stacker, and stockpile are owned by Cleveland Cliffs Inc.

In 2006, 98 percent of the usable iron ore produced in the United States was shipped from Minnesota and Michigan taconite operations, with Minnesota accounting for about 75 percent of total shipments. In 2007 there are a total of ten iron ore open pit mines, eight concentration plants and eight pelletizing plants, and eight of the mines are operated by three companies. Cleveland Cliffs, U. S. Steel and Mittal Steel USA account for more than 99 percent of production (*Mining Magazine* April 2007:14).

Throughout Erie Mining Company and LTVSMC operation between 1957 and 2001, mining, crushing, concentration and agglomerization (or pelletization) were all accomplished at the site in buildings and structures constructed in 1954-1957 with additions in 1967. As shown on Table 1 and 2, the plant area within the APE includes a coarse and fine crusher (SL-HLC-002 and -003), concentrator building (SL-HLC-008), general shop building (SL-HLC-005), central heating plant (SL-HLC-011), a tailings basin (SL-HLC-016), and fuel oil tanks (SL-HLC-012). The pelletizing building owned by Cleveland Cliffs Inc. is currently under demolition (SL-HLC-010). A reservoir and water tower (SL-HLC-006 and 007) are located at the highest elevation of the site (Figure 2). The structures and buildings are linked by mine tracks and are interconnected by underground pipe and electrical tunnels. Outside the APE, the plant is flanked by inactive open pit taconite mines and waste rock stockpiles, railroad tracks, and a network of paved and gravel roads and rail tracks that extend to and around the ore pits and mine stockpiles (Figures 13-15).

PolyMet's NorthMet project ore body contains copper, nickel, cobalt, platinum, palladium and gold with traces of zinc and silver. After the hydrometallurgical recovery of metals from primary sulfidic ores became commercially established in the 1990s, the ability to use the Erie site to crush and grind the ore offered a new use for the plant (PolyMet 2007). During Erie's 43 years of operation between despite refinements and advances in plant technology, the stripping, mining, crushing, concentration, and pelletizing process remained relatively unchanged. The proposed processing of non-ferrous metals at the plant will rely on much of the same equipment.

4.2 Geological Setting

Along the 100-mile length of the Mesabi Iron Range during the early 20th century, roughly between Grand Rapids at the west and Aurora at the east, many areas of the iron-formation yielded high-grade, hematite ores near the surface. Mined by open pit or underground methods, the high-grade ore was suited for direct shipment and required little or no beneficiation before shipment across the Great Lakes for smelting. Most of the tonnage of early 20th-century Mesabi mining came from high-grade beds.

Until after World War II, mining companies passed over the lower grade taconite, which was is comprised of quartz and iron oxides, carbonates and silicates. Described as "a hard, abrasive, gray-black rock," it carries about 30 percent iron and is capable of producing a taconite pellet with an approximate 64 percent iron content. As defined by law, taconite is "a ferruginous chert of slate in the form of a compact siliceous rock, in which the iron oxide is so finely disseminated that substantially all of the iron-bearing particles of merchantable grade ore are smaller than 20 mesh" (*EMJ* Dec 1956:94). State Geologist Newton H. Winchell is credited with naming taconite in 1892, when he identified the "taconite strata" of the iron formation on the Mesabi and linked it to the geologic series recognized in the Taconic mountains of Massachusetts and Vermont (Witzig 1959:61).

In Minnesota, taconite occurs in the Biwabik Iron Formation, which is comprised of a series of Pre-Cambrian sediments deposited along the southern flank of the Giant's Range granite that underpins the highest elevations of the Mesabi Iron Range. The beds overlain on the granite are Pokegema quartzite, the lower cherty, lower slaty, upper cherty, upper slaty, and the hanging wall Virginia slate. The deposits are between 340 and 300 feet deep (*EMJ* 1955:85). Early analysis showed that much of the taconite ore was concentrated in the cherty layers and could be concentrated by magnetic separation. The slaty layers, however, contain very fine magnetic iron particles that proved difficult to grind and separate for commercial purposes.

Taconite occurs across the Great Lakes mining region (and in other locations throughout the world), with notable deposits in Michigan. Minnesota's ore, however, is coarser grained than Michigan's and requires less grinding to separate iron particles. Minnesota's ore beds dip less steeply, and can be more easily mined. Among other factors contributing to marketability is the abundance of magnetite in Minnesota. Michigan's ore is primarily non-magnetic hematite, which requires flotation processes for concentration. Pellets produce a more spherical shape that performs better in blast furnaces and during shipping (Kakela 1982:528).

4.3 Pioneering With Taconite

Taconite processing is one form of beneficiation, which is "the use of any processing method for the purpose of improving the physical structure or the chemical composition of the ore" (Witzig 1959:53). Such processes were applied to lower-grade ore. Beneficiation began on the western Mesabi at Coleraine in 1907, where it was applied to the area's sandy ores. At Coleraine and other locations, the ores were concentrated by washing to remove undesirable silica. A more complex form of beneficiation known as retreat involves heavy media separation to remove larger chunks of silica. A third process known as sintering fused ore from small chunks by exposure to open flame in a furnace (Witzig 1959:53). By 1955, there were 49 concentration plants on the Mesabi using washing, retreat, or sintering methods for ore concentration. The taconite pellet production process transforms crude taconite ore into a fine powder through a wet or dry process, and then into a concentrate that is magnetically separated and formed into pellets before placement in a furnace where magnetite is converted to hematite (Witzig 1959:74).

Experimentation with methods of extracting higher-grade ore from taconite began in Minnesota in 1913 at the University of Minnesota's Mines Experiment Station. By 1915, University of Minnesota Professor Edward W. Davis (1888-1973) developed a magnetic tube separator and produced a concentrate that assayed at 60 percent iron (Davis 1964:22-23). Concurrently, early test plants were developed at locations such as Sellwood, Ontario, and in North Carolina, Pennsylvania, New York, and New Jersey and in Europe (Witzig 1959:66). Efforts to test commercial methods of production in Minnesota began in 1919, when the Mesabi Iron Company developed the Mesabi Iron Company Magnetic Concentration Plant at Babbitt that used ore from the Sulphur Mine near Mesaba. Much of the product, known as Mesabi Sinter in reference to its concentration process, was purchased by the Ford Motor Company. The plant closed in 1924 but was refurbished and operated by the Reserve Mining Company as a test plant between 1952 and 1957. The Mesabi Iron Company facility is regarded as the first commercial-scale taconite processing plant in Minnesota (Roberts 1987:8.2).

Industrial investment in commercial taconite production after World War II also included experimental plants by Erie Mining Company near Aurora (1948), by Reserve Mining Company at Ashland, Kentucky (1950) and then at Babbitt at the former Mesabi Iron Company plant. U.S. Steel opened the Pilotac Plant near Mountain Iron in 1953 (Davis 1964:142-3; *EMJ* Dec 1956:77).

4.4 Pickands Mather & Company

Pickands Mather & Company of Cleveland, Ohio observed the potential depletion of high-grade reserves during World War I demand and began to explore the use of low-grade ores. The firm was founded in 1883 by James Pickands (1839-1896) and Samuel Mather (1851-1931) and initially had interests in pig iron and coal. The firm worked as sales agents on the Mesabi Iron Range in the 1880s and 1890s and acquired interests in a number of blast furnaces. By the 1920s Pickands Mather was the second-largest producer of iron ore in the U.S. The firm's Henry Dalton and Elton Hoyt II led research into taconite in the late 1930s (Encyclopedia of Cleveland History 2007). Testing on Pickands Mather land north of Aurora confirmed high magnetic content of ores and an 1938-1939 exploration campaign involved extensive diamond drilling from Aurora to Nashwauk (*EMJ* 1955:86).

In 1939, Reserve Mining Company was founded to develop and implement technologies for extracting and processing low-grade iron ore. In 1940, Pickands Mather created the Erie Mining Company for the same purpose (Witzig 1959:84). At the time Pickands Mather was operating 25 open pit and underground mines across the Lake Superior ranges. The highly diversified company also managed the Interlake Steamship Company and was involved in coal and pig iron as well as ore handling and related fields (*EMJ* 1955:87). The mining companies operated by Pickands Mather were owned by other companies, with many interrelated interests among them. In 1942 the Erie Mining Company established a laboratory in Hibbing to experiment with concentration and agglomeration techniques (*EMJ* 1955:89).

After World War II, when demand for steel was high, domestic reserves of high-grade, readily accessible naturally occurring iron ore were dwindling and a domestic and European iron ore shortage appeared to be on the horizon (Kakela 1982:524). More than 85 percent of the ore consumed during World War II came from the Lake Superior region, with more than 60 percent from the Mesabi (Kakela 1981:132). Intensified exploration programs and improved technology were two of the means available for improving the reserve (Earney 1969:516).

In 1948 the Erie Mining Company built its now-razed experimental plant near Aurora. Known as the Preliminary Plant, its purpose was to evaluate commercial processing and pelletizing methods

developed at the University, "testing the flowsheet worked out in the laboratory on commercial-sized equipment" (EMC 1969:3). In order to begin the successful commercial production of taconite it was necessary to develop a process to crush the hard taconite ore to a fine powder, magnetically concentrate the ore from 20 to 30 percent iron to 60 to 64 percent, and agglomerate—or transform—the fine powder into marble-like ball suitable for firing in a furnace. The addition of bentonite, a clay-like mineral, as a binder allowed successful mixing and forming of the balls (Kakela 1981:133). The Preliminary Plant was designed to produce 200,000 tons annually, and until 1952 was the only taconite plant using commercial-size units. This plant demonstrated that laboratory work could be developed and refined on a commercial scale (*EMJ* 1955:91). Industrially-financed research such as Erie's, as well as state and federally-funded research, focused on developing technology to concentrate taconite into high-grade pellets. Mining companies also focused on identifying reserves of high-grade hematite in countries such as Chile, Venezuela, Africa, and Canada (Kakela 1981:132).

Mine location and operation decisions involve complex political considerations, and the Erie Mining Company development would not have been possible without major reform of the Minnesota tax structure. The tax schedules that applied to early high-grade iron ore reserves had yielded enormous sums to the State of Minnesota. When applied to the expensive taconite process, however, the rates were prohibitive (*EMJ* 1955:87). The 1941 session of the Minnesota Legislature passed the "taconite tax" that ensured that Erie could acquire state and private leases on taconite lands (Kakela 1982:526). Under the bill, taconite was to be taxed on production, rather on the value of the ore in the ground, representing a major departure from previous practice. The legislature concurrently revised the royalties on state-owned mining lands.

4.5 Plant Site History

The Erie Mining Company plant and surrounding open pit mine areas occupy part of an area associated with some of the earliest mining exploration of the Mesabi Range. In 1888 mining surveyor John Mallman investigated the area around the Red Pan Cut of the Duluth & Iron Range Railway near Mesaba in Section 28, T59N, R14W (Zellie 2005:2-32). The Mayas Mine, opened in Section 14, T59N, R14W in 1906 by the Mayas Mine Company, was the closest natural ore mine and was later incorporated into the stripping stockpile of Erie's Area 2 Mine Pit (Figure 3).

South of the Erie Mining Company plant site and mine areas, early natural ore mines between the towns of Aurora and Mesaba included the Stephens Mine (1903), a large open pit opened in Section 26, T59N, R15W by the Oliver Mining Company (Crowell and Murray 1911:128). The Perkins (1909) and Weed (ca. 1914) mines adjoined the Stevens. To the east, underground mines were opened at the Adriatic (1906) in Section 30 and the Knox (1909) in Section 19 (Crowell and Murray 1911:134,158). The Vivian Mine (1912-3) in Section 20 T59, R14 was also opened as an underground mine (Zellie 2005:2-33; Figure 4). Such early 20th-century mining company investment in the area was eclipsed by high-grade discoveries further west at Biwabik and Mountain Iron. By the 1950s, however, a few new natural ore mines were opened south of the plant, including the Wentworth and Graham located in Sections 19, 20, and 21, T59N, R14W.

The former townsite of Mesaba (1891) is located south of the plant site in Section 21, T59N, R14W (Figure 5). Mesaba was briefly a center of trade for the first mining activity on the eastern Mesabi (van Brunt 1921:702, Davis 1964:16). The construction of the DM&IR Railway from Duluth to Tower on the Vermilion Range encouraged investment in the townsite (van Brunt 1921:704). Nearby mines had poor yields, however, and mining interest shifted to the west. The corporate structure of Mesaba village was dissolved in 1947 (Zellie 2005:3-44). The first diamond drill site on the Mesabi Iron Range was developed in 1890 by E. J. Longyear. It is located in Section 33, T59N, R14W

(NRHP; SL-HLC-001). The townsite of Aurora, southwest of the plant site, was founded in ca. 1898 and in 1905 was relocated about one mile north where it had steady growth near the Stephens, Meadow-Fowler, and other mines. Aurora's population peaked at about 2,800 in 1920; in 2000 it fell to 1,850 (Zellie 2005:3-33).

The Duluth and Iron Range Railroad (D&IR) was completed to the Soudan Mine at Tower on the Vermilion Range in 1884. The line hauled ore to shipping facilities at Two Harbors. The D&IR was acquired by the Illinois Steel Company in 1887 (King: 1972:25). In 1901 the D&IR and the Duluth, Missabe and Iron Range Railway (DM&IR) were acquired by the U.S. Steel Company and were merged as the DM&IR in 1938 (King 1972:67;119). The Hinsdale siding of the road appears on the 1949 USGS map in Section 17, T59N, R14W (Figure 5). In 2004 the DM&IR was sold to the Canadian National Railway (CN). Logging began in upland areas in the 1890s and continues periodically. A portion of the Erie Mining Company property is situated within the Lake Superior National Forest, which was created in 1909.

4.6 Plant Design and Construction

In 1953, the Erie Mining Company began planning a new facility with an annual pellet capacity of 7.5 million tons. Plant construction began in 1954 and operations were underway in 1957 (EMC 1969:3). By this time, the Reserve Mining Company's E. W. Davis Works at Silver Bay was in full production, with a yearly output of 3,750,000 tons per year.

The Erie plant site was placed on a knob of the Giant's Range Granite, approximately eight miles northeast of Aurora, and six miles north of Hoyt Lakes. Trunk Highway 135 north of Aurora leads to the plant road that intersects with the Hoyt Road (County Highway 666) about 1.2 miles from the main gate. This road connects Hoyt Lakes with the plant.

The plant buildings were placed on terraces excavated at the foot of the Embarrass Mountains at an elevation of 1,750 feet, which drops about 200 feet within a mile to the north (Figure 7). Wetlands occupied much of the terrain to the south. Second Creek, a tributary of the Partridge River, drained the site from Section 21, T59N, R14W. The Partridge River drained Whitewater and Colby Lakes five miles to the south. Numerous small streams dissected the area. Spring Mine Lake was northeast of the plant site in Section 11, T59N, R14W 11, R14W.

Anaconda Copper Mining Company produced approximately 8,000 drawings for the original plant design. Foley Constructors of Minnesota was the general contractor. Anaconda's experience with plants in Chile, Mexico, and the United States was reflected in plant layout and equipment design. The four-year construction project involved more than 6,000 workers and 65,000 tons of structural steel and 400,000 cubic yards of concrete. The plant construction process was meticulously drawn and detailed, with a comprehensive archive of drawings maintained throughout the period of plant operation. The initial project cost totaled more than $300 million (*EMJ* 1955:83;92). The plant design provided for 24-hour-per-day, 365-day per year operation with 2,800 employees mining 22,500,000 tons of crude taconite ore per year (*EMJ* 1955:92). Daily capacity was rated at 63,000 tons.

The Erie Mining Company was managed during initial plant construction by Pickands Mather. Pickands Mather subsequently sold part of their share to the Dalton Ore Company, and Dalton was then acquired by Interlake Iron Company, resulting in four owners. By 1955, Bethlehem Steel owned 45 percent, Youngstown Sheet and Tube Company owned 35 percent, and Interlake Iron and the Steel Co. of Canada Ltd. each owned 10 percent (*EMJ* 1955:87).

4.7 Commercial Taconite Production and the Erie Mining Company

> . . . but suddenly the woods fall away and there is a brand-new town . . . beyond the woods close in again, the road goes on a few miles and another startling vista opens. Here are buildings and facilities so huge the eye can hardly comprehend them. They loom impressively on the horizon but as the car comes closer they grow awesomely.
>
> "The Taconite Trail," *New York Times* (11 Nov. 1956:14)

When the plant opened in 1957, its scale and potential economic impact were celebrated in the mining and general press, and called a tribute to the "vision, skill, confidence, ingenuity and courage" of the company. The plant was lauded as the "largest taconite concentrating and agglomerating structure ever built as a single unit" (Witzig 1959:84). The previous 80 years of open pit and underground mining on the Mesabi and Vermilion iron ranges had been accompanied by frequent public announcement of new technology and an emphasis on the scale of the undertakings. The press surrounding the taconite era, however, emphasized the rebirth of the iron industry as well as the gargantuan scale of the structures that housed the concentration and pelletizing operations. One typical account noted, "as much material is moved in less than three weeks at the Erie operation as the average large Mesabi Range mine, operating in conventional hematite ore, moves in a year" (EMC 1969:9). Similar buildings and technology would be employed at other Mesabi taconite plants, but the Erie design was particularly self-sufficient, with repair bays built into every processing step to ensure maximum operating availability (personal communication with David Hughes, PolyMet Mining 9/08/07).

The commercial production of taconite commenced at the Erie Mining Company plant at Hoyt Lakes and the Reserve Mining Company plant at Silver Bay proved successful, and production problems were steadily resolved. Technology continued to "refine the definition of desirable iron ore stocks," and the resource stocks of so-called "red ore" that had previously been the backbone of the American iron and steel industry through two world wars" became a drag on the market (Kakela 1982:526). Pelletizing technology, developed by necessity to utilize low-grade ore, "turned out to be a breakthrough, one whose full benefits could not be duplicated when using high-grade hematites" (Kakela 1982:526). By the early 1960s, the productivity of the Mesabi's taconite plants brought prosperity to the iron range and corporations appealed to voters to amend the state constitution to provide tax stability. The 1964 Taconite Amendment to the Minnesota State Constitution provided a 25-year pledge that the state would not increase taxes on taconite companies at rates exceeding those on manufacturing companies.

The Taconite Amendment triggered immediate investment and the opening of additional taconite plants. In 1964, an increase in pellet output from 17 million tons to 45 million tons in 1974 was predicted (*New York Times* 15 Nov 1964:49). In 1966 there were eleven plants in operation on the Mesabi including Erie, which immediately made a $50 million expansion to increase annual pellet production capacity to 10.3 million tons. Two new Minnesota plants were the Butler Pellet Company Plant at Cooley, and the National Steel Pellet Company Plant at Keewatin. The largest was U.S. Steel's Mountain Iron plant, with an annual capacity of 18 million tons (*New York Times* 19 June 1966:131). These developments were praised as a "foundation stone" for "rebuilding the mining industry to enormous proportions" (*New York Times* 15 No 1964:49).

4.8 Plant Expansion

The buildings and equipment placed in service by the Erie Mining Company in 1957 were continually analyzed and sometimes modified to reduce costs and improve productivity. By 1965, Erie shipped 8 million gross tons of iron ore pellets, slightly below the record 1963 tonnage (*SMR* 12 Feb. 1966:1).

In 1967 the company completed a $50 million expansion project designed to increase annual pellet capacity to 10.3 million tons. The project was designed and built by the Parsons-Jurden Corporation (*SMR* 12 Feb. 1966:6). The expansion included an addition to the concentrator to add nine new mill lines, and a method for 325-mesh separation of magnetite at high tonnage rates, and the addition of a 27th shaft furnace to the pelletizer (*SMR* 12 Feb. 1966:6, 19). Centralization of operating controls and pumping improvements were also added (EMC 1969:10). Enlargements to the power plant at Taconite Harbor were completed in 1967 (*SMR* 12 Feb. 1966:6).

New taconite plants in Cooley, Keewatin and Mountain Iron were placed in service during this period. In 1967, the Hanna Mining Company opened the Butler Taconite Plant at Cooley in Itasca County, 15 miles west of Hibbing. The capacity of the plant was 2 million tons per year (*SMR* 8 July 1967:1) It was immediately followed by the National Steel Pellet Plant of Hanna Mining Company at Keewatin. Both plants hauled pellets to Superior, Wisconsin for loading into vessels (*SMR* 6 July 1967:1) U.S. Steel's Minntac at Mountain Iron was also opened in 1967 (*SMR* 22 July:7).

4.9. Plant Description

As shown in Figures 2, 8, and 13-15), the coarse and fine crushers, concentrator building and pelletizing building were flanked by the general shops, a water reservoir, fuel oil and other tanks, tailings thickeners, and a pellet stockpile, and various auxiliary buildings were dispersed across the site. Shops for mine areas (pits) No. 1 and 2 were placed between the mine areas and the plant in Sections 15 and 18, T59N, R14W. The primary plant buildings and structures were placed on deep concrete foundations at various elevations of the terraced site, with the reservoir and water tower at the highest point. The plant buildings were interconnected by a deep and extensive system of tunnels carrying power, water, and crushed ore. A two-story administration building was constructed south of the plant. A tailings basin containing the unusable results of crushing and concentrating was placed north of the Concentrator Building. Much of the equipment in use between 1957 and 2001 remains in the concentrator and other plant buildings. The Pelletizing Building (SL-HLC-010) and three of the five Tailings Thickener Tanks (SL-HLC-009) have recently been demolished.

The original mine Areas 1, 2, and 3 were framed by access roads and pit tracks (Figure 9). Stripping and lean ore stockpiles were deposited along the edges. Area 1, west of the plant was the lower cherty pit, with its stripping stockpile (waste rock) at the north; Area 2, directly southeast of the plant, was designated as the initial upper cherty pit, with stripping stockpiles to the north. Area. 3 was opened directly north of Area 2 and was incorporated into it by 1959 (Figure 9).

The DM&IR (formerly the D&IR and now the CN), is located the west of the plant area and outside the APE in Section 17, T59N, R14. The Erie Mining Company Railroad's 74-mile route to Taconite Harbor commences south of the stockpile and travels east across Sections 16, 22, 23 and 24 of T59N, R14W (Figure 6). Throughout the plant area, the Erie Mining Company Railroad plant track, paved roads, and parking lots frame the processing and support structures (Figure 2). The plant road, now Highway 666, was built between the plant and the Hoyt Lakes townsite. Another road followed the plant water supply pipeline to Colby Lake.

4.10 Erie Mining Company Property and Process Description

Shipping of the finished pellets to Taconite Harbor was preceded by stripping, mining, crushing, concentration, and pelletization processes. The crude ore was crushed and ground and upgraded in the concentrator as feed for the agglomerization operation that produced taconite pellets. The final

product was a hard pellet ranging in size from 5/8 to 1 1/12 inch. The iron content totaled 64 percent, with 7.5 percent silica, 0.01 percent phosphorus, and fractional amounts of manganese, alumina, lime, and magnesia (*EMJ* 1955:92).

4.10.1 Stripping

The taconite ores of the east Mesabi are thinly covered with glacial drift, and stripping operations are less complex than in the western and central portions of the range (Witzig 1959:68).
Mine Areas 1 and 2, to the west and east of the plant respectively, were opened in 40-foot benches with holes spaced about 20 feet apart (*EMJ* 1955:91). These areas were quite long as compared with an ordinary open pit mine. Area 1, the lower cherty pit, was 4 miles long and shallow, at about 125 feet (*EMJ* 1955:91). During the stripping operation, electric shovels removed the overburden and loaded material in 85-ton trucks equipped with 13- or 16-yard dippers. Smaller shovels or front-end loaders prepared the final surface and each step was carefully controlled (EMC 1969:7). Erie's fleet of nine 85-ton diesel electric trucks in use in the mid-1960s were the first of their type on the Mesabi (*SMR* 12 Feb 1966:7).

The initial annual capacity of 7.5 million tons of pellets required more than 22 million tons of raw taconite. After plant expansion in 1967, more than 50 million tons of material was required to produce 10.3 million tons of pellets (EMC 1969:6). Nearly half of the tonnage was waste rock and surface stripping material.

In 1965 Erie opened Mine Area 8, located 20 miles northeast of the plant. Known as the Dunka Pit, this area relied on truck haulage to move crude ore approximately 3,400 feet to the loading pockets. Trains carried the crude ore 17 miles over a new railroad to a marshalling yard, where the ore was picked up by the mine railroad and transported three miles to the primary crusher (*SMR* 12 Feb 1966:6). Mine Area 6, located six miles southwest of the plant, was opened in 1966. As at Mine Area 8, trucks were used to move the crude ore to a railroad loading pocket.

By 1969, there were six active mining areas. Mine Areas 1, 6, and 9 west and southwest of the plant were in the lower cherty members of the iron formation and were found to be easily drilled and blasted, and had good milling characteristics. North and east of the plant, Mine Areas 2, 3, and 8 were situated on the lower and upper cherty. A variation in the formation provided by the Duluth Gabbro required alteration of drilling, blasting, and mining techniques, and Mine Areas 2 and 3 contained especially hard taconite that proved difficult to blast (EMC 1969:6).

4.10.2 Drilling and Blasting

As noted above, the hard, abrasive taconite ore required special drilling and blasting methods. Jet drilling was developed for taconite mining, and was accomplished by jet drilling or piercing, which involved kerosene and other fuel ore burned with oxygen in a blow pipe that rotates against the rock face. The high-velocity, high temperature flame (4,250° F) disintegrated the rock by spalling. Jet drilling produced a hole ranging in diameter from 6 ½ inches to 14 inches, at an average depth of 35 feet (EMC 1969:9).

Various blasting methods were employed depending on the terrain and taconite hardness. In a normal blast, approximately 500,000 tons of crude taconite was liberated along a bank of approximately 2,000 feet. The material could be mined in four or five parallel shovel cuts. Oversize material too large for the shovel was broken by a "skullcracker" (EMC 1969:9). At Mine Areas 1, 2, and 3, ore was loaded by shovels into ore trains. At Mine Areas 6, 8, and 9, the ore was loaded into trucks and

transferred into rail cars on a vibrating feeder. The shovels were equipped with 7, 8, and 13-yard dippers (EMC 1969:9). Erie's initial use of rail lines to haul crude ore to the crusher was a different practice than that at Reserve, where trucks were used for hauling (Witzig 1959:85).

Taconite processing requires a uniform crude ore mix. Each load of crude ore required grading for analysis, mineralogy, and hardness, all factors affecting final pellet quality (EMC 1969:7). By 1969, about 85,000 tons of crude ore were delivered to the crushing mills each day and about 51,000 tons of rock and surface were removed.

Beginning at the mine pit, the plant was arranged to provide accessibility for efficient maintenance, and the "flow-sheet" circuit arrangement was conducive to low operating costs (1969:10; Figure 11). Mine geology, mining methods, mine life, and expansion potential were factors in plant design. The Anaconda Copper Company's experience with previous large-scale plants influenced innovations in features such as car dumping, dust control, pumping, and control room design. For example, experience at Anaconda's Chuquicamata, Chile mine resulted in "car dumping by stationary hydraulically-actuated arms rather than by rotary dumper" which provided smoother control of the operation (*EMJ* 1955:92). Chilean experience also influenced dust control, with enclosure of the whole crusher pocket (*EMJ* 1955:92).

4.10.3 Coarse Crusher Building (SL-HLC-002)

An expensive, high energy-consuming component of taconite production, crushing includes the processes used to reduce ore size prior to the milling circuit and is the first contact between the run of mine ore and the processing route (*Mining Magazine* Nov. 2006:18). The coarse and fine crushing buildings are the highest buildings at the plant site. The coarse crusher is placed at the north end of the Erie Mining Company plant site on a double-track segment of the Erie Mining Company Railroad. It is linked to the fine crusher by a conveyor and drive house (Figure 2). The building rests on a deep concrete foundation with a total area of 20,667 sq. ft. The heavy structural steel frame is clad in corrugated metal. The flat roof is supported by metal trusses.

The coarse crushing building received the crude taconite ore directly from the pit by rail car. The ore was reduced from chunks up to 5 feet long into pieces less than 5 inches in size. The crushing equipment, like that throughout the plant, was designed for efficient maintenance and a minimum of downtime in replacing parts and units. Much of the equipment was interchangeable, with units designed to be maintained in repair bays.

The coarse crusher is comprised of two identical but independent crushing units, each in continuous operation with a daily capacity of more than 90,000 tons. A 60-inch gyratory crusher, followed by four 36 x 70-inch crushers, provided a two-stage reduction process. Gyratory crushers have inner and outer vertical crushing cones. The ore falls between the two cones and is progressively crushed until it is small enough to fall through the gap at the bottom (*Mining Magazine* Nov. 2006:18). Erie Mining Company patented the hydraulic systems for adjusting the settings on the crushers; each was powered by a 400-hp motor (EMC 1969:10). The second coarse crushing line was added immediately after the plan began operation in 1957.

4.10.4 Fine Crusher Building (SL-HLC-003)

The fine crusher is placed at the north end of the Erie Mining Company plant site to the east of the Concentrator Building (SL-HLC-008, Figure 2). The fine and coarse crushing buildings (SL-HLC-002) are the tallest processing buildings at the plant site. The approximately 10-story building rests on

a deep concrete foundation and has a total area of 41,000 s.f. The concrete-floored building is framed in heavy structural steel and the exterior is clad in corrugated metal. The two-level flat roof is supported by metal trusses. The building is linked to the coarse crusher by a conveyor and drive house. The 60-inch wide conveyor is housed in a steel structure (SL-HLC-004).

Following coarse crushing, the ore was loaded on the 60-inch-wide conveyor leading to the top of the fine crushing building where the rock was broken into pieces less than ¾ inch in size (*EMJ* 1955:92).

The fine crushing building has centrally located electrical control units and lower level oil rooms. The plant initially housed six crusher units consisting of one 7-foot standard cone crusher and two 7-foot shorthead cone crushers. Each was driven by a 350-hp motor. Vibrating feeders on each crusher line were placed under the coarse ore bin, and the ore was fed by conveyor from the feeders into the standard crushers. The only screening performed in the crushing building occurred after the standard crusher (*EMJ* 1955:92).

Engineers attempted to control the loss of steel liners during the crushing stage. The amount of wear could depend on factors such as variations in the ore, but frequent "change-outs" of the steel liner were required. By 1967, the life of the liner was increased from 65,000 to 100,000 tons by changing the carbon content of the manganese steel, and automated controls on the crushers replaced manual operations and ensured a maximum crushing rate. A seventh fine crushing line was added in 1967-1968 (EMC 1969:12).

4.10.5 Concentrator Building (SL-HLC-008) and Tailings Thickener Tanks (SL-HLC-009)

The Concentrator Building rises 174 feet above the adjacent grade. The building originally measured 1,110 x 275 feet, and was placed to step down a terrace at a lower elevation than the adjacent coarse and fine crusher buildings (Figures 2 and 12). Water and electrical tunnels line the foundation of the structure. The building rests on a deep concrete foundation and floors are concrete. The exterior is clad in corrugated metal. The flat roofs are supported by metal trusses and a series of overhead cranes are mounted below the roof structure.

The Concentrator Building housed fine ore bins, grinding, and magnetic separation sections as well as pumping equipment and control centers for the power and water distribution systems. The original construction consisted of 27 identical mill lines. Wet grinding in the rod and ball mills preceded the removal of iron particles by a three-stage magnetic separation process. The central repair bay is flanked by two long operating areas. At the south side there are 12 mill lines, and at the north side there are 15 mill lines. Each line was divided into sections comprised of four lines. Designed to minimize delay for scheduled repairs and breakdowns, each line handled tailings and concentrate, processing approximately 120 tons of feed per hour (EMC 1969:13).

In 1955 an engineer described the Erie process:

> The magnetic concentrate joins with the plus ¼ inch screen oversize as it enters the ball mills. Each of the 27 ball mills is equipped with a revolving screen on the discharge end for the removal of ball fragments. The ball mill discharge is then concentrated in 108 magnetic separators. The magnetic concentrates are pumped to the 135 sizing cyclones for classification. The oversize material from the cyclones returns to the ball mills and the finished sized material flows to the 108 three-drum Finisher Magnetic Separators which complete the milling operation (EMC 1965:n.p.).

Waste material from the magnetic separators was directed to the water reclamation system, which included four 255-foot diameter steel tailings thickeners and 7 hydro-separators at the west side of the Concentrator Building.

A $50 million expansion project completed in 1967 extended the concentrator by 350 feet on the north end. The total length of 1,460 feet housed nine new mill lines, each incorporating one rod mill and one ball mill. A fifth thickener tank was added to the west side of the building, and primary conveyors were speeded. Fine screening was added to all mill lines (*SMR* 12 Feb. 1966:1,6,19). The control room installed for initial operation utilized an analog system that was later upgraded to digital controls in 1967. Three of the five thickener tanks were removed in ca. 2006 (SL-HLC-009).

4.10.6 Pelletizing (Agglomerating) Building (SL-HLC-010)

Long treatment at the right temperature produces a satisfactory pellet.
Engineering and Mining Journal (March 1955:91)

The Pelletizing Building (also called the pellitizer) was placed at the southern end of the plant (Figure 2). The building rested on a deep concrete foundation and the exterior was clad in corrugated metal. Floors were concrete, and the flat roof was supported by metal trusses. The building contained 140,252 sq. ft. Water and electrical tunnels line the foundation of the structure. The pelletizer is owned by Cliffs Erie and is currently undergoing demolition as required by Minnesota mining reclamation law.

Transformation of taconite powder into iron ore pellets was accomplished here. Pelletizing is one method of agglomeration; others include briquetting, nodulizing, and sintering (Earney 1969:514). The building housed the handling, storage, blending and dewatering of magnetic concentrates that were pumped a distance of 1700 feet from the concentrator.

The functions of the pelletizing building included:

1. Balling the concentrate.
2. Induration (heat hardening) of green balls.
3. Screening and conveying the furnace product
4. Direct loading of the screened pellets into railroad cars (during the shipping season) or into stockpiles during the winter.
5. Reprocessing of furnace fines.
6. Storage and handling of bentonite used in the pelletizing process (EMC 1969:16).

Reprocessed dust collect residue was mixed with the slurry and after sampling fed into a sump pump. After dewatering and filtering in a vacuum filter, bentonite was added as a binder. Control instruments and conveyor belt scales maintained constant tonnage of concentrate feed to the 9-foot revolving balling drums, where it was formed into green, unfired balls.

A trommel, or integrating screen, was built into the discharge end of the drum to maintain a closely-sized ball. Undersized balls that fell through the screen were recirculated through the drum. In the mid-1960s, vibrating screens were used on newly installed drums (EMC 1969:18). The unfired, green balls were evenly distributed over the bed of vertical shaft furnaces by electronically controlled charging machines. The green balls entered the furnaces on a conveyor, and were discharged as indurated (heat-hardened) taconite pellets. The pellets spent about four hours in the furnace. Screening captured any undersized pellets, which were reground and re-pelletized (EMC 1969:18).

The 27 vertical shaft furnaces were at the heart of the building. Shaft furnaces were one of three firing methods available to producers, in addition to the continuous grate and the grate-kiln (Earney 1969:514). The original furnace layout was based on four rows of six, with a fifth row of two high-capacity furnaces added in ca. 1958 and another additional furnace in 1967. The original 24 furnaces produced approximately 1,140 tons of pellets per day. The 3 additional units placed in operation resulted in an average of 1,620 tons per day by 1968 (EMC 1969:18).

Pellet quality and operating efficiency was improved during the first ten years of operation by modifications to the balling circuit and furnace charging including air and temperature distribution as well as stockline length. By the late 1960s, a pellet of a very uniform size and composition was produced (EMC 1969:20). Product sampling was conducted throughout the process, and components of the operating system, including feed rate, balling, additive addition, discharge balance, stockline contours, and air temperature controls were constantly monitored (EMC 1969:21).

The furnaces consisted of a brick-lined, vertical steel shell, each about 60 feet high and about 7 feet wide. Length varied between 15 and 21 feet, with the units added in the mid 1960s of the greatest length. A carefully controlled process of air blowing, chunk breaking (to break up any clusters of pellets that formed during induration) resulted in magnetite particles in the green balls reaching 2,350° F, at which point an exothermic reaction increased the actual temperature to 2,500° F. At discharge, the pellets were at an average temperature of 750° F (EMC 1969:18).

The pellets were discharged onto rubber conveyor belts and transferred to vibrating, double-deck product screens. Testing for factors such as hardness and chemical and moisture composition was conducted on samples from each 4-hour operating period (EMC 1969:18) Three 80,000-barrel fuel oil tanks provided storage for the oil used in the furnaces. The $50 million expansion project in 1967 added a shaft furnace that was housed in an extension at the east side of the building.

4.10.7 Pellet Stacker and Stockpile (SL-HLC-013)

The stockpile is located southwest of the Pelletizing Building opposite a loading pocket (Figure 2). During the winter when Great Lakes navigation was idled, pellets were stockpiled. A belt conveyor stacker served an area of nearly 4 million-ton-capacity. At the time of its construction, the belt stacker was the world's largest (EMC 1965: n.p.). At the start of the shipping season, stored pellets were loaded from the stockpiles by an electric shovel onto a string of cars. Each train held about 8,000 tons of pellets, suitable for dumping at Taconite Harbor in about 6 ½ minutes while in motion at about 10 mph. (The stockpile, like the pelletizing building, is owned by Cliffs Erie, not PolyMet.)

4.10.8 Tailings Basin (SL-HLC-016)

Taconite processing requires large areas for waste disposal. Tailings were pumped from the thickeners adjacent to the Concentrator Building into the tailings basin placed in the low-lying land north of the plant site (Figure 2). The basin was expanded at various times during plant operation from 1957 to 2001. Three cells comprise the basin; 1E is approximately 875 acres, 2E is about 616 acres, and 2W totals approximately 1,447 acres. Basin features include pumping stations and a roadway along the basin dike.

4.10.9 General Shops and Garage (SL-HLC-005)

The Erie plant had a high degree of self-sufficiency and the capacity to repair as well as fabricate

equipment. The centrally located general shops buildings provided facilities for general maintenance and repair, and a garage for maintenance of heavy equipment (Figure 2). The flat-roofed main building and adjacent garage are clad in corrugated metal. There is also a gable-roofed, wood-framed carpentry and storage building.

4.10.10 Central Heating Plant (SL-HLC-011)

The central heating plant was placed near the fuel storage area and fuel oil tanks at the west side of the Pelletizing Building (Figure 2). It provided heat for pelletizer furnace fuel and plant buildings (*SMR* 7 July 1956:2).

4.10.11 Reservoir (SL-HLC-006) and Water Tower (SL-HLC-007)

The 10-million-gallon, concrete-lined reservoir was placed on the highest terrace of the plant site to hold water for use in wet processes and boilers (Figure 2). There is a 100-gallon metal water tower used for fire protection on the west rim of the reservoir.

4.10.12 Mine Area 1 Shops (SL-HLC-017) and Mine Area 2 Shops (SL-HLC-014)

Area 1 Shops in Section 18 included fuel equipment rebuilding and repair, an electrical shop, boiler house, fire pump house, and oil storage facility. The shops were enlarged in the late 1960s to accommodate larger trucks (Figure 2). Area 2 Shops in Section 15 provided a locomotive facility, cold storage, and fuel storage (Figure 2). The complexes include steel framed, metal-clad buildings. Most buildings have gable roofs and multiple garage and service entries. Each area was served by mine track (SL-HLC-015).

4.10.13 Erie Mining Company Railroad (SL-HLC-015)

The 74-mile Erie Mining Company Railroad main line was constructed to haul finished pellets from the pellet loader to the Taconite Harbor shipping facility (Figures 6, 9). A separate system of mine and plant track served the pits and plant buildings (Figure 2). Although the DM&IR, a common carrier with a junction two miles south of the plant, could have provided rail service to Erie's Taconite Harbor facilities or the DM&IR's Two Harbors facilities, "the kind, quality and cost of service did not fit into the overall requirements of the new taconite industry" (Witzig 1959:100). Erie Mining Company found the greatest economy in building its own single-purpose line as part of its industrial plant.

The company provided engineering, and the subgrade was excavated by Arrowhead Constructors (*EMJ* 1955:93). The main line was built across swampy terrain requiring eight bridges across streams or for grade separation, and was tunneled through a bluff near the terminus of the line. The roadbed was planned to minimize grades. The single track consisted of 140-lb rails, with 24 rails per section. The tracks were laid over stone ballast over a washed gravel subgrade. Spur sidings were located at 14-mile intervals and a main passing siding was provided near the mid-point (EMC 1969:22). The railroad handled more than 10 million tons of pellets during the shipping season from mid April to early December. Approximately 58,000 tons per day were moved on seven round trips between plant and harbor. Erie patented a dumping mechanism for the cars that allowed them to be dumped while in motion, permitting a full non-stop trip (EMC 1969:22). An ore train typically consisted of 96 cars pulled by four 1,750-hp diesel electric locomotives. The cars were equipped with 36-inch roller bearing wheels instead of standard 33-inch wheels. Unloaded trains traveled at 55 mph and loaded trains at 45 mph (Figure 2).

4.10.14 Administration Building

A one-story administration building south of the plant in Section 20 T59, R14W was completed in 1958 and was enlarged in 1967. This building is located outside the APE. The $200,000 enlargement project included a new two-story wing. The wing housed administrative and technical services, including additional computing services, related to the plant's $50 million expansion that increased pellet production from 7.5 million to 10.3 million tons (*SMR* 2 Sept. 1967:18). The building vault room still houses an extensive collection of Erie Mining Company drawings, plans, plant records, photographs, and other documents.

4.10.15 Water Supply

Taconite production requires an "enormous" supply of water (Witzig 1959:92). The Reserve Mining Company placed its plant directly on the shore of Lake Superior, while Erie Mining Company relied on surface water from two lakes five miles south of the plant. Two dams were constructed at Whitewater Lake and raised the level of Whitewater to that of Colby Lake, 30 feet higher. Whitewater became the reservoir and water was pumped from Colby through a 36-inch pipeline to a 12 million-gallon reservoir at the plant. The system was designed to use surplus run off from spring floodwater (*EMJ* 1955:92). The diversion works (1957) straddle Whitewater and Colby Lakes.

4.10.16 Power Supply

Power requirements for taconite processing are much greater than for other types of low-grade ore processing (Witzig 1959:96). Erie Mining Company, like Reserve Mining Company, constructed its own power plant adjacent to the harbor facilities. The lakeshore site ensured economical access to fuel (coal) and to a water supply for cooling and steam generation (Witzig 1959:97). The Taconite Harbor power plant supplied the dock facilities, the Hoyt Lakes plant and the Hoyt Lake townsite. The 225,000 kw-capacity steam plant generated power for transmission to the Hoyt Lakes plant from three 75,000 kw reheat, tandem, hydrogen-cooled, double-flow turbines. A tie line between the power plant and the Minnesota Power and Light Company steam generating plant built on the north shore of Colby Lake in 1953 enabled another means of operation during an emergency (EMC 1969:23). There are segments of power lines and poles across the plant site and a substation on the north side of the Concentrator Building.

4.11 Historic Context Summary

Erie Mining Company's Hoyt Lakes Concentration Plant was the second large plant put in operation in Minnesota for the commercial production of taconite, following Reserve Mining Company's facility opened at Silver Bay in 1956. In operation from 1957 to 2001, it was praised as "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken," and the Concentrator Building (SL-HLC-008) was called the "largest ever built as a single initial unit" (*Iron News*, June 1957:3; *SMR* 7 July 1956:20). Early experimentation, planning, design, and operation are exemplary of the first commercial phase of production on the Mesabi Iron Range, where large investment placed a complete manufacturing process across a landscape of mineral and water resources. The plant, water system, power system, railroad, harbor shipping facilities, and company town are a diagram of 1950s and 1960s mine-engineering design. The enlargement of the Erie concentrator and other plant improvements in 1967 reflected the economic impetus provided by the 1964 Minnesota Taconite Amendment. Erie and the five other Mesabi plants in operation by 1969 led the revitalization of the economy of northeastern Minnesota and contributed to employment and

community stability. While the plants employed similar equipment and processes, Erie's long-term reliance on vertical shaft furnaces in the Pelletizing Building is distinctive, as is the lack of alteration of most of the plant facilities. Recent demolition of the Pelletizing Building resulted in loss of a critical processing component at the core of the complex.

4.12 Period of Significance

The period of significance for the Erie Mining Company Concentration Plant is 1954 to 1969, spanning the design, engineering, and construction of the facilities, and reflecting the plant's role in early commercial taconite production on the Mesabi Iron Range. The period of significance also spans the design and construction of plant improvements that followed the 1964 Taconite Amendment and resulted in a 1969 output of 10.9 million tons of iron ore pellets.

5.0 PHASE I RESULTS

5.1 Inventory Evaluation

The Phase I architectural history survey inventoried 16 properties within the APE (Figure 2, Tables 1 and 2). Properties include the primary Erie Mining Company Concentration Plant buildings such as the coarse and fine crushers and the concentrator, mine and plant track segments of the Erie Mining Company Railroad, a tailings basin, and Mine Areas No. 1 and 2. The Pelletizing Building currently under demolition was also inventoried as well as the adjacent pellet stockpile area outside the APE. Information contained in Bulletin 42, *Guidelines for Identifying, Evaluating and Registering Historic Mining Sites* (rev 1997), and the historic context, "The Erie Mining Company Concentration Plant at Hoyt Lakes, Minnesota, 1954-1969" provide a basis for recommendations of NRHP eligibility.

5.1.2 Concentration Plant Complex (SL-HLC-018)

During its period of operation, Erie Mining Company Concentration Plant was exemplary of an engineer-designed system with every component designed to reduce costs, increase production, and maximize profits. The plant complex initially appeared to be potentially significant as a district associated with industry and engineering under Criterion A, which applies to properties associated with events that have made significant contributions to broad patterns of history. The complex also appeared to be potentially significant as a district associated with engineering under Criterion C, which applies to properties embodying distinctive characteristics of a type, period, or method of construction; possessing high artistic values; or representing a significant and distinguishable entity whose components may lack individual distinction. Most of the remaining individual components of the plant site retain a fair to excellent level of integrity, with alterations typical of properties in a mining landscape. There has been extensive filling and disturbance of the areas around the buildings and structures.

A critical component of taconite production, however, is missing. The demolition of the Pelletizing Building (SL-HLC-010; 1957) creates an important break in the processing system that significantly alters the historic integrity of the plant complex

Bulletin 42 notes that if clear physical evidence of a "complete system remains intact, deterioration of individual aspects of the system may not eliminate the overall integrity of the resource" (Noble and Spude rev 1997:21). The Bulletin also states, "the integrity of mining properties will frequently hinge not so much on the condition of the extant buildings, but rather on the degree to which the overall mining system remains intact and visible" (Noble and Spude rev 1997:21). The loss of the central component of the pellet process greatly diminishes historic integrity and the significance of a potential district associated with taconite production.

Historic integrity is the ability of a property to convey its significance and is the composite effect of location, design, setting, materials, workmanship, feeling, and association. To retain historic integrity, a property will always possess several, and usually most, of the aspects. The purpose of the plant was to manufacture and ship taconite pellets. While the complex retains its monumental scale and the enormous concentrator building, without the pelletizing plant the plant site loses its qualities of association (with taconite pellet production), design (there is a missing link in the engineered system), and related aspects of feeling and setting (there is a large gap in the former plant landscape).

The pelletizer and concentrator were at the heart of the Erie Mining Company operation and each building had unique characteristics. The coarse and fine crushers and other buildings and structures

appear to be typical of similar building types at other large taconite operations on the Mesabi Iron Range.

5.1.3 Concentrator Building

Of the remaining buildings and structures comprising the plant complex, the Concentrator Building (1957; SL-HLC-008) is a key property that reflects decades of experimentation by a leading mining firm with the magnetic separation of taconite ore. The concentrator was originally called the "largest ever built as a single initial unit" and was enlarged to 1,460 feet in 1967, representing the Erie Mining Company's efforts to continually improve production through engineering design The addition allowed an increase in pellet output to 10.3 million tons per year (*SMR* 12 Feb. 1966:1). The production line included repair bays to ensure continual operation. The Concentrator Building is recommended individually eligible for the NRHP under Criterion A in the areas of Industry and Engineering, and also under Criterion C in the area of Engineering. The building retains a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association and setting is fair, due to the removal of the pellitizer. At the interior, much of the layout and equipment dates to original construction.

5.1.4 Erie Mining Company Railroad (SL-HLC-015)

The Erie Mining Company Railroad is a 74-mile, engineered system of ore transport designed solely for taconite shipment to Taconite Harbor. The railroad was in operation during the plant's period of significance (1954-1969) and directly linked pellet production with shipping facilities in Taconite Harbor. The main track of the railroad from the plant to Taconite Harbor is outside the APE. Mine track and plant track segments, however, were part of a system that connected to the main rail corridor south of the plant in Section 16. The mine and plant track segments of the Erie Mining Company Railroad are recommended as NRHP eligible under Criterion A in the areas of Commerce, Industry, and Transportation. They are components of a potential linear district associated with a complete railroad system from the plant to Taconite Harbor. The right-of-way and roadbed are generally intact; some sections of track have been removed. Integrity of location and design is excellent; integrity of feeling and association remains good although the line is not currently in use.

The evaluation of the history and development of the entire corridor, as well as its current level of historic integrity, was outside the scope of the current study. Registration requirements established for the Duluth Missabe & Northern (DM&N) Railway's Alborn Branch Line may provide guidance for future evaluation of Erie Mining Company Railroad resources (Bradley 2003:7-14).

5.1.5 Other Plant Properties

As noted above, the Concentrator Building (SL-HLC-008) is recommended as individually eligible for the NRHP because of its association with engineering experimentation and achievement of large-scale production, elements that represented the Erie Mining Company's efforts to continually improve output. The remaining plant properties within the APE, such as the coarse and fine crushers, fuel tanks, shops, heating plant, reservoir, and paved and unpaved roads, are exemplary of more standard buildings, structures, and features required for commercial taconite plant operation. They represent aspects of the plant's function and contribute to the integrity of the plant setting, but without the connection to the metallurgical process concluded in the Pelletizing Building they lack individual distinction under Criterion A or C. They are recommended as not eligible for the NRHP. Additional evaluation of crushers, concentrators, pelletizers and related building types at other taconite plants on

the Mesabi Iron Range may provide additional information about the significance of the Erie Mining Company properties. That evaluation was outside the scope of the current study.

Table 1. Phase I Architectural History Survey Properties Eligible for Listing on the NRHP

SHPO #	Property Name	Location	Date
SL-HLC-008	Concentrator Building	Sections 8, 17, T59, R14W	1957, 1967
SL-HLC-015	Erie Mining Co. RR Mine and Plant Track	Parts of Sections 8, 9, 15, 16, 17, 18, T59N, R14W	1957

Table 2. Phase I Architectural History Survey Properties Recommended Not Eligible for Listing on the NRHP

SHPO #	Property Name	Location	Date
SL-HLC-002	Coarse Crusher	Section 9, T59N, R14W	1957
SL-HLC-003	Fine Crusher	Section 16, T59N, R14W	1957
SL-HLC-004	Conveyor and Drive House	Section 9, T59N, R14W	1957
SL-HLC-005	General Shops	Section 16, T59N, R14W	1957
SL-HLC-006	Reservoir	Section 9, T59N, R14W	1957
SL-HLC-007	Water Tower	Section 9, T59N, R14W	1957
SL-HLC-009	Tailings ThickenerTanks	Section 17, T59N, R14W	1957
SL-HLC-010	Pelletizing Building (razed)	Section 17, T59N, R14W	1957
SL-HLC-011	Central Heating Plant	Section 17, T59N, R14W	1957
SL-HLC-012	Fuel Oil Tanks	Section 16, T59N, R14W	1957
SL-HLC-013	Pellet Stockpile and Stacker (adjacent to Pelletizing Building)	Section 17, T59N, R14W	1957
SL-HLC-014	Mine Area No. 2 Shops	Section 15, T59N, R14W	1957
SL-HLC-016	Tailings Basin	Parts of Sections 3, 4, 5, 8, 9, 10, and 16, T59N, R14W; parts of Sections 32, 33, and 34, T60N, R14W	1957-
SL-HLC-017	Mine Area No. 1 Shops	Section 18, T59N, R14W	1957
SL-HLC-018	Erie Mining Company Concentration Plant Complex	Parts of Sections 7,8,9,16 T59N, R14W	1957-

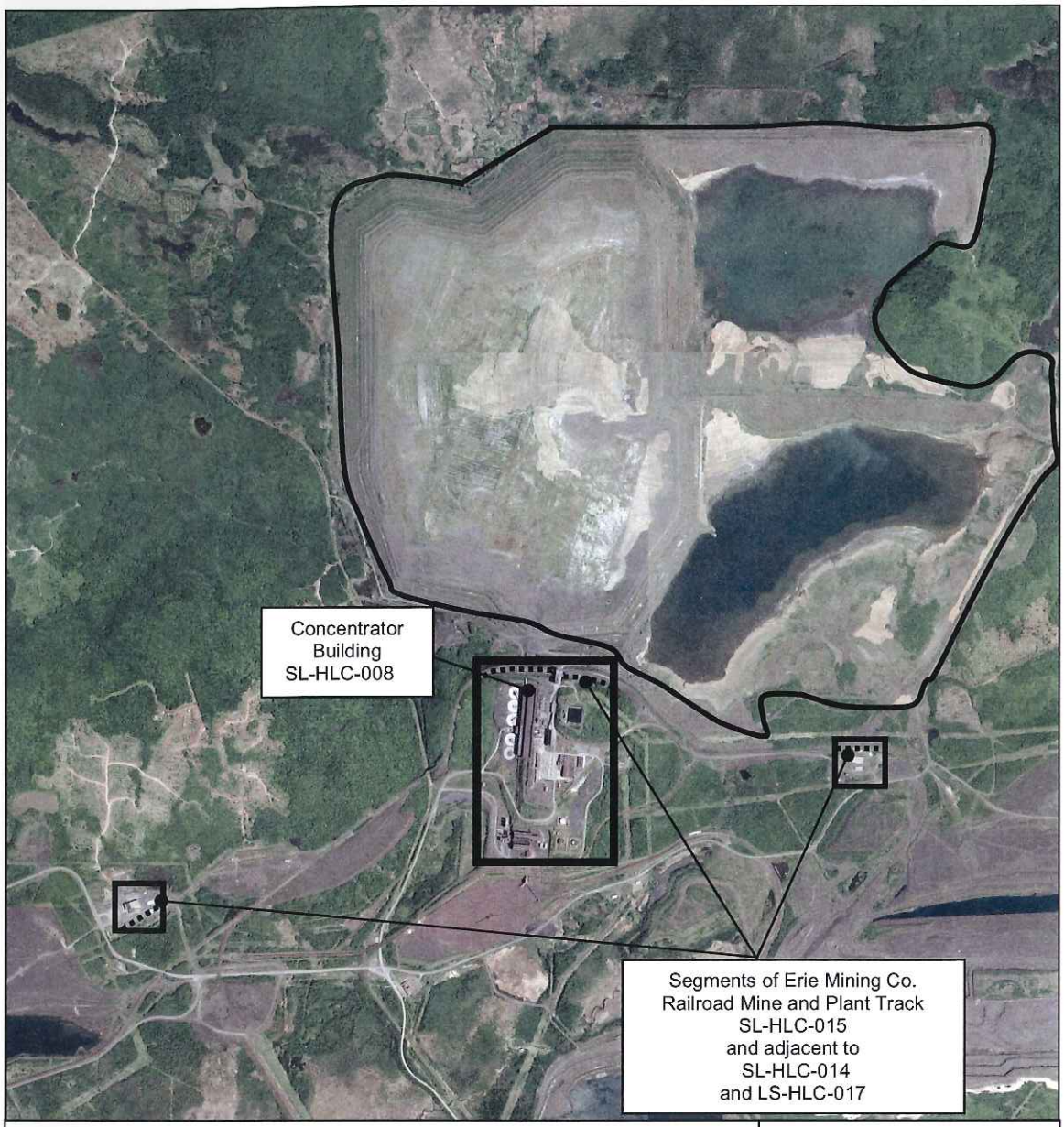
5.2 Summary and Recommendations

In 2004, a preliminary architectural history assessment of the plant site noted that "because it is one of a very small number of large and complex taconite mining facilities developed on the Mesabi Iron Range," there was high potential for NRHP-eligibility (Ketz 2004:16). The study noted that "the development of a new mining district complete with a processing facility and company town and the significance of the taconite industry for Minnesota" potentially contributed to historic significance.

With the 2007 demolition of the Pelletizing Plant, however, and based on evaluation of the Phase I survey and related historic context development, it is recommended that the properties comprising the Erie Mining Company Concentration Plant (SL-HLC-018; 1957-) are not eligible for the NRHP as a mining landscape or historic district. The Concentrator Building (SL-HLC-008; 1957) is recommended as individually eligible under Criterion A and C. Segments of the Erie Mining Company Railroad mine and plant track (SL-HLC-015) are recommended as eligible for the NRHP under Criterion A as part of a potential linear district (Figure 3).

The proposed project will have a low direct impact on the Concentrator Building because there will be minor alterations to the building exterior and interior, including existing equipment. Alterations to the building stacks will be made if required by state and federal regulations. There will be minor exterior and interior alterations to the other primary plant buildings and structures. The proposed project will include the construction of several new buildings within the APE adjacent to the Concentrator Building, with indirect effects to the setting (Figures 16 and 17). There will be no impact on the segments of the Erie Mining Company mine and plant track within the APE.

After mining is finished, reclamation of the properties as required under Minnesota State Law will be completed (Rule 6132-1300 E 4 c). This will result in demolition of the Concentrator and other plant buildings. Therefore, additional recordation of the Concentrator Building (SL-HLC-008) is recommended to further document the property's significance to the Erie Mining Company and to describe its role in engineering design and taconite production on the Mesabi Iron Range. Other key plant buildings and structures, including the coarse and fine crusher, conveyor and drive house, general shops, and reservoir contribute to the integrity of the setting and should be included in recordation. The excellent archives housed in the Erie Mining Company Administration Building (now PolyMet's Administration Building) provide necessary documentation. A selection of copies of original drawings and plans of each property should be accompanied by new large-format photography and accompanying property descriptions. The Guidelines for Architectural and Engineering Documentation and Historic American Engineering Record Guidelines (HAER) should be consulted in project planning (Federal Register 21 July 2003:43159). Completed recordation should be placed in appropriate archives such as the Minnesota Historical Society (St. Paul) and the Iron Range Research Center (Chisholm).


Concentrator
Building
SL-HLC-008
Segments of Erie Mining Co.
Railroad Mine and Plant Track
SL-HLC-015
and adjacent to
SL-HLC-014
and LS-HLC-017
Source: 2003 Aerial View PolyMet Mining Corp.
PHASE I ARCHITECTURAL HISTORY RESOURCES INVENTORY
POLYMET MINING COMPANY, HOYT LAKES, MINNESOTA
0
2000
4000 FT
Project Area
and APE
N
LANDSCAPE RESEARCH LLC
FIGURE 3
Recommended
NRHP Eligible
Properties

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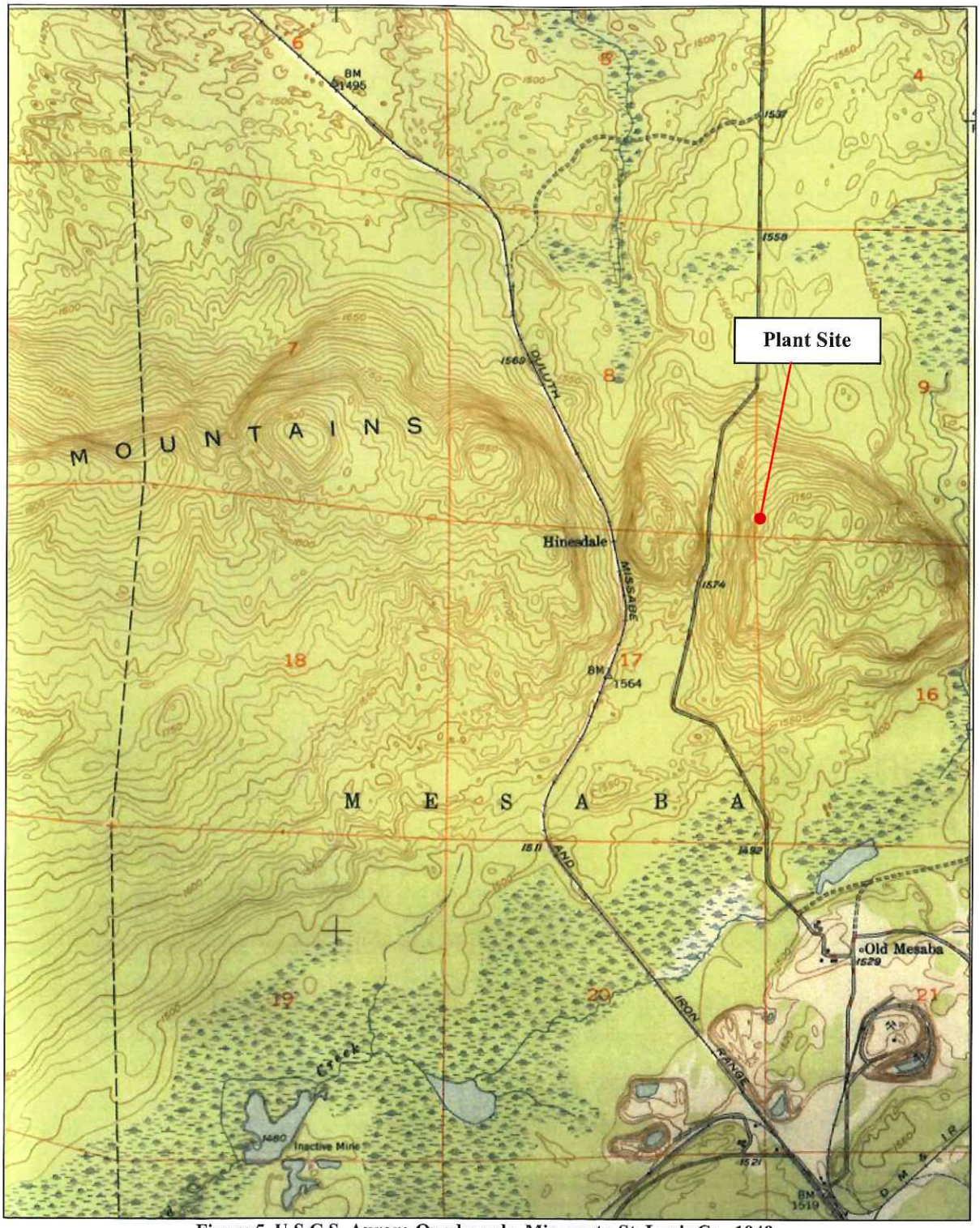


Figure 5. U.S.G.S. Aurora Quadrangle, Minnesota-St. Louis Co., 1949.

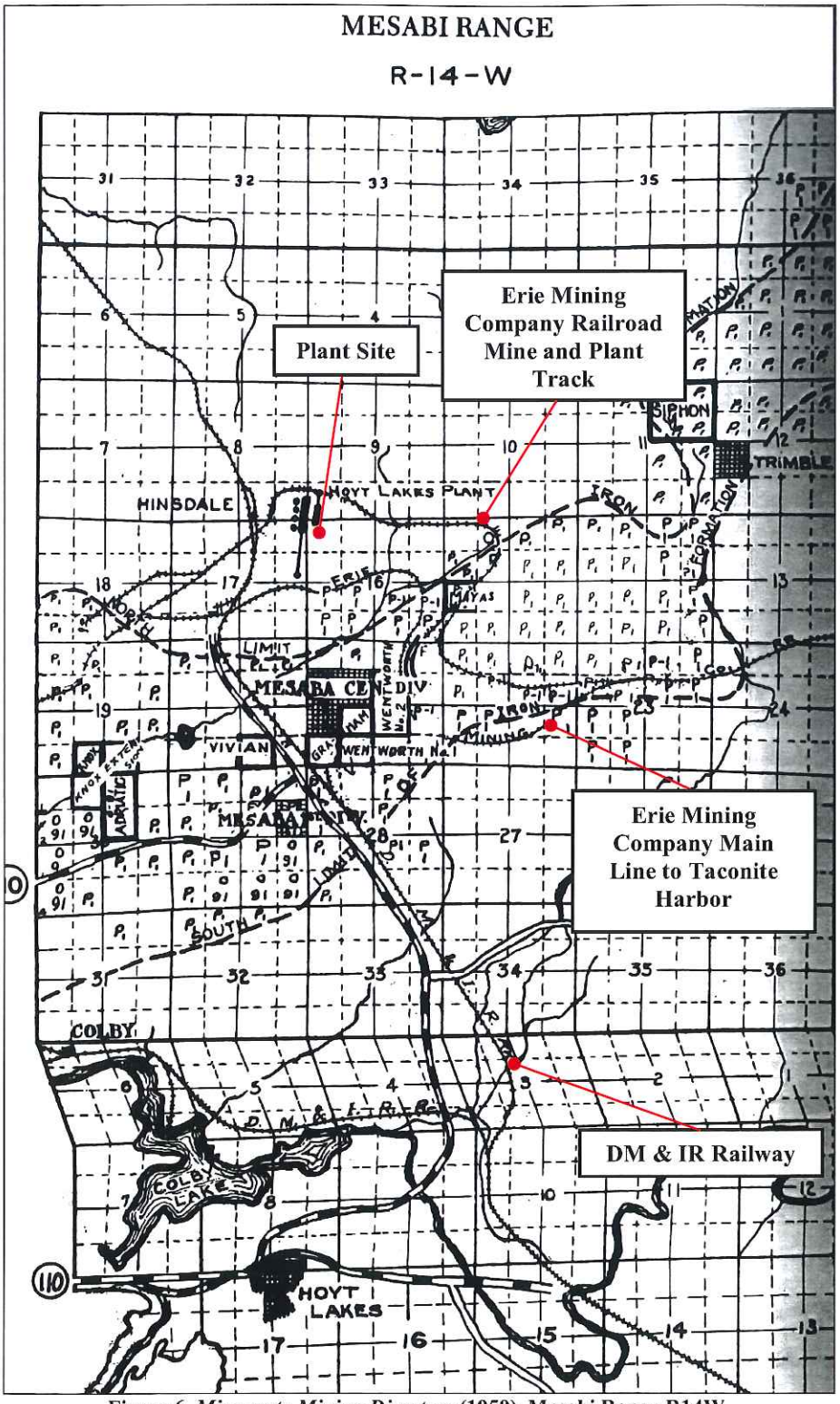


Figure 6. ***Minnesota Mining Directory*** **(1959), Mesabi Range R14W, T58N-T60N, p. 26.**

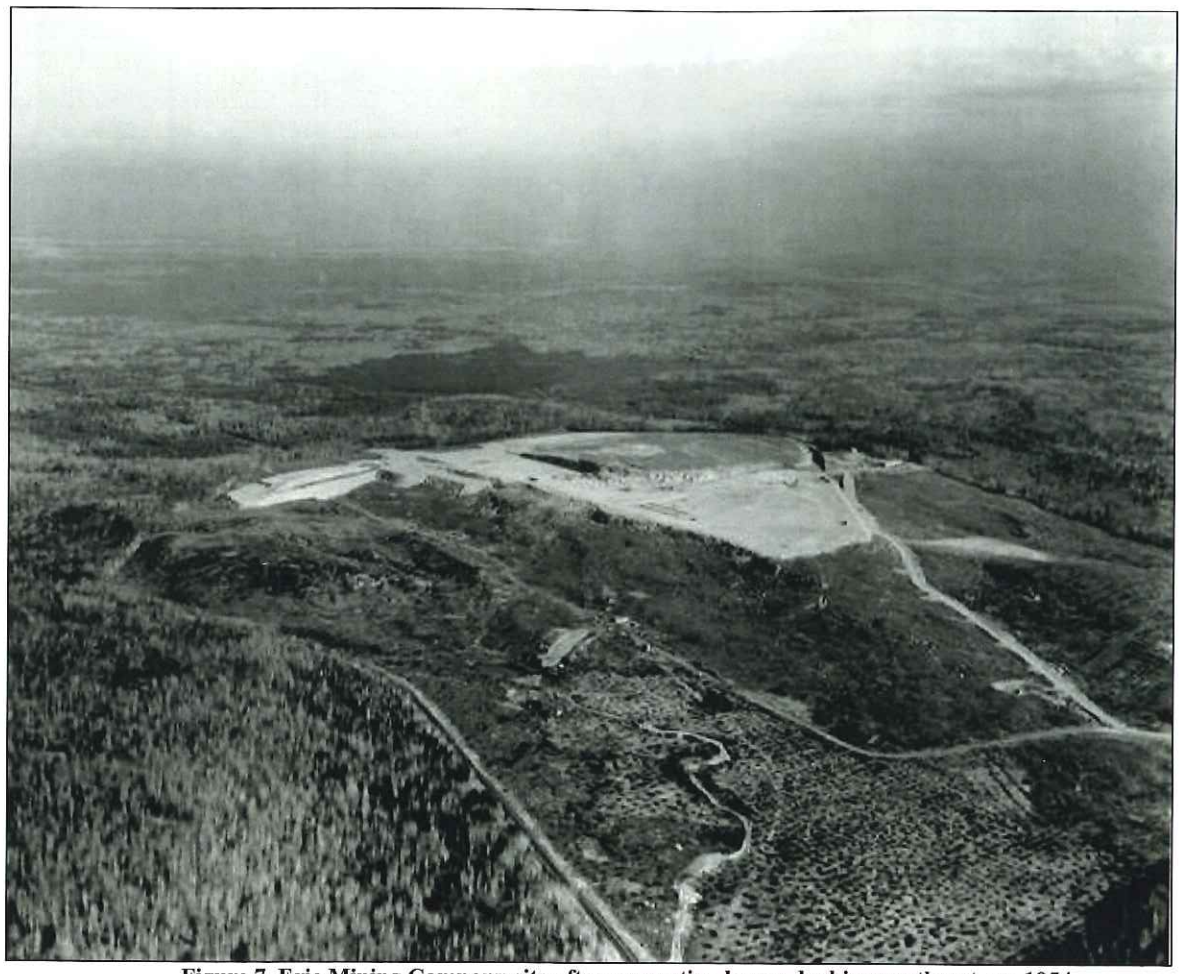


Figure 7. Erie Mining Company site after excavation began, looking northeast, ca. 1954. Minnesota Historical Society.

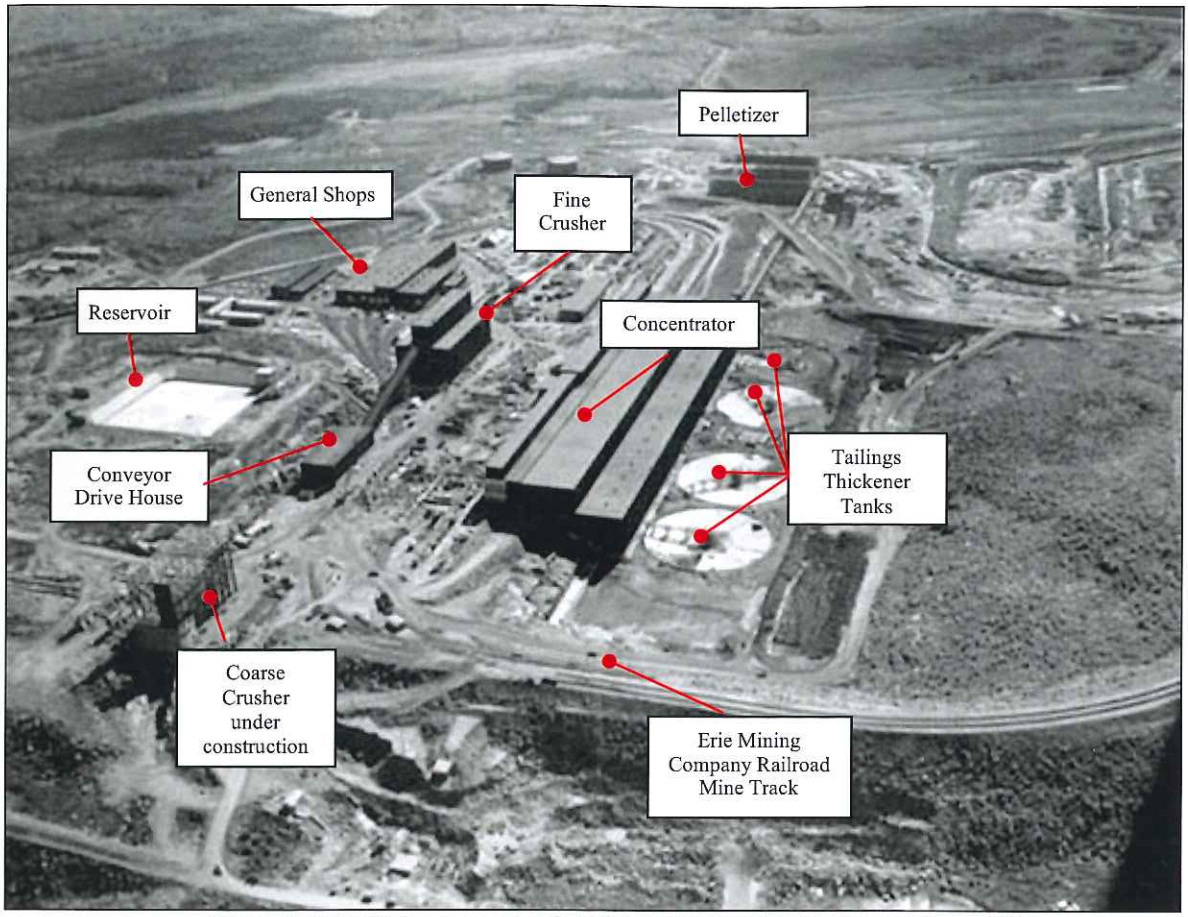


Figure 8. Erie Mining Company site during construction, looking south, ca. 1956. Minnesota Historical Society.

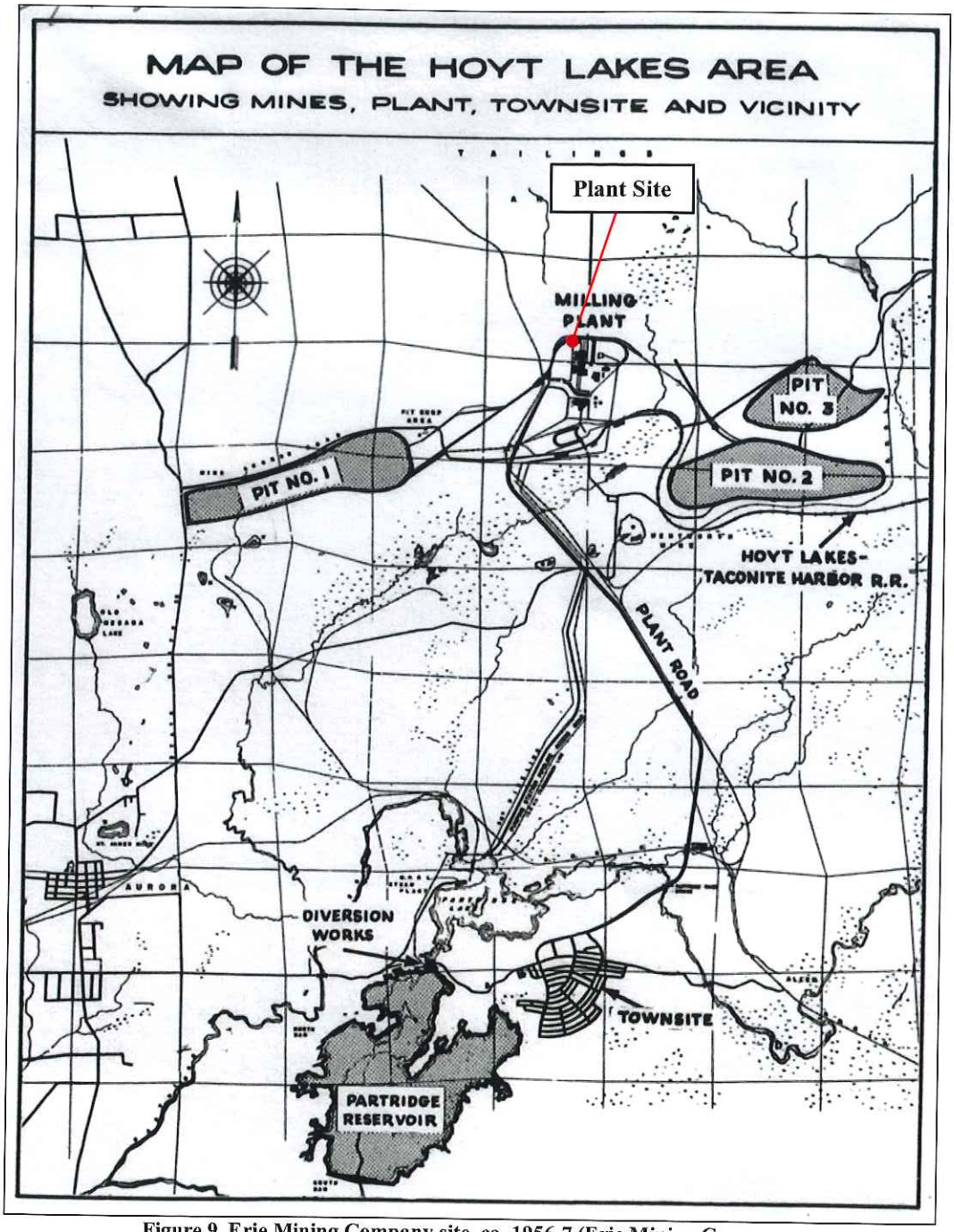


Figure 9. Erie Mining Company site, ca. 1956-7 (Erie Mining Company, *Erie Taconite,* ca. 1956-7, 15).

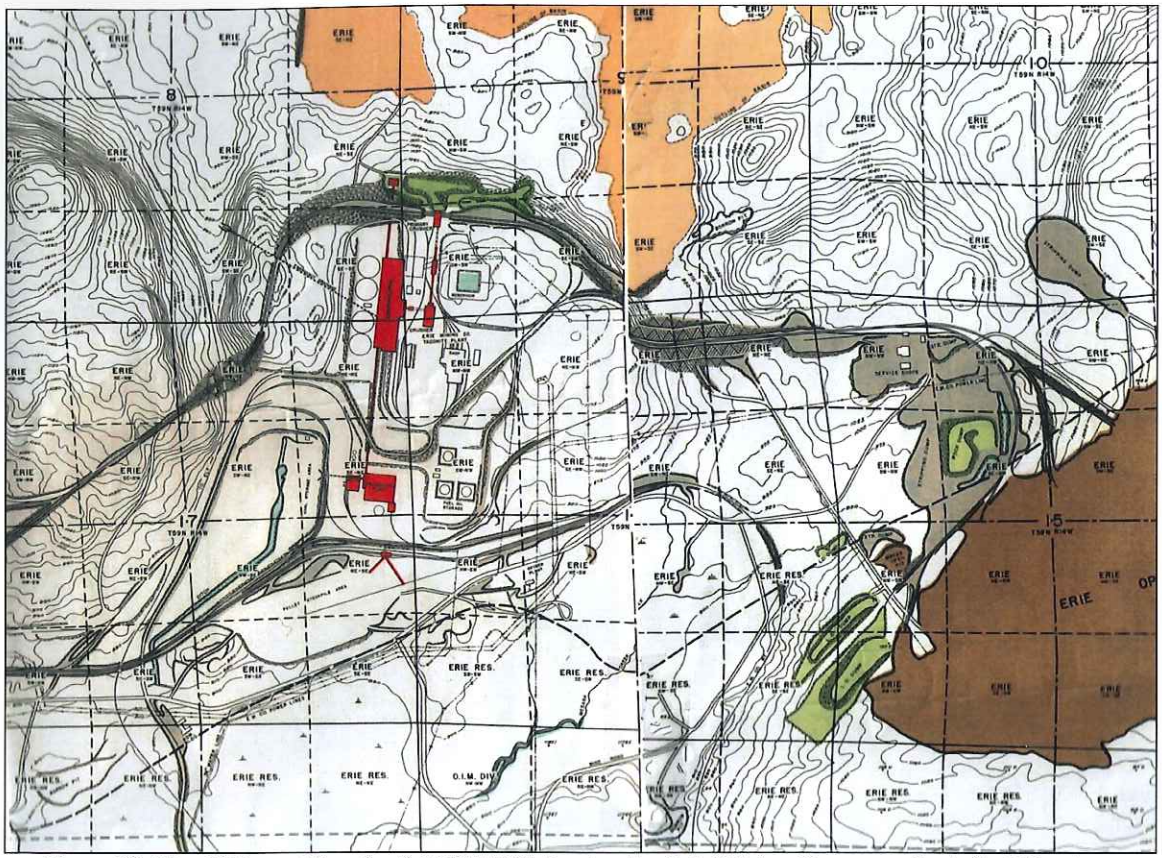


Figure 10. ***Mesabi Range Maps*** **for R 14W T59N showing the Erie Mining Company plant site, Mine Area Shops No. 2, and a portion of Mine Area No. 2 at right (Great Northern Ore Properties 1959).**

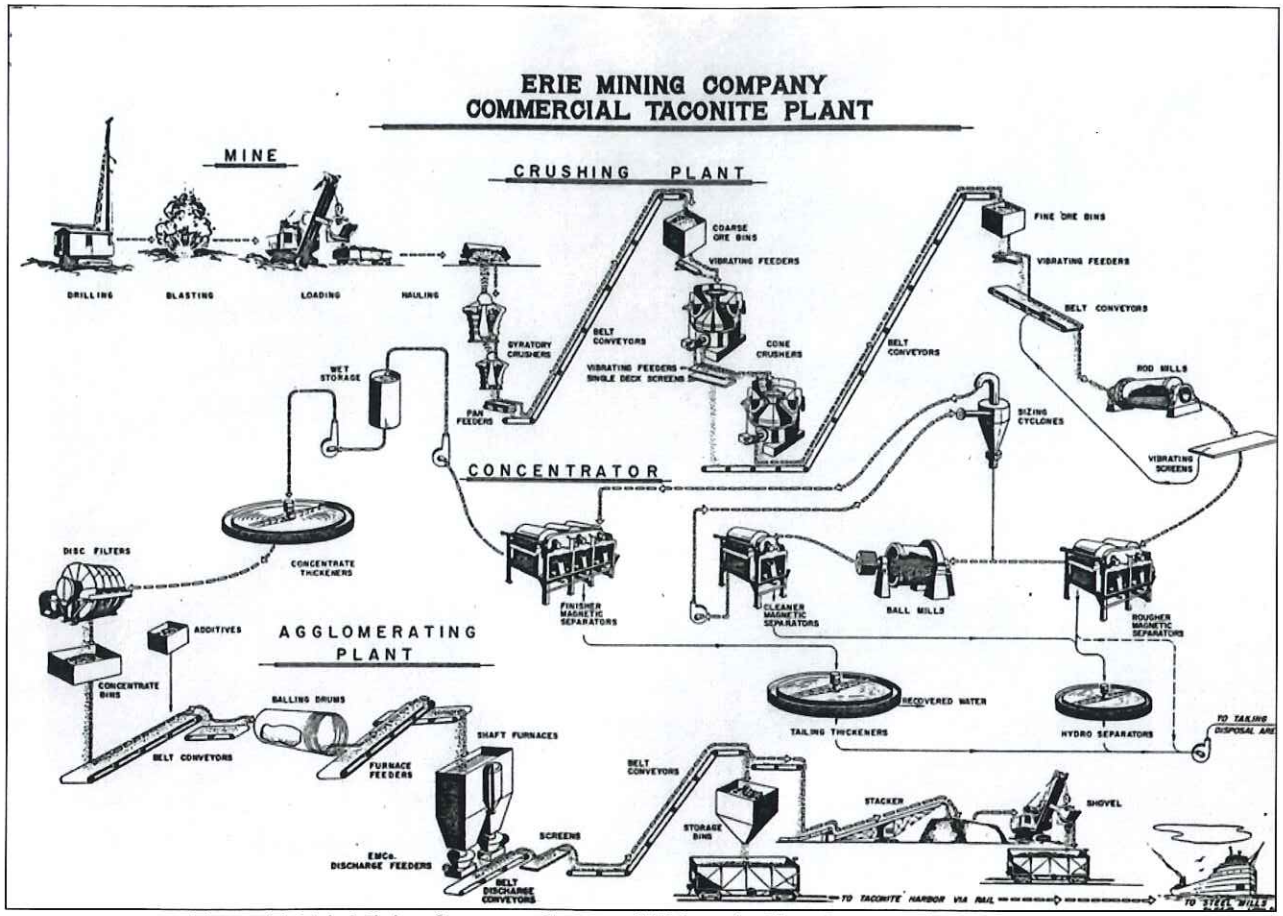
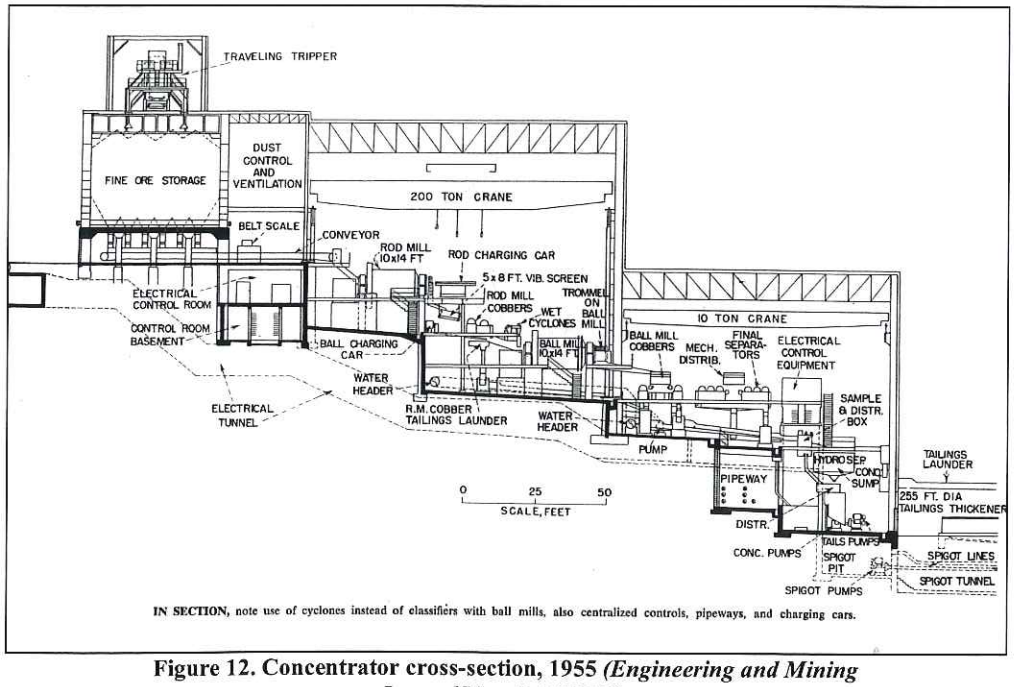


Figure 11. Erie Mining Company Commercial Taconite Plant Process Diagram. 1969. (Erie Mining Company, *The Story of Erie Mining*, 1969, n.p.).



IN SECTION, note use of cyclones instead of classifiers with ball mills, also centralized controls, pipeways, and charging cars.

Figure 12. Concentrator cross-section, 1955 *(Engineering and Mining Journal* March 1955:79).

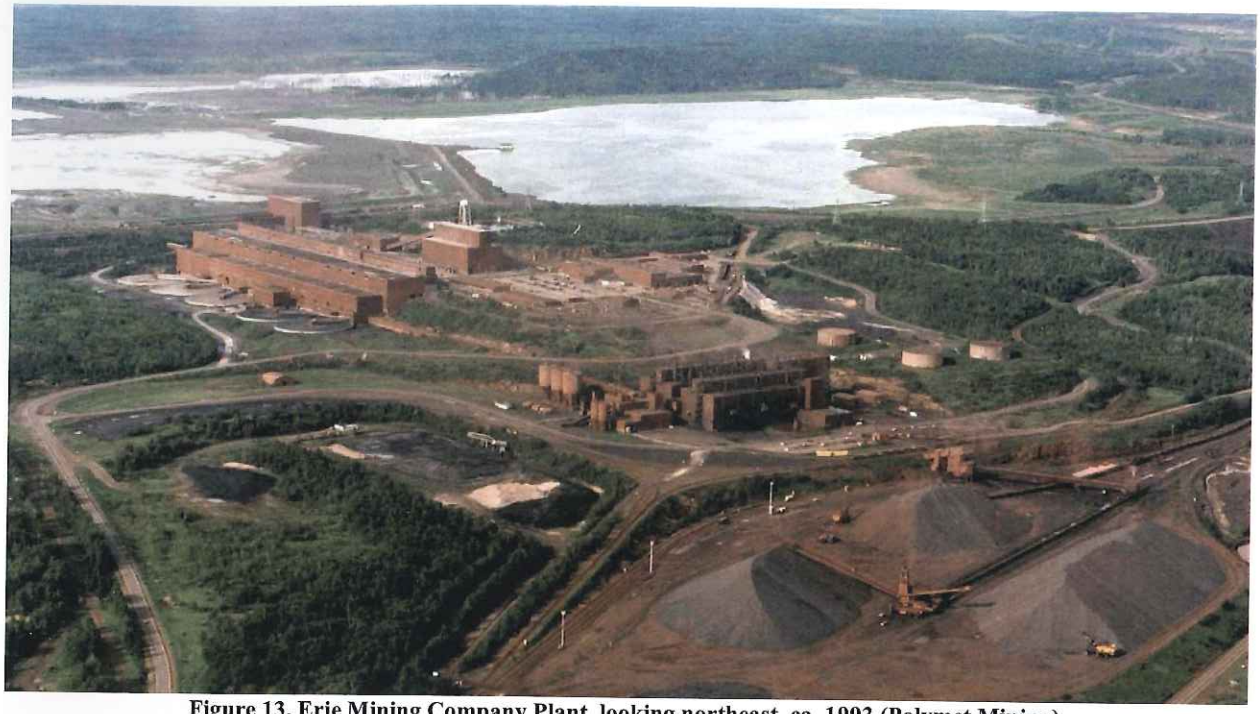
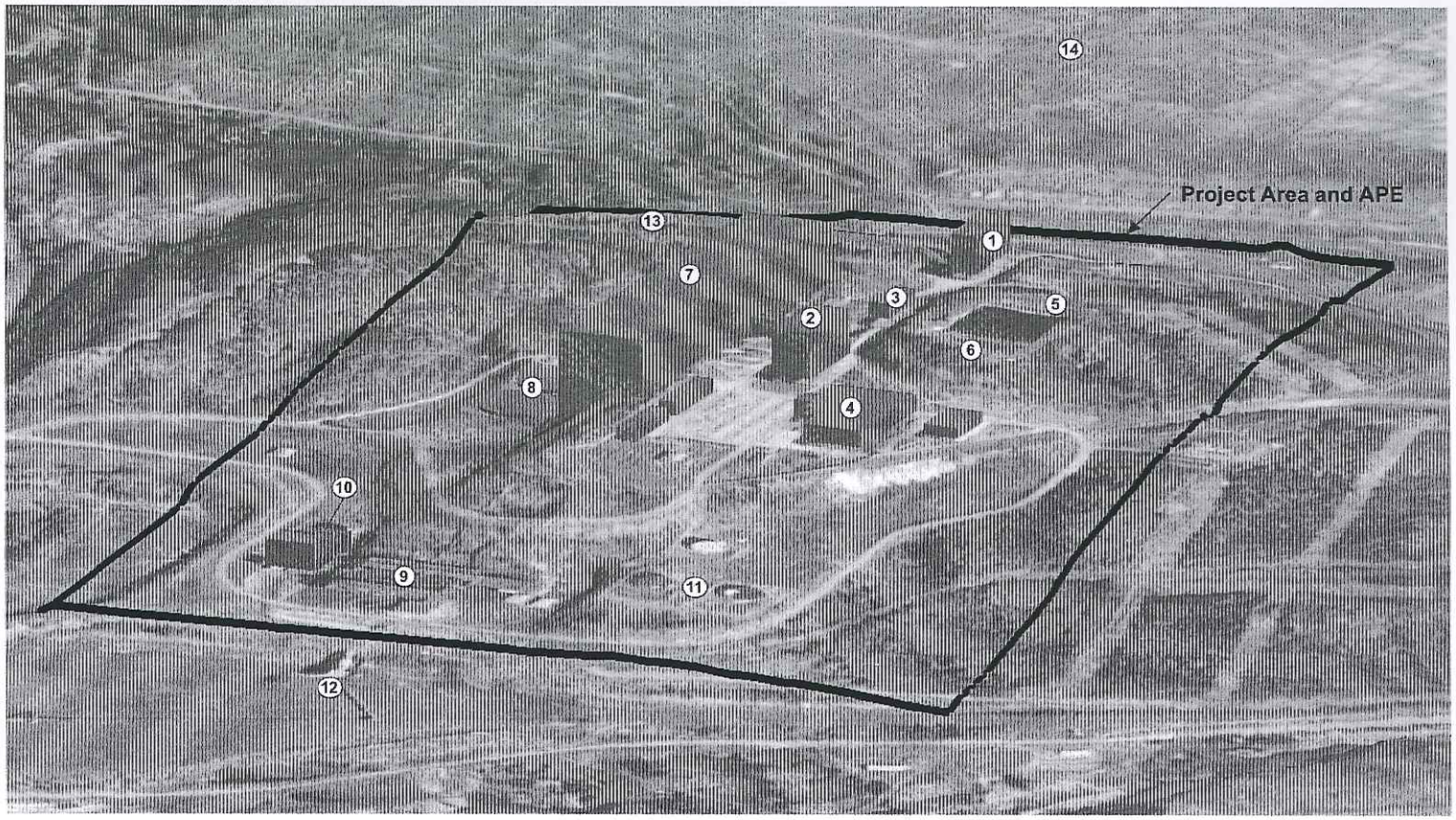


Figure 13. Erie Mining Company Plant, looking northeast, ca. 1993 (Polymet Mining).

Figure 14. Erie Mining Company concentrator (right) and coarse and fine crushers (left foreground and background, looking northeast, ca. 1993 (Polymet Mining).

Figure 15. Erie Mining Company concentrator (right background) and coarse and fine crushers (right foreground); general shops and pelletizer at left, looking south, ca. 1999 (Polymet Mining).

P:\Mpls\23 MN\69\2369862\MovedFromMpls_P\Figures_Graphics\Polymet Project Area Existing Plant.CDR RLG 01-28-08



1. Coarse Crusher SL-HLC-002
2. Fine Crusher SL-HLC-003
3. Conveyor & Drive House SL-HLC-004
4. General Shops SL-HLC-005
5. Reservoir SL-HLC-006
6. Water Tower SL-HLC-007
7. Concentrator SL-HLC-008
8. Thickening Tanks SL-HLC-009
9. Pelletizing Plant (under demo) SL-HLC-010
10. Central Heating Plant SL-HLC-011
11. Fuel Oil tanks SL-HLC-012
12. Pellet Stacker & Stockpile SL-HLC-013
13. Erie Mining Co. RR Mine & Plant Track SL-HLC-015
14. Tailings Basin 1E, 2E, 2W SL-HLC-016

Figure 16

Project Area
PolyMet Mining Co.
Existing Plant
1/2008

Barr Engineering 2008

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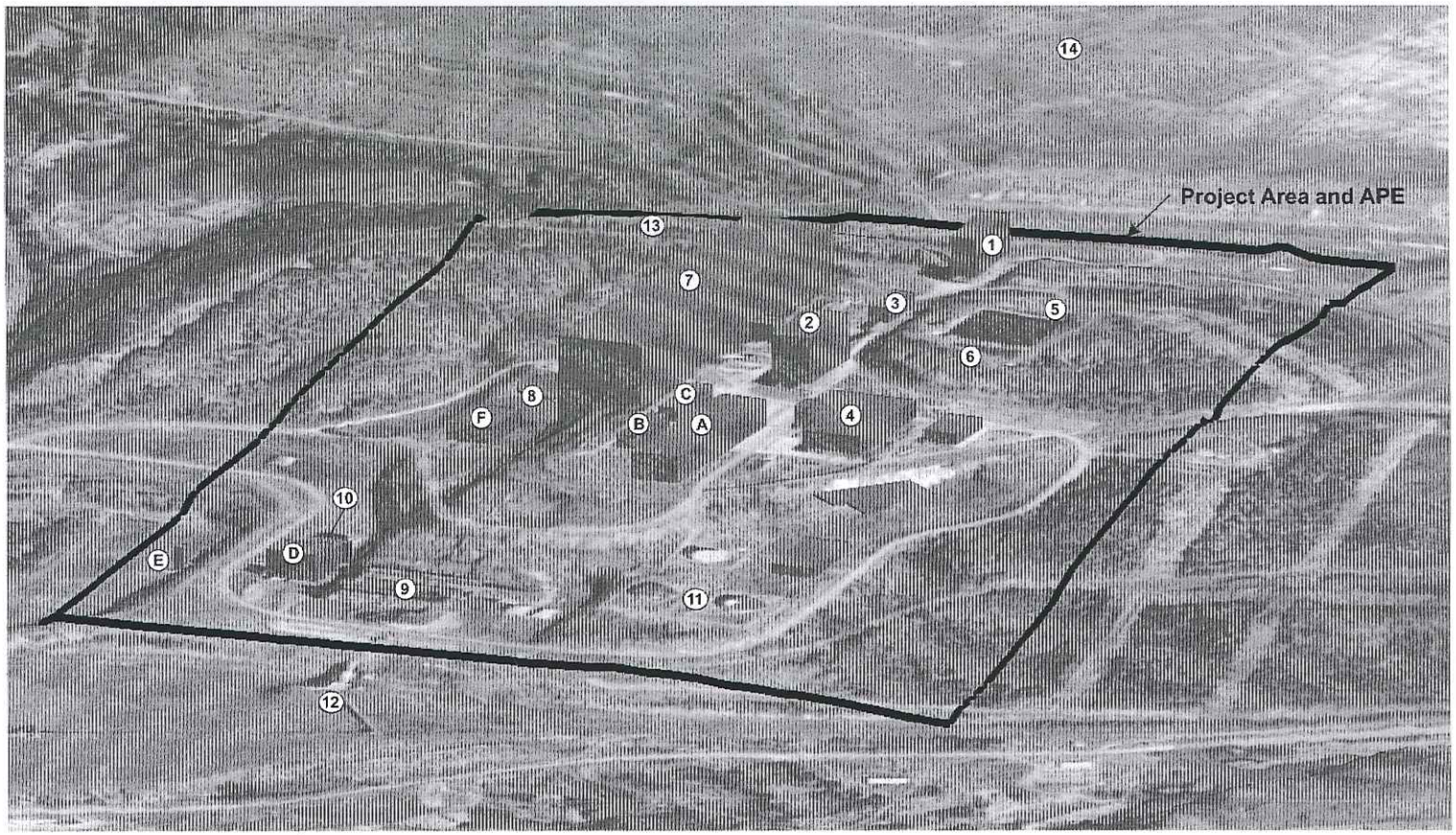

1. Coarse Crusher SL-HLC-002
2. Fine Crusher SL-HLC-003
3. Conveyor & Drive House SL-HLC-004
4. General Shops SL-HLC-005
5. Reservoir SL-HLC-006
6. Water Tower SL-HLC-007
7. Concentrator SL-HLC-008
8. Thickening Tanks SL-HLC-009
9. Pelletizing Plant (under demo) SL-HLC-010
10. Central Heating Plant SL-HLC-011
11. Fuel Oil tanks SL-HLC-012
12. Pellet Stacker & Stockpile SL-HLC-013
13. Erie Mining Co. RR Mine & Plant Track SL-HLC-015
14. Tailings Basin 1E, 2E, 2W SL-HLC-016

A. HydroMet Plant
B. Warehouse 1
C. Warehouse 2
D. Additive Plant
E. Car Dump
F. Oxygen Plant

Barr Engineering 2008

Figure 17

Project Area
PolyMet Mining Co.
Proposed New Construction

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APPENDIX A
Inventory Forms

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MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Coarse Crusher

Address Section 9 T59N, R14W
Township Hoyt Lakes
County St. Louis
Legal Description
NW 1/4-SW-1/4-SW-1/4 Sec 9 T59N, R14W
USGS Aurora, MN 1984
UTM Z15 E564822 N5272694 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-002 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Coarse Crushing Plant
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description
The coarse crusher is placed at the north end of the Erie Mining Company plant site on a double-track segment of the Erie Mining Company Railroad. This railroad extended from the mine pit to Taconite Harbor. The coarse and fine crushing buildings (SL-HLC-003) are the highest processing buildings at the plant site. The building rests on a deep concrete foundation with a total area of 20,667 sq. ft. The building is framed in heavy structural steel and the exterior is clad in corrugated metal. The flat roof is supported by metal trusses and floors are concrete. There is a dumping pocket on the track and the building is linked to the fine crusher by a conveyor and drive house.

History
The coarse crushing building received the crude taconite ore directly from the pit by rail car. Crushing is an expensive, high energy-consuming component of taconite production and includes the processes used to reduce ore size prior to the milling circuit. It is the first contact between the run of mine ore and the processing route (*Mining Magazine* Nov. 2006:18). The ore was reduced from chunks up to 5 feet long into pieces less than 5 inches in size. The crushing equipment, like that throughout the plant, was designed for efficient maintenance and a minimum of downtime in replacing parts and units. Much of the equipment was interchangeable, with units designed for maintenance in repair bays.

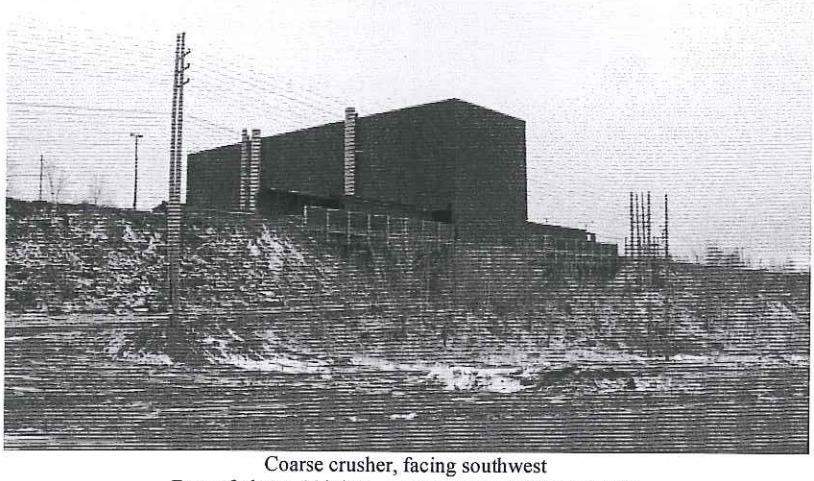
The coarse crusher is comprised of two identical but independent crushing units, each in continuous operation with a daily capacity of more than 90,000 tons. A 60-inch gyratory crusher, followed by four 36 x 70-inch crushers, provided a two-stage reduction process. Gyratory crushers have inner and outer vertical crushing cones. The ore falls between the two cones and is progressively crushed until it is small enough to fall through the gap at the bottom (*Mining Magazine* Nov. 2006:18). Erie Mining Company patented the hydraulic systems for adjusting the settings on the crushers; each was powered by a 400-hp motor (EMC 1969:10). The second coarse crushing line was added immediately after construction in 1957.

Significance and Evaluation
This building is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. Further study of other crushing facilities on the Mesabi Iron Range is required to determine if this property is individually eligible for the NRHP under Criterion A in the areas of Engineering, Industry, or Commerce, or under Criterion C in the area of Engineering. It does not appear that this facility represented an advancement in crusher design or technology. The building is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The coarse crusher retains a good level of historic integrity, including qualities of location, design, setting, materials and workmanship. Qualities of feeling and association are fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

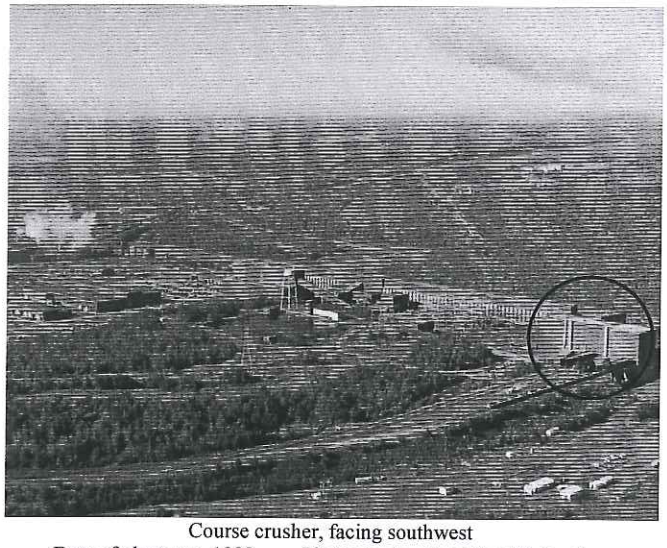
Sources

Erie Mining Company (EMC)
1969 *Story of the Erie Mining Company.* Erie Mining Company, Hoyt Lakes, Minn.
Erie Mining Company (EMC)
1954-1967 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.
Mining Magazine
2006 "Grinding out Mining Profits." Nov. 2006:18.

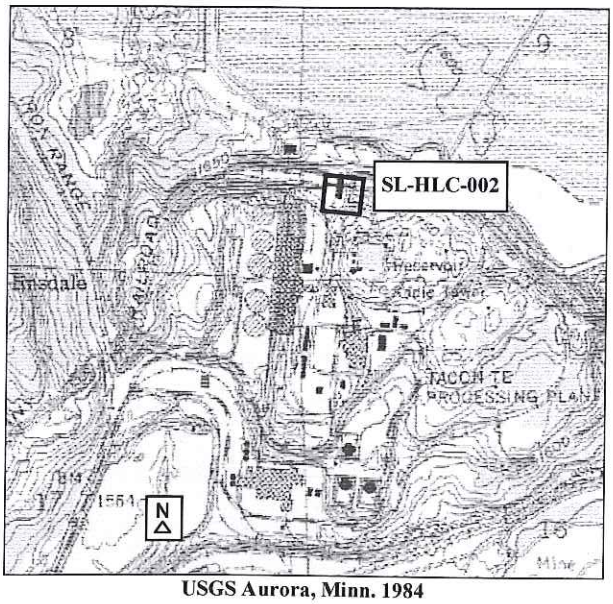
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Coarse crusher, facing southwest
Date of photo: 11/5/07 Photographer: Carole Zellie



Course crusher, facing southwest
Date of photo: ca. 1999 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Fine Crusher

Address Section 16 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
NW 1/4-NW-1/4-NW-1/4 Sec 16 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564812 N5272271 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-003 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Fine Crushing Plant
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description
The fine crusher is placed at the north end of the Erie Mining Company plant site and to the east of the Concentrator Building (SL-HLC-008). The fine and coarse crushing buildings (SL-HLC-002) are the highest processing buildings at the plant site. The building rests on a deep concrete foundation with a total area of 41,000 sq. ft. The building is framed in heavy structural steel and the exterior is clad in corrugated metal. The two-level flat roof is supported by metal trusses and floors are concrete. The building is linked to the coarse crusher by a conveyor and drive house. A 60-inch wide conveyor is housed in a steel structure (SL-HLC-004).

History
Following coarse crushing, the ore was loaded on the conveyor leading to the top of the fine crushing building where it was broken into pieces less than ¾ inch in size (*EMJ* 1955:92).

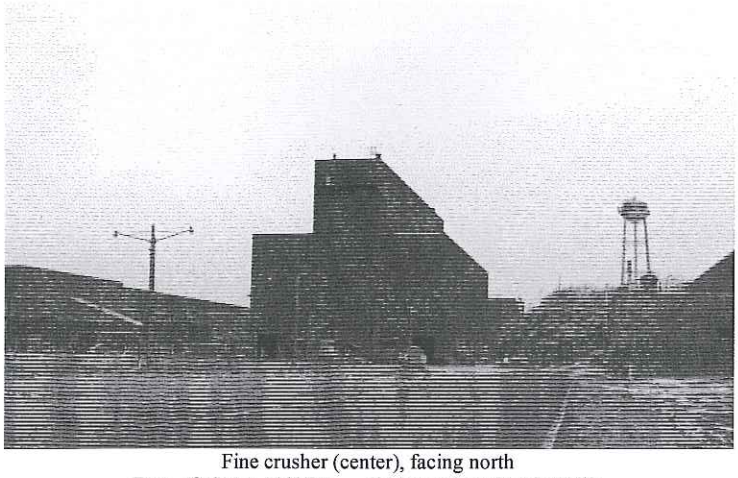
The plant initially housed six crusher units consisting of one 7-foot standard cone crusher and two 7-foot shorthead cone crushers. Each was driven by a 350-hp motor. Vibrating feeders on each crusher line were placed under the coarse ore bin, and the ore was fed by conveyor from the feeders into the standard crushers. The only screening performed in the crushing plant occurred after the standard crusher (*EMJ* 1955:92).

Engineers attempted to control the loss of steel liners during the crushing stage. The amount of wear could depend on factors such as variations in the ore, but frequent "change-outs" of the steel liner were required. By 1967, the liner life was increased from 65,000 to 100,000 tons by changing the carbon content of the manganese steel, and automated controls on the crushers replaced manual operations and ensured a maximum crushing rate. A seventh fine-crushing line with two shorthead crushers was added in 1967-1968.

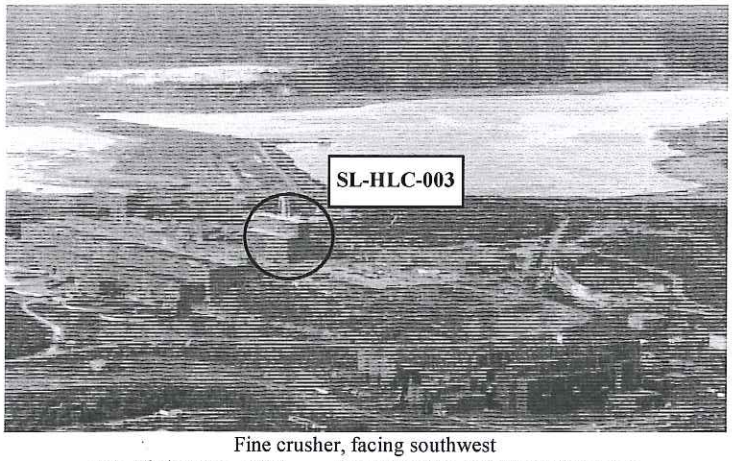
Significance
This building is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. Further study of other crushing facilities on the Mesabi Iron Range is required to determine if this property is individually eligible for the NRHP under Criterion A in the areas of Engineering, Industry, or Commerce or under Criterion C in the area of Engineering. It does not appear that this facility represented an advancement in crusher design or technology. The building is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The building retains a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer. At the interior, much of the layout and equipment dates to original construction. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Engineering and Mining Journal (EMJ)
1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.
Erie Mining Company (EMC)
1969 *Story of the Erie Mining Company.* Erie Mining Company, Hoyt Lakes, Minn.

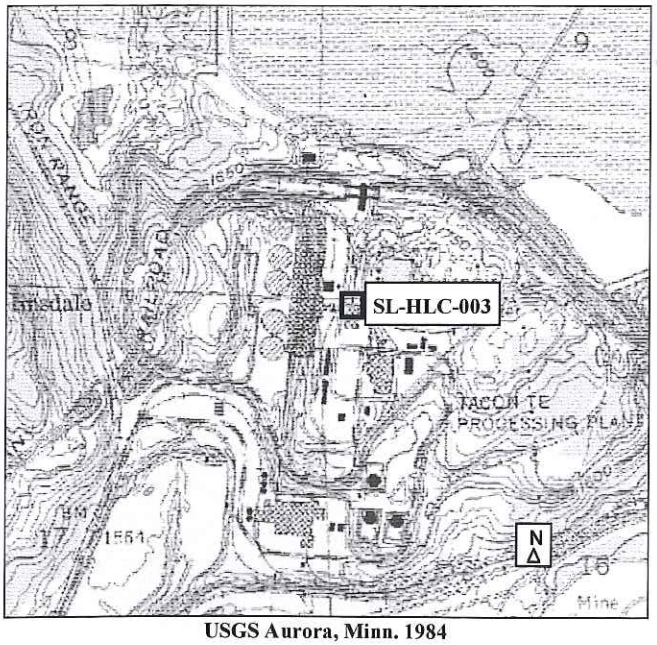
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Fine crusher (center), facing north
Date of photo: 11/5/07 Photographer: Carole Zellie



Fine crusher, facing southwest
Date of photo: ca. 1993 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Conveyor and Drive House

Address Section 9 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SW 1/4-SW-1/4-SW-1/4 Sec 9 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564812 N5272271 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-004 p. 1/2

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Conveyor and Drive House
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

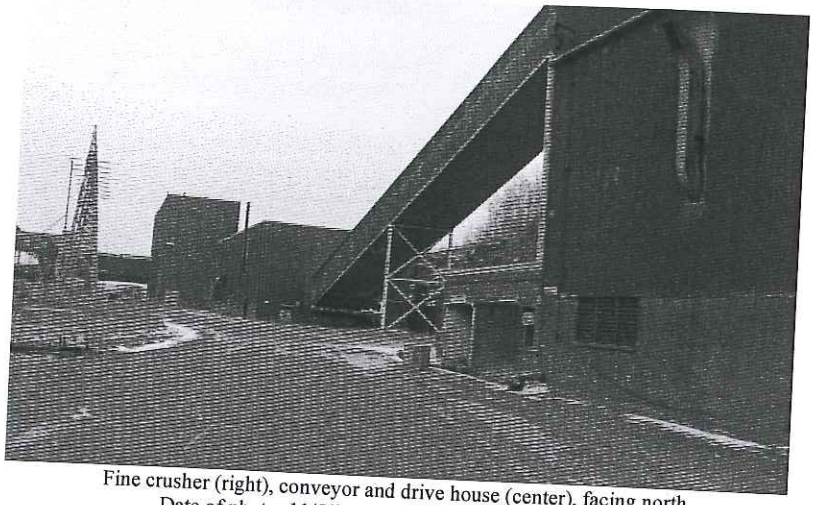
Description
The conveyor and drive house supply the fine crusher (SL-HLC-003) and are sited south of the coarse crusher and west of the concentrator on the Erie Mining Company plant site. The structures rest on deep concrete foundations. The 14,540-sq. ft. drive house is framed in heavy structural steel and the exterior is clad in corrugated metal. The floor is concrete. The flat roof of the drive house is supported by metal trusses. The 60-inch wide conveyor is housed in a steel structure.

History
Following coarse crushing, the ore was loaded on the conveyor leading to the top of the fine crushing building where it was broken into pieces less than ¾ inch in size (*EMJ* 1955:92).

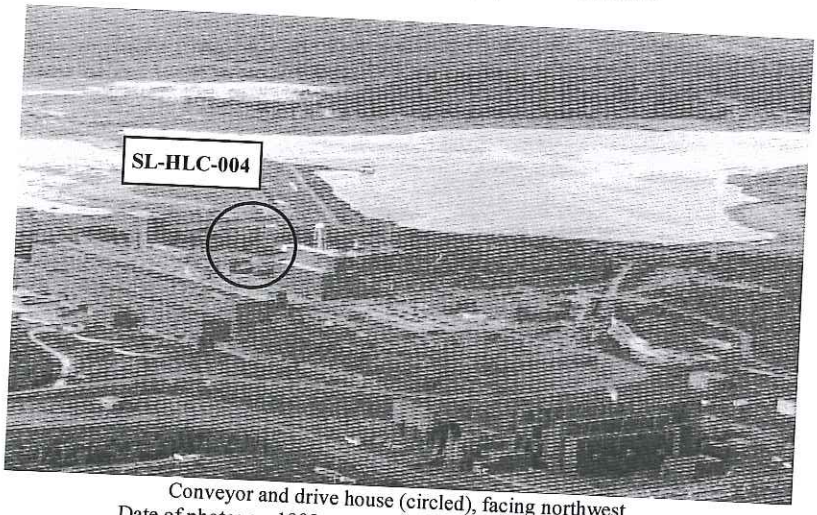
Significance
This building is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. Further study of similar properties on the Mesabi Iron Range is required to determine if this property is individually eligible for the NRHP under Criterion A in the area of Engineering, or under Criterion C in the area of Engineering. It does not appear that this property represented an advancement in conveyor design or technology. The building is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The building retains a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer.
(Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Engineering and Mining Journal (EMJ)
1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.

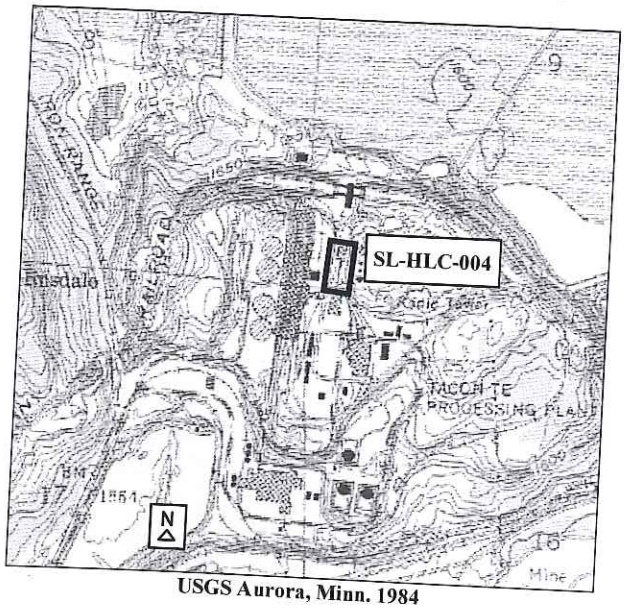
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Fine crusher (right), conveyor and drive house (center), facing north
Date of photo: 11/5/07 Photographer: Carole Zellie



Conveyor and drive house (circled), facing northwest
Date of photo: ca. 1993 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
General Shops

Address Section 16 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SW 1/4-NE-1/4-NE-1/4 Sec 16 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564909 N5272098 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-005 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	General shops
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description

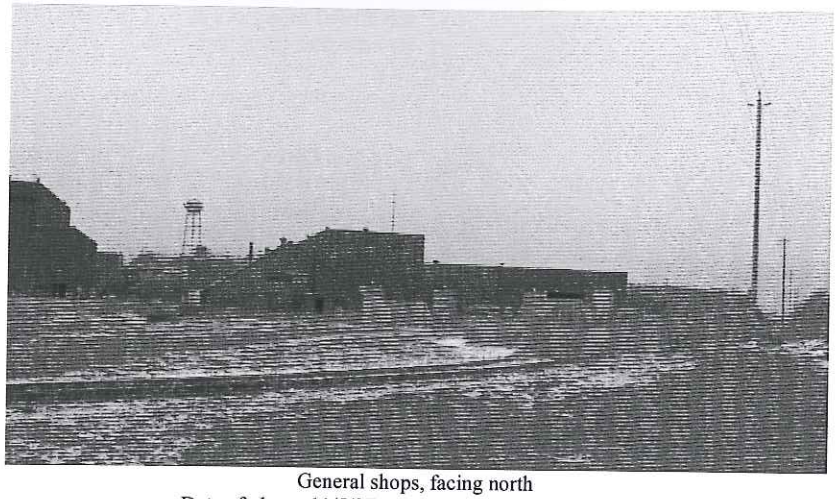
The general shops include one primary building placed southeast of the fine crusher and a separate garage building. The flat-roofed, steel-framed buildings are clad in corrugated metal. There is also a wood post-and-beam, gable-roofed building at the south end of the general shops building

History
The Erie plant had a high degree of self-sufficiency and the capacity to repair as well as fabricate equipment. The centrally located general shops building provided facilities for general maintenance and repair, and the garage was used for maintenance of heavy equipment. Another building adjacent to the east side of the concentrator included a rubber shop and lube house.

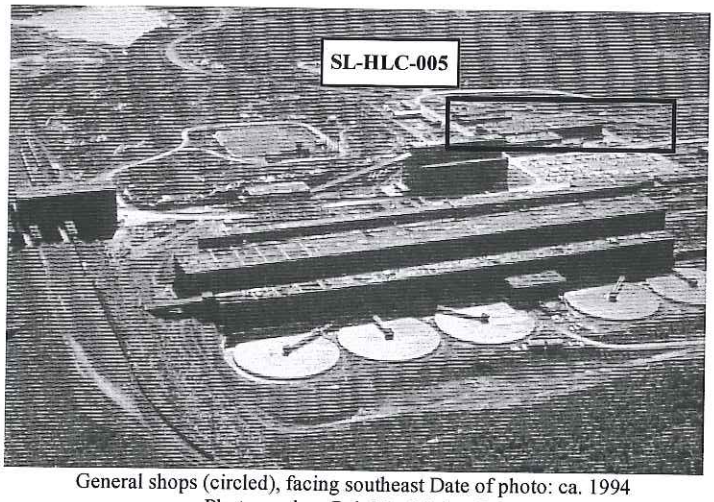
Significance
Further study of other general shop facilities on the Mesabi Iron Range is required to determine if the general shops are individually eligible for the NRHP under Criterion A in the areas of Engineering or Industry, or under Criterion C in the area of Engineering. The demolition of the pelletizing plant (SL-HLC-010) resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The general shops retain a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Erie Mining Company (EMC)
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.

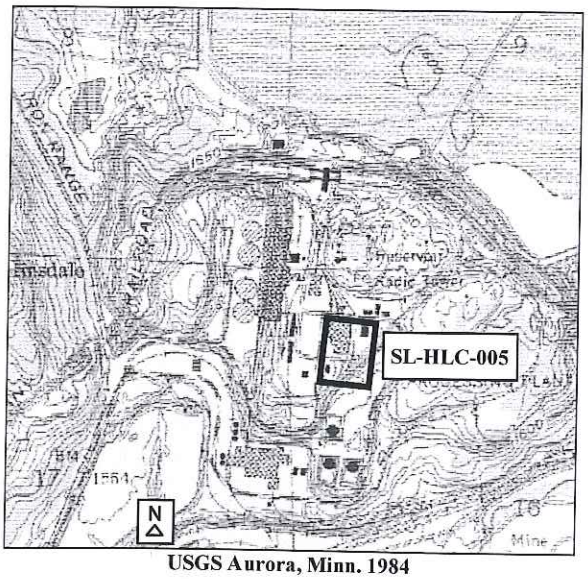
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



General shops, facing north
Date of photo: 11/5/07 Photographer: Carole Zellie



General shops (circled), facing southeast Date of photo: ca. 1994
Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company Reservoir

Address Section 9 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SE-1/4-SW-1/4-SW-1/4 Sec 9 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564959 N5272403 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-006 p. 1/2

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Reservoir
Current Use	
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

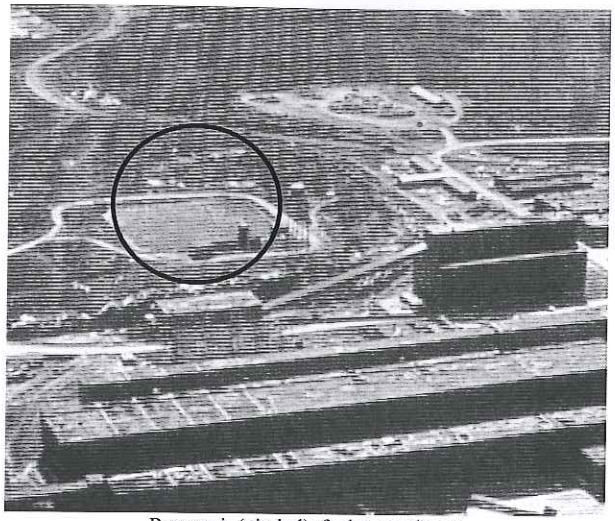
Description
The concrete-lined reservoir was placed on the highest terrace of the plant site. The reservoir capacity is 10 million galloons. There is a 100-gallon metal water tower on the west rim of the reservoir.

History
The reservoir held water for use in wet processes and boilers.

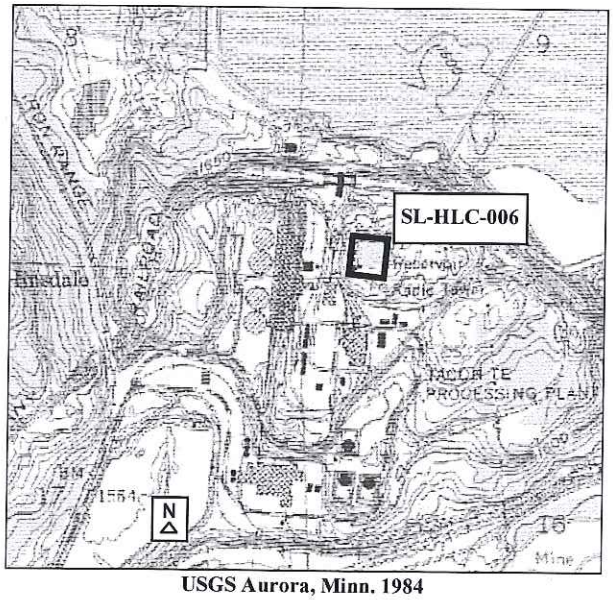
Significance
The reservoir is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. Further study of similar properties on the Mesabi Iron Range is required to determine if this property is individually eligible for the NRHP under Criterion A in the areas of Engineering or Industry, or under Criterion C in the area of Engineering. The reservoir appears to be of standard design and does not represent an advancement in technology. The structure is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The general shops retain a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Engineering and Mining Journal (EMJ)
1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Reservoir (circled), facing southeast
Photographer: PolyMet Mining Inc. Date of photo: ca. 1994



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Water Tower

Address Section 9 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SE-1/4-SW-1/4-SW-1/4 Sec 9 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564878 N5272362 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-007 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Water Tower
Current Use	Water Tower
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

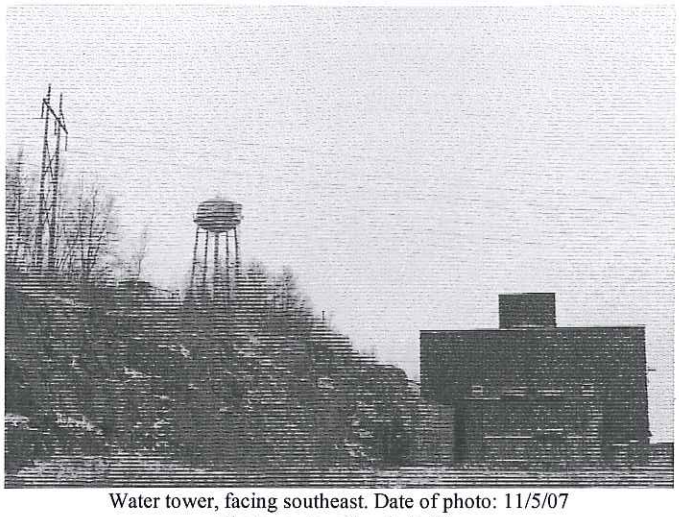
Description
The 100-gallon water tower is placed on the west rim of the concrete-lined reservoir.

History
The tower provides a water supply for fire protection.

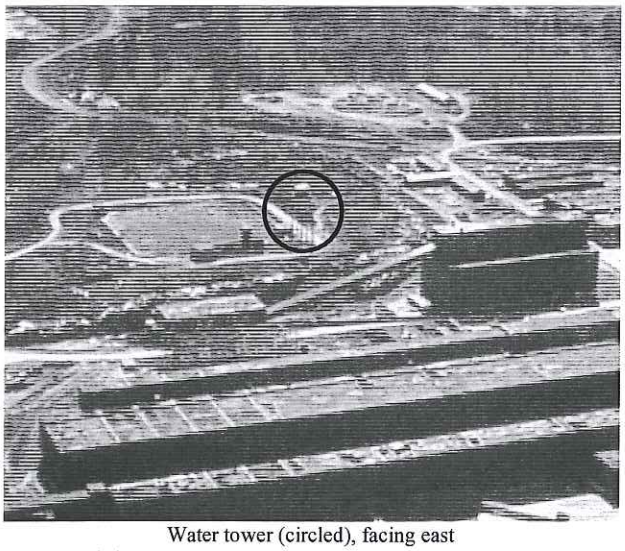
Significance
The water tower is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. Further study of similar properties on the Mesabi Iron Range is required to determine if this property is individually eligible for the NRHP under Criterion A in the area of Engineering or Industry, or under Criterion C in the area of Engineering. Like the adjacent reservoir, the tower appears to be of standard design and does not represent an advancement in technology. The structure is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The reservoir retains a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Source
Engineering and Mining Journal (EMJ)
1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.

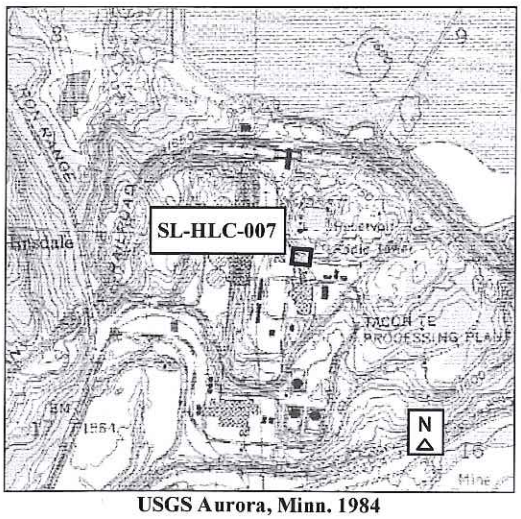
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Water tower, facing southeast. Date of photo: 11/5/07
Photographer: Carole Zellie



Water tower (circled), facing east
Date of photo: ca. 1994 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company Concentrator Building
Address Sections 8 and 17 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SE 1/4-SE-1/4-SE 1/4 Sec 8 T59 N R14W and
NE 1/4-NE-1/4-NE 1/4 Sec 17 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564670 N5272379 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # / Review and Compliance # SL-HLC-008 p. 1/3

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Concentrator
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Eligible

Description

The Concentrator Building rises 174 ft. above the adjacent grade at the north end of the plant complex. The building originally measured 1,110 x 275 ft., and was placed to step down a terrace at a lower elevation than the adjacent coarse and fine crusher buildings. In 1967, an addition extended the length of the structure to 1,460 ft., and the total area to 389,490 sq. ft. Water and electrical tunnels line the foundation of the structure. The building rests on a deep concrete foundation with concrete floors and the exterior is clad in corrugated metal. The flat roofs (built-up fiberglass with tar) are supported by metal trusses and a series of overhead cranes are mounted below the roof structure.

The Concentrator Building housed fine ore bins, grinding, and magnetic separation sections as well as pumping equipment, laboratories, and control centers for the power and water distribution systems. The original construction consisted of 27 identical mill lines. Wet grinding in the rod and ball mills preceded the removal of iron particles by a three-stage magnetic separation process. The central repair bay is flanked by two long operating areas. At the south side there are 12 mill lines, and at the north side there are 15 mill lines. Each line was divided into sections comprised of four lines. Designed to minimize delay for scheduled repairs and breakdowns, each line handled tailings and concentrate, processing approximately 120 tons of feed per hour (EMC 1969:13).

The concentrator mills ground the crushed crude taconite to a fine powder and added water to remove waste and unwanted materials. Following magnetic separation, the water was removed and the tailings waste was pumped to the tailings basin while the water was recovered for reuse. An Erie Mining Company engineer described the process:

> The magnetic concentrate joins with the plus ¼ inch screen oversize as it enters the ball mills. Each of the 27 ball mills is equipped with a revolving screen on the discharge end for the removal of ball fragments. The ball mill discharge is then concentrated in 108 magnetic separators. The magnetic concentrates are pumped to the 135 sizing cyclones for classification. The oversize material from the cyclones returns to the ball mills and the finished sized material flows to the 108 three-drum Finisher Magnetic Separators which complete the milling operation (EMC 1965:n.p.).

Waste material from the magnetic separators was directed to the water reclamation system, which included four 275-foot diameter steel tailings thickeners and 7 hydro-separators at the west side of the Concentrator Building.

A $50 million expansion project completed in 1967 extended the concentrator by 350 ft. on the north end. The total length of 1,460 ft. housed nine new mills lines, each incorporating a rod mill and ball mill. A fifth tailings thickener was added to the west side of the building, and primary conveyors were speeded. Fine screening was added to all mill lines (*SMR* 12 Feb. 1966:1,6,19). The control room installed for initial operation utilized on an analog system that was later upgraded to digital controls in 1967.

Significance

The Concentrator Building is a significant component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. Although the recent demolition of the pelletizing plant (SL-HLC-010) resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex, of the remaining buildings and structures comprising the Erie plant complex, the concentrator is a key property that reflects decades of experimentation with the magnetic separation of taconite ore by a leading mining company. The concentrator was originally called the "largest ever built as a single initial unit" and was enlarged to 1,460 ft. in 1967, representing the Erie Mining Company's efforts to continually improve

production through engineering design. The addition allowed an increase in pellet output to 10.3 million tons per year (*SMR* 12 Feb. 1966:1). The Concentrator Building is recommended individually eligible for the NRHP under Criterion A in the areas of Industry and Engineering, and also under Criterion C in the area of Engineering. The building retains a good level of historic integrity, including qualities of location, design, setting, materials, workmanship and feeling. The quality of association is fair, due to the removal of the pelletizer. At the interior, much of the layout and equipment dates to original construction. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources

Engineering and Mining Journal (EMJ)

1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.

Erie Mining Company (EMC)

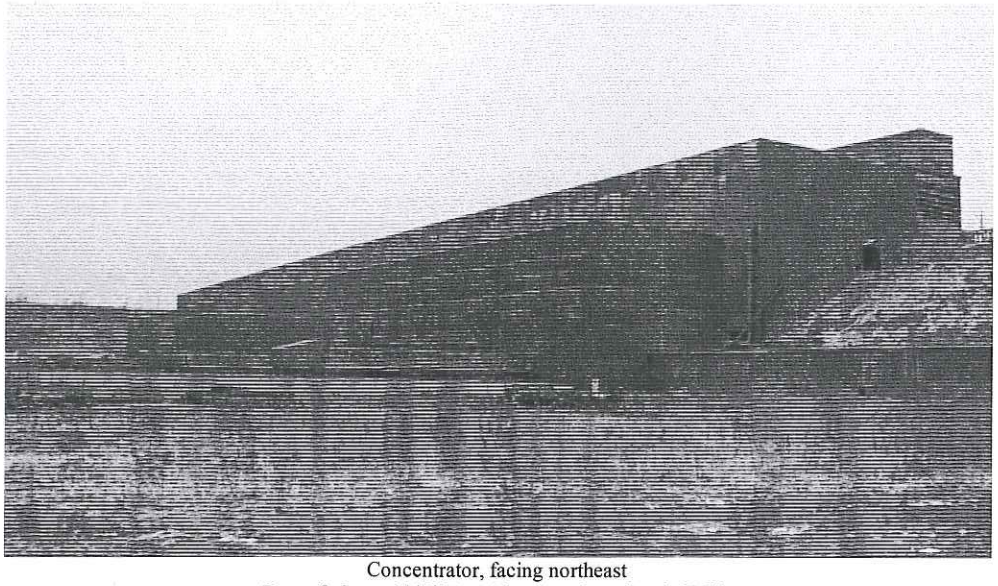
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.

1965 *Welcome to Erie*. Erie Mining Company, Hoyt Lakes, Minn.

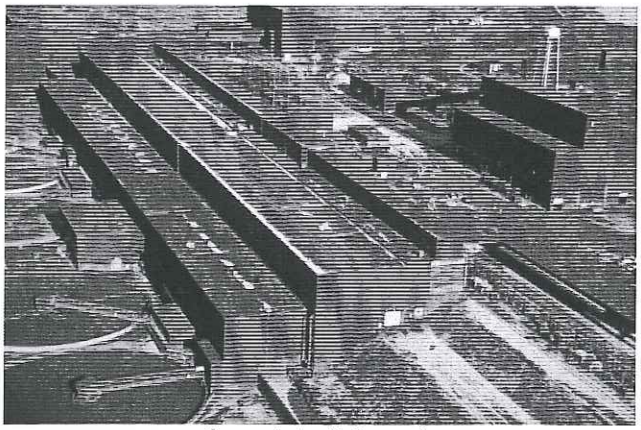
Skillings Mining Review (SMR)

1966 "Erie Mining Company: Mesabi Range Taconite Development Expanding." 12 Feb.:1

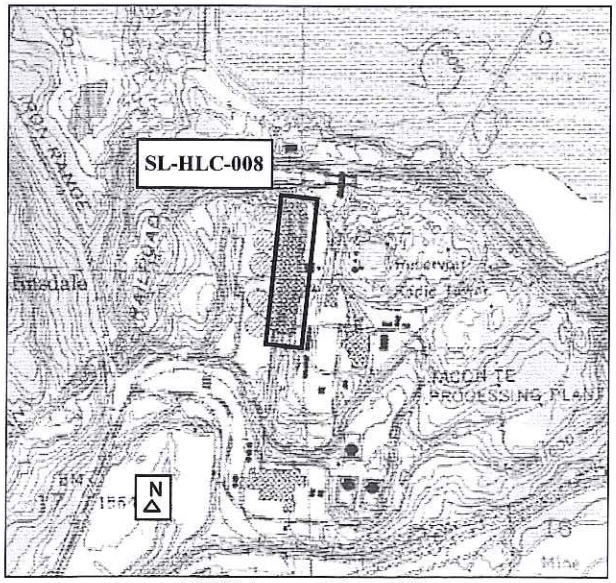
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Concentrator, facing northeast
Date of photo: 11/5/07 Photographer: Carole Zellie



Concentrator, facing north
Date of photo: ca. 2000 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Tailings Thickener Tanks
Address Sections 8 and 17 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SE 1/4-SE-1/4-SE 1/4 Sec 8 T59 N R14W and
NE 1/4-NE-1/4-NE 1/4 Sec 17 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564670 N5272379 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-009 p.1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Concentration thickening process
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility	Not eligible

Description
Two of the former five tailings thickener tanks are situated below grade at the south end of the west elevation of the concentrator. Each open tank is 255 ft. in diameter and has a single rake. Underflow, including tailings, was pumped from the thickeners to the tailings basin. Overflow was decanted and brought back into the concentrator for reuse. Make-up water requirements of the process were pumped from the Partridge Reservoir to the 10-million-gallon plant reservoir (SL-HLC-006; EMC fact sheet n.d:n.p).

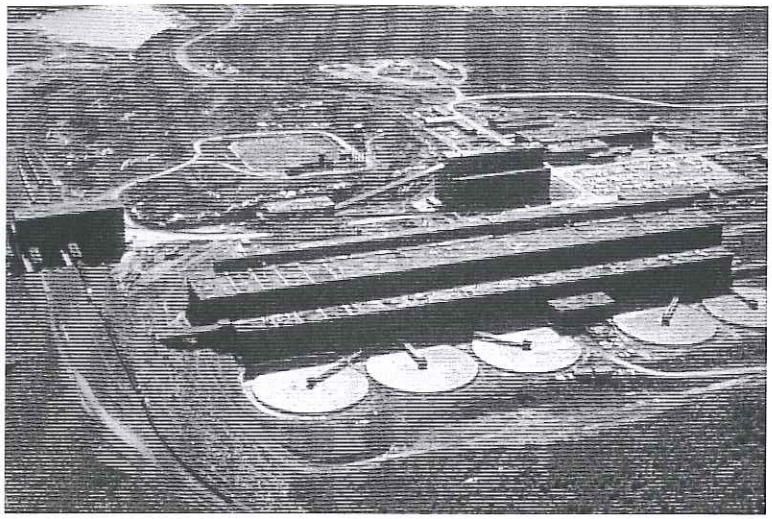
History
Waste material from the magnetic separators in the Concentrator Building was directed to this water reclamation system, which initially included four 255-foot diameter steel tailings thickeners and 7 hydro-separators. A fifth tailings thickener was added in 1967 (*SMR* 12 Feb. 1966:1,6,19). Three of the tanks were removed in ca. 2005.

Significance
The thickener tanks were linked to the Concentrator Building. The concentrator is a significant component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex and its potential district eligibility. The Concentrator Building (1957; SL-HLC-008) is a key property that reflects decades of experimentation with the magnetic separation of taconite ore by a leading mining company, but the thickener tanks have lost integrity due to demolition of three of the original five. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

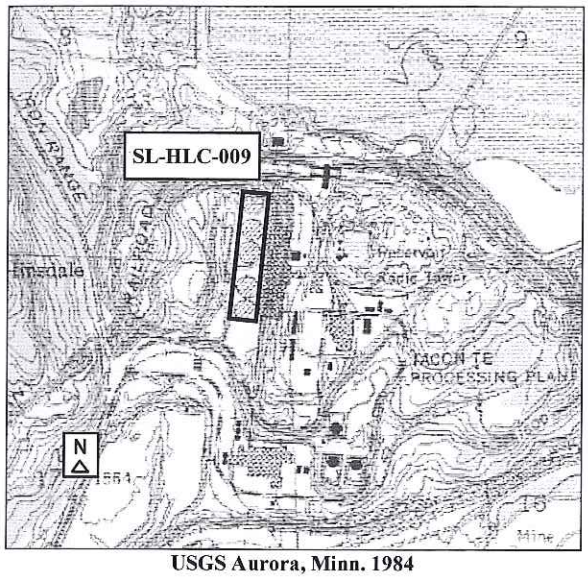
Sources

Erie Mining Company (EMC)
n.d. Erie Fact Sheet
1965 *Welcome to Erie*. Erie Mining Company, Hoyt Lakes, Minn.
1969 *Story of the Erie Mining Company*. Erie Mining Company, Hoyt Lakes, Minn.
Erie Mining Company (EMC)
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.
Skillings Mining Review (SMR)
1966 "Erie Mining Company: Mesabi Range Taconite Development Expanding." 12 Feb.:1

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Concentrator and tailings thickener tanks (foreground), facing east
Date of photo: ca. 1994 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Pelletizing Building
Address Section 17 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SW 1/4-SW-1/4-NW 1/4 Sec 17 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564609 N5271631 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-010 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	Cliffs Erie
Original Use	Taconite pellet agglomerization
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description
The Pelletizing Building (also called the pelletizer) was placed at the southern end of the plant site. The building rested on a deep concrete foundation and the exterior was clad in corrugated metal. The floors were concrete, and the flat roofs were supported by metal trusses. The building contained 140,252 sq. ft. Water and electrical tunnels lined the foundation of the structure. The pelletizer is currently undergoing demolition as required by Minnesota mining reclamation law.

History

Taconite powder was transformed into iron ore pellets in this pelletizing (or agglomerating) structure. Pelletizing is one method of agglomeration; others include briquetting, nodulizing, and sintering (Earney 1969:514). The plant housed the handling, storage, blending and dewatering of magnetic concentrates pumped a distance of 1700 ft. from the concentrator.

1. Balling the concentrate.
2. Induration (heat hardening) of green balls.
3. Screening and conveying the furnace product
4. Direct loading of the screened pellets into railroad cars (during the shipping season) or into stockpiles during the winter.
5. Reprocessing of furnace fines.
6. Storage and handling of bentonite used in the pelletizing process (EMC 1969:16)

Reprocessed dust collect residue was mixed with the slurry and after sampling fed into a pumping sump. After dewatering and filtering in a vacuum filter, bentonite was added as a binder. Control instruments and conveyor belt scales maintained constant tonnage of concentrate feed to the 9-foot revolving balling drums, where it was formed into green, unfired balls.

A trommel, or integrating screen, was built into the discharge end of the drum to maintain a closely-sized ball. Undersized balls that fell through the screen were recirculated through the drum. In the mid-1960s, vibrating screens were used on newly installed drums (EMC 1969:18). The unfired, green balls were evenly distributed over the bed of vertical shaft furnaces by electronically controlled charging machines. The green balls entered the furnaces on a conveyor, and were discharged as indurated (heat-hardened) taconite pellets. The pellets spent about four hours in the furnace. Screening captured any undersized pellets, which were reground and re-pelletized (EMC 1969:18).

The original installation included 24 vertical shaft furnaces. Shaft furnaces were one of three firing methods available to producers, in addition to the continuous grate and the grate-kiln (Earney 1969:514). The original furnace layout was based on four rows of six, with a fifth row of two high-capacity furnaces added in ca. 1958 and another additional furnace in 1967. The original 24 furnaces produced approximately 1,140 tons of pellets per day. The 3 additional units placed in operation resulted in an average of 1,620 tons per day by 1968. Pellet quality and operating efficiency was improved during the first ten years of

operation by modifications to the balling circuit and furnace charging including air and temperature distribution as well as stockline length. By the late 1960s, a pellet of a very uniform size and composition was produced (EMC 1969:20). Product sampling was conducted throughout the process, and components of the operating system, including feed rate, balling, additive addition, discharge balance, stockline contours, and air temperature controls were constantly monitored (EMC 1969:21).

The furnaces consisted of a brick-lined, vertical steel shell, each about 60 ft. high and about 7 ft. wide. Length varied between 15 and 21 ft., with the units added in the mid 1960s of the greatest length. A carefully controlled process of air blowing, chunk breaking (to break up any clusters of pellets that formed during induration) resulted in magnetite particles in the green balls reaching 2,350°F, at which point an exothermic reaction increased the actual temperature to 2,500°. At discharge, the pellets were at an average temperature of 750°.

The pellets were discharged onto rubber conveyor belts and transferred to vibrating, double-deck product screens. Testing for factors such as hardness and chemical and moisture composition was conducted on samples from each 4-hour operating period (EMC 1969:18) Three fuel oil tanks, each with 80,000 bbl capacity, provided storage for the oil used in the furnaces. A $50 million expansion project in 1967 added a shaft furnace that was housed in an extension at the east side of the plant.

Significance

The Erie Mining Company Pelletizing Building was at the heart of "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken" (*Iron News*, June 1957:3). Erie was one of two firms (with Reserve Mining Company, which began pellet production at the E. W. Davis Works in 1955) that led investment in commercial taconite production. The Erie plant was lauded as the "largest taconite concentrating and agglomerating structure ever built as a single unit" (Witzig 1959:84).

Pelletizing technology, developed by necessity to utilize low-grade ore, "turned out to be a breakthrough, one whose full benefits could not be duplicated when using high-grade hematites" (Kakela 1982:526). The productivity of the Mesabi's three taconite plants in the early 1960s brought prosperity to the range and corporations appealed to voters to amend the state constitution to provide tax stability. In 1966 there were eleven plants in operation on the Mesabi including Erie, which immediately made a $50 million expansion to increase annual pellet production capacity to 10.3 million tons. Expansion in the 1960s at Erie was praised as a "foundation stone" for "rebuilding the mining industry to enormous proportions" (*New York Times* 15 Nov. 1964:49). (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources

Earney, F. C. F.
1969 New Ores for Old Furnaces: Pelletized Iron. *Annals of the Association of American Geographers* Sept.:512-534.

Erie Mining Company (EMC)
1965 *Welcome to Erie.* Erie Mining Company, Hoyt Lakes, Minn.
1969 *Story of the Erie Mining Company.* Erie Mining Company, Hoyt Lakes, Minn.

Erie Mining Company (EMC)
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.

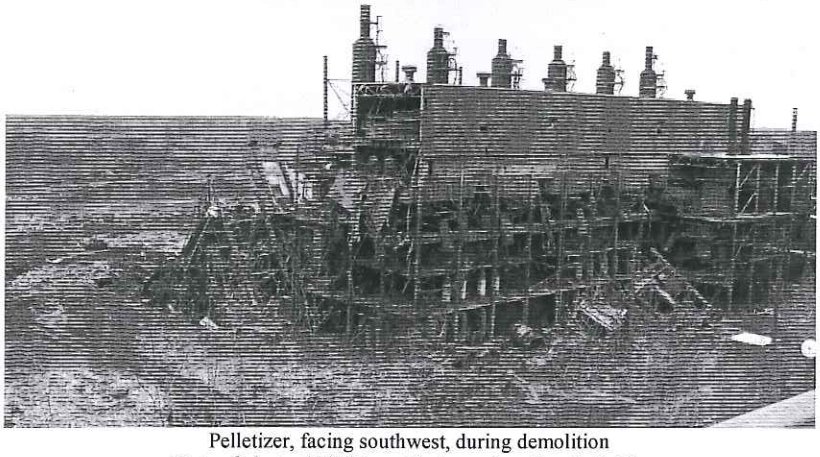
Iron News
1957 "Erie Mining Plant Gets Finishing Touches." June:3.

Kakela, P. J.
1981 "Iron Ore: From Depletion to Abundance." *Science* 10 April 1981:132

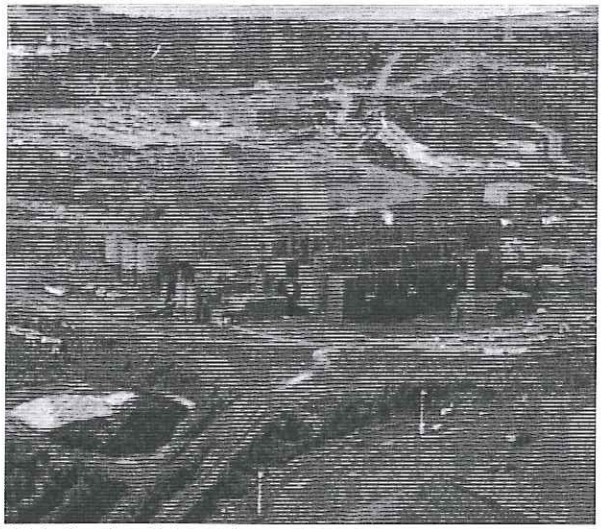
New York Times
1964 "Taconite Expansion Gains in Minnesota." 16 Nov. Business Financials:49.

Skillings Mining Review (SMR)
1966 "Erie Mining Company: Mesabi Range Taconite Development Expanding" 12 Feb.:1

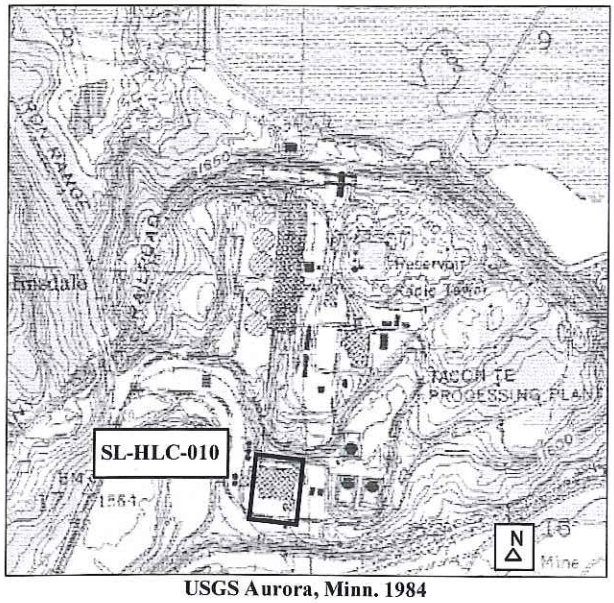
Witzig, F.
1959 A Geographic Study of the Taconite Industry of Northeastern Minnesota. Unpublished dissertation. University Microfilms, Ann Arbor, Mich.



Pelletizer, facing southwest, during demolition
Date of photo: 11/5/07 Photographer: Carole Zellie



Pelletizer (right) before demolition, facing northeast; fuel tanks and central heating plant (left)
Date of photo: ca. 1993 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Central Heating Plant
Address Section 17 T59N R14W
Township Hoyt Lakes
County St. Louis
Legal Description
SE 1/4-SE-1/4-NE 1/4 Sec 17 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564522 N5271651 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-011 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining
Original Use	Plant and fuel heating
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description

The Central Heating Plant is located at the west elevation of the Pelletizing Building. The building contains 29,806 sq. ft. and rests on a deep concrete foundation. The exterior is clad in corrugated metal and the flat roof is supported by metal trusses.

History

The coal-fired central heating plant was placed near the fuel storage area and fuel oil tanks at the west side of the pelletizing building. The facility provided heat for pelletizer furnace fuel and for plant buildings (*SMR* 7 July 1956:2). In 1994 the boilers were updated from coal to natural gas. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

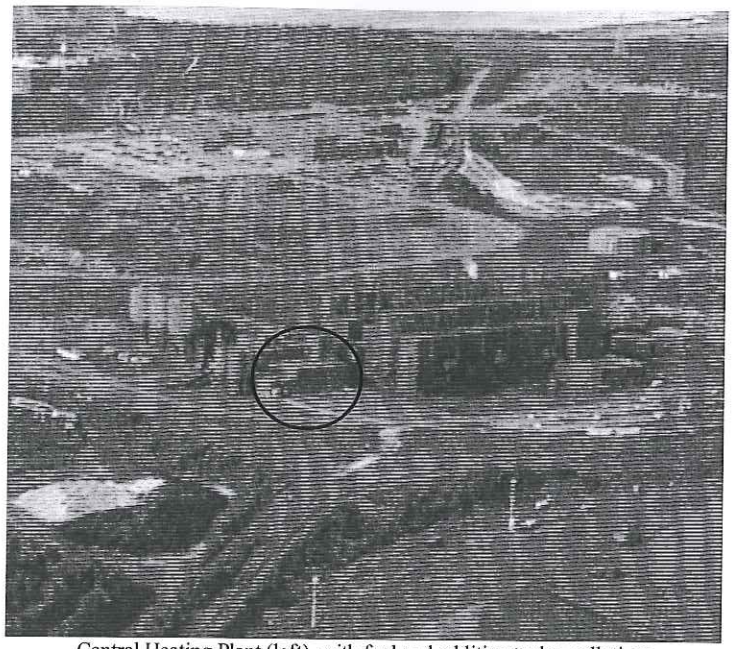
Significance and Evaluation

The Central Heating Plant heated fuel for furnaces in the Erie Mining Company Pelletizing Building, which was at the heart of "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken" (*Iron News*, June 1957:3). The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The Central Heating Plant appears to be of standard design and does not represent an advancement in technology and is not eligible for the NRHP under Criterion A or C. It is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. It has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The Central Heating Plant retains a good level of historic integrity, including qualities of location, design, setting, materials, and workmanship. The qualities of association and feeling are poor, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

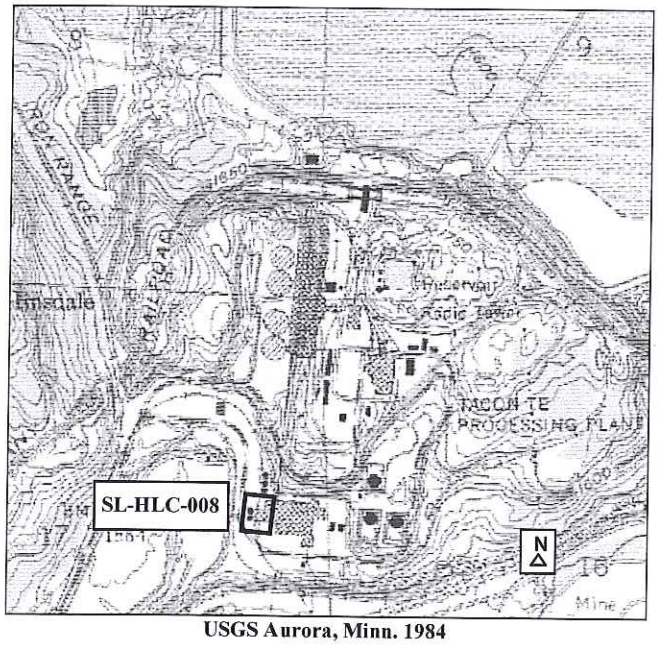
Sources

Erie Mining Company (EMC)
1969 *Story of the Erie Mining Company.* Erie Mining Company, Hoyt Lakes, Minn.
Erie Mining Company
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Central Heating Plant (left), with fuel and additive tanks; pelletizer is at right, all facing northeast
Date of photo: ca. 1993 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Fuel Oil Tanks
Address Section 16 T59N R14W
County St. Louis
Township Hoyt Lakes
Legal Description
SW 1/4-SW-1/4-NE-1/4 Sec 16 T59 N R14W and
SE-1/4-SW-1/4-NW-1/4 Sec16 T59 N R14W
USGS Aurora, MN 1984
UTM Z15 E564609 N5271631 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # / Review and Compliance # SL-HLC-012 p.1/2

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	Polymet Mining
Original Use	Fuel storage
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description
A field of three fuel tanks is placed east of the former pelletizing building. Each tank held 3.1 million gallons of Bunker C or No. 2 fuel.

History
The fuel tanks supplied the furnaces in the pelletizer.

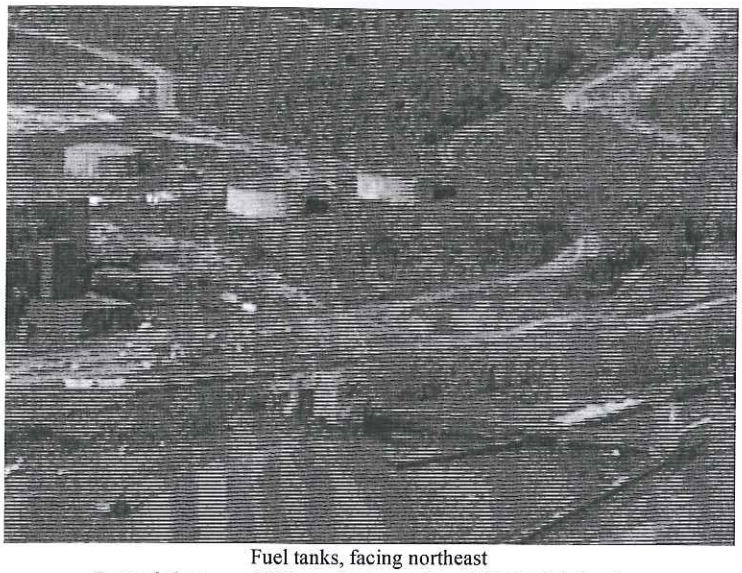
Significance

The fuel tanks supplied the Erie Mining Company Pelletizing Building, which was at the heart of "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken" (*Iron News*, June 1957:3). The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The tanks appear to be of standard design and do not represent an advancement in technology and are not eligible for the NRHP under Criterion A or C. The tanks are not known to be associated with persons significant in local, state, or national history and are not eligible for the NRHP under Criterion B. They have not yielded, nor are they likely to yield information important in prehistory or history and are not eligible under Criterion D. The tanks retain a good level of historic integrity, including qualities of location, design, setting, materials, and workmanship. The qualities of association and feeling are poor, due to the removal of the pelletizer.
(Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

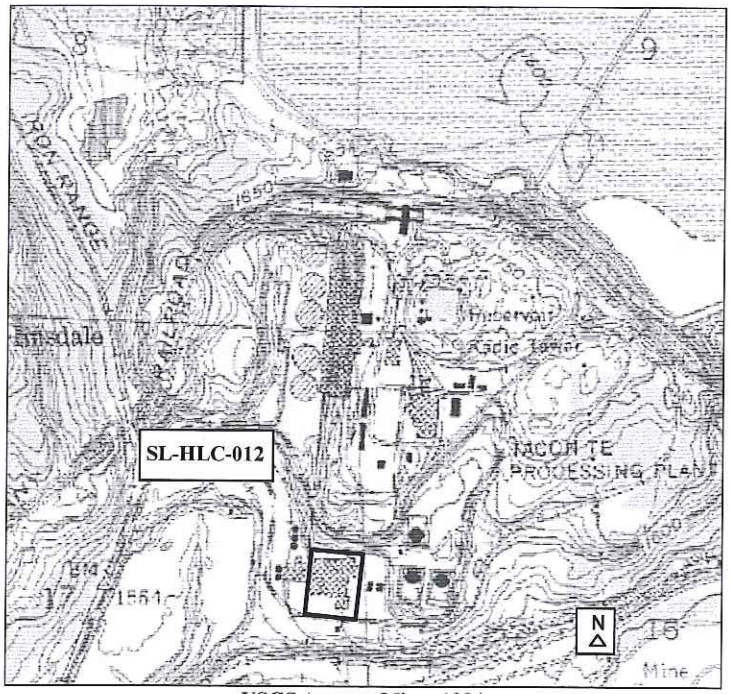
Sources

Erie Mining Company (EMC)
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.
New York Times
1964 "Taconite Expansion Gains in Minnesota." 16 Nov. Business Financials:49.
Skillings Mining Review (SMR)
1966 "Erie Mining Company: Mesabi Range Taconite Development Expanding." 12 Feb.:1

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Fuel tanks, facing northeast
Date of photo: ca. 1993 Photographer: PolyMet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Pellet Stacker and Stockpile
Address Section 17 T59N R14W
County St. Louis
Township Hoyt Lakes
Legal Description
NE 1/4-NE-1/4-NW-1/4 Sec 17 T59 N R14W and
USGS Aurora, MN 1984
UTM Z15 E564659 N5271494 NAD 83

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I/Reconnaissance
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-013 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	Cliffs Erie
Original Use	Pellet stacker
Current Use	
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

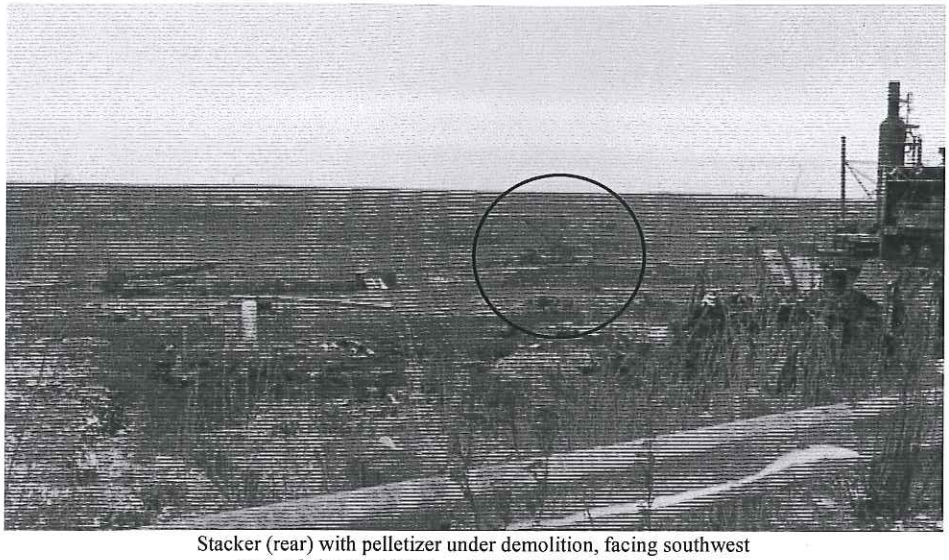
Description
The pellet stacker and stockpile are located south and southwest of the Pelletizing Building opposite a loading pocket. (The stockpile, like the pelletizing building, is owned by Cliffs Erie, not PolyMet.) The stacker has the capacity to serve an area of nearly 4 million tons. The stacker assembly includes a conveyor and conveyor drive house.

History
The stacker was in primary use during the winter when Great Lakes navigation was idled. When the shipping season began, pellets were loaded from the stockpiles by an electric shovel onto a string of cars. Each train held about 8,000 tons of pellets, suitable for dumping at Taconite Harbor in about 6 ½ minutes while in motion at about 10 mph.

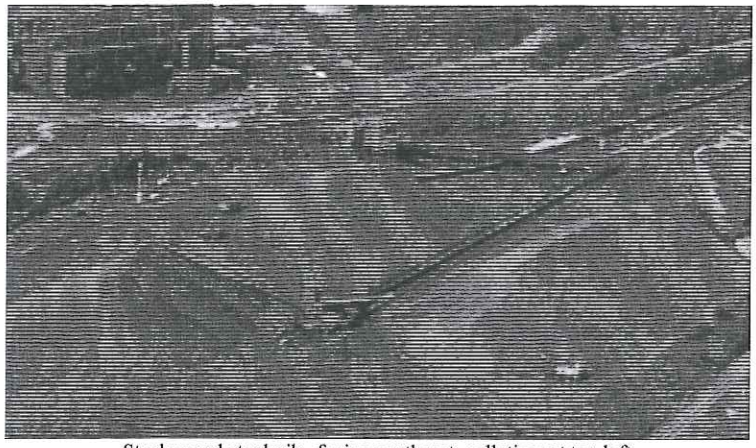
Significance and Evaluation
At the time of its construction, the stacker was reportedly the world's largest (EMC 1965: n.p.). Although associated with a new scale of operation, anecdotal information suggests that within a decade of construction, stackers at other plants surpassed this one in size. With the recent demolition of the pelletizing building, the structure loses its association with pellet production and other plant functions. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Erie Mining Company (EMC)
1965 *Welcome to Erie*. Erie Mining Company, Hoyt Lakes, Minn.
1969 *Story of the Erie Mining Company*. Erie Mining Company, Hoyt Lakes, Minn.
Personal communication with Dave Hughes, PolyMet Mining, 7/13/2007.

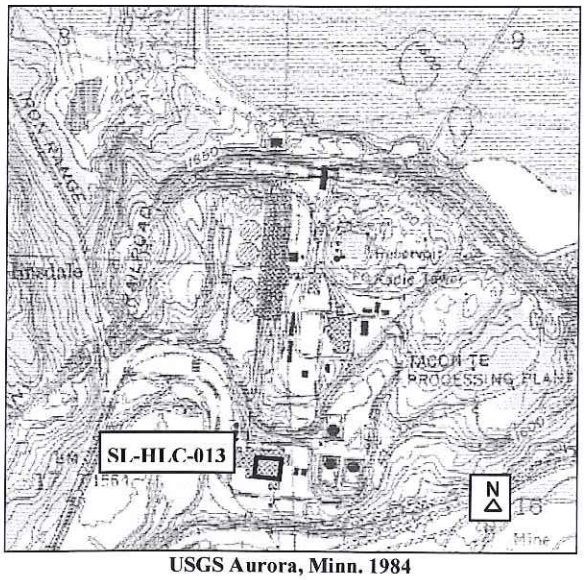
MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Stacker (rear) with pelletizer under demolition, facing southwest
Date of photo: 11/5/07 Photographer: Carole Zellie



Stacker and stockpile, facing northeast; pelletizer at top left
Date of photo: ca. 1993 Photographer: Polymet Mining Inc.



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Mine Area No. 2 Shops
Address Section 15 T59N R14W
County St. Louis
Township Hoyt Lakes
Legal Description
SE 1/4-NW-1/4-NW-1/4 Sec 15 T59 N R14W
USGS Allen, MN 1984
UTM Z15 566646E 5272108N (NAD 83)

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # / Review and Compliance # SL-HLC-014 p.1/2

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Shops and storage
Current Use	
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

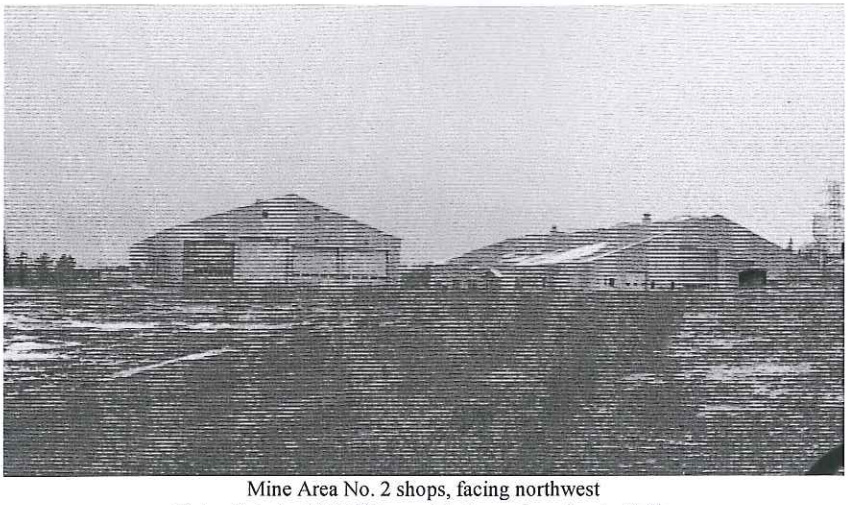
Description
Mine Area No. 2 Shops are located at the northwest edge of Mine Area 2 along the Erie Mining Company Railroad and approximately one mile east of the primary buildings of the former Erie Mining Company plant. There are three primary buildings and related sheds, fuel tanks, and a watertower. The gable-roofed buildings are clad in corrugated siding and have multiple garage and service entries.

History
Mine Area No. 2 Shops provided locomotive and cold storage facilities, and fuel storage. Adjacent Mine Area 2 was opened by the Erie Mining Company as one of three initial open pits. Area 2 was eventually combined with Area 3 to the north.

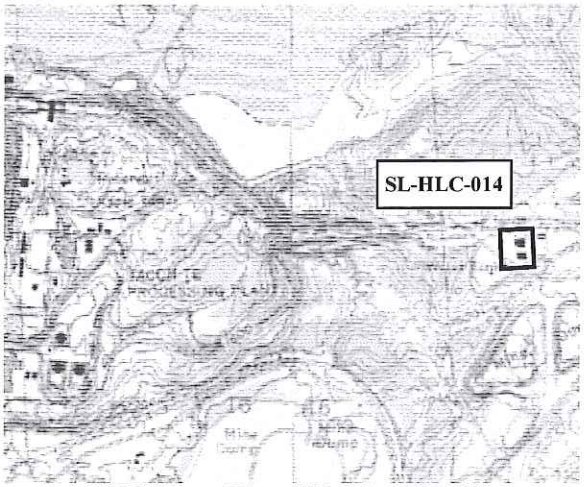
Significance and Evaluation
Mine Area No. 2 shops are a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The shops appear to be of standard design and do not represent an advancement in technology and are not eligible for the NRHP under Criterion A or C. The shops are not known to be associated with persons significant in local, state, or national history and are not eligible for the NRHP under Criterion B. They have not yielded, nor are they likely to yield information important in prehistory or history and are not eligible under Criterion D. The buildings and structures within the shop complex retain a good level of historic integrity, including qualities of location, design, setting, materials, and workmanship. The qualities of association and feeling are fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Erie Mining Company (EMC)
1954-1957 Plans on file at PolyMet Administration Building, Hoyt Lakes, Minn.

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Mine Area No. 2 shops, facing northwest
Date of photo: 11/05/07 Photographer: Carole Zellie



USGS Aurora, Minn. 1984; Allen, MN, 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Railroad Mine and Plant Track
Address Parts of Sections 8,9,15,16,17,18 T59N R14W
County St. Louis
Township Hoyt Lakes
Legal Description

USGS Aurora, MN 1984; Allen, MN 1984
UTM Z15 566646E 5272108N (NAD 83)

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-015 p. 1/3
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Mining Railroad
Current Use	
Property Type	Transportation
Property Category	Railroad
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Arrowhead Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Eligible

Description
A system of mine and plant track served the pits and plant buildings and Mine Area Shops No. 1 and No. 2. Segments at various locations are at grade and on a raised roadbed. Features of the permanent way, including the right-of-way, ties, and rail, signals, and routing (including grade, alignment, and curvature) appear to be generally intact.

History
The main line of the 74-mile Erie Mining Company (EMC) Railroad began south of the pelletizer and was constructed to haul pellets from the plant to the Taconite Harbor shipping facility. A separate system of mine and plant track served the pits and plant buildings. Although the DM&IR, a common carrier with a junction two miles south of the plant, could have provided rail service to Erie's Taconite Harbor facilities or DM&IR's Two Harbors facilities, "the kind, quality and cost of service did not fit into the overall requirements of the new taconite industry" (Witzig 1959:100). Erie Mining Company found the greatest economy in building its own single-purpose line as part of its industrial plant.

The company provided engineering, and the subgrade was excavated by Arrowhead Constructors (*EMJ* 1955:93). The main line was built across swampy terrain and required eight bridges across streams or for grade separation, and was tunneled through a bluff near the terminus of the line. The roadbed was planned to minimize grades. The single track consisted of 140-lb rails, with 24 rails per section. The tracks were laid over stone ballast over a washed gravel subgrade. Spur sidings were located at 14-mile intervals and a main passing siding was provided near the mid point (EMC 1969:22). The railroad handled more than 10 million tons of pellets during the shipping season from mid April to early December. Approximately 58,000 tons per day were moved on seven round trips between plant and harbor. Erie patented a dumping mechanism for the cars that allowed them to be dumped while in motion, permitting a full non-stop trip (EMC 1969:22). An ore train typically consisted of 96 cars pulled by four 1,750-hp diesel electric locomotives. The cars were equipped with 36-inch roller bearing wheels instead of standard 33-inch wheels. Unloaded trains traveled at 55 mph and loaded trains at 45 mph.

Significance and Evaluation
The project area includes segments of the mine and plant track that served ore pits and the plant. The right of way and roadbed are generally intact; some sections of track have been removed. Integrity in location and design is excellent, and feeling and association are good although the line is not currently in use.

This inventory focused only on railroad resources within the APE. While the Erie Mining Company taconite plant site has lost integrity as a potential district or mining landscape because of the demolition of the pelletizing plant, the railroad segments are recommended as components of a potential linear district eligible for the NRHP. The creation of a complete railroad system from Hoyt Lakes to Taconite to serve the Erie Mining Company Concentration Plant may be significant under Criterion A, with commerce and transportation the applicable areas of significance. The railroad was in operation during the plant's period of significance (1954-1969). Registration requirements established for Duluth Missabe & Northern (DM&N) Railway's Alborn Branch Line may provide guidance for future evaluation of Erie Mining Company Railroad resources (Bradley 2003:7-14). (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

Sources

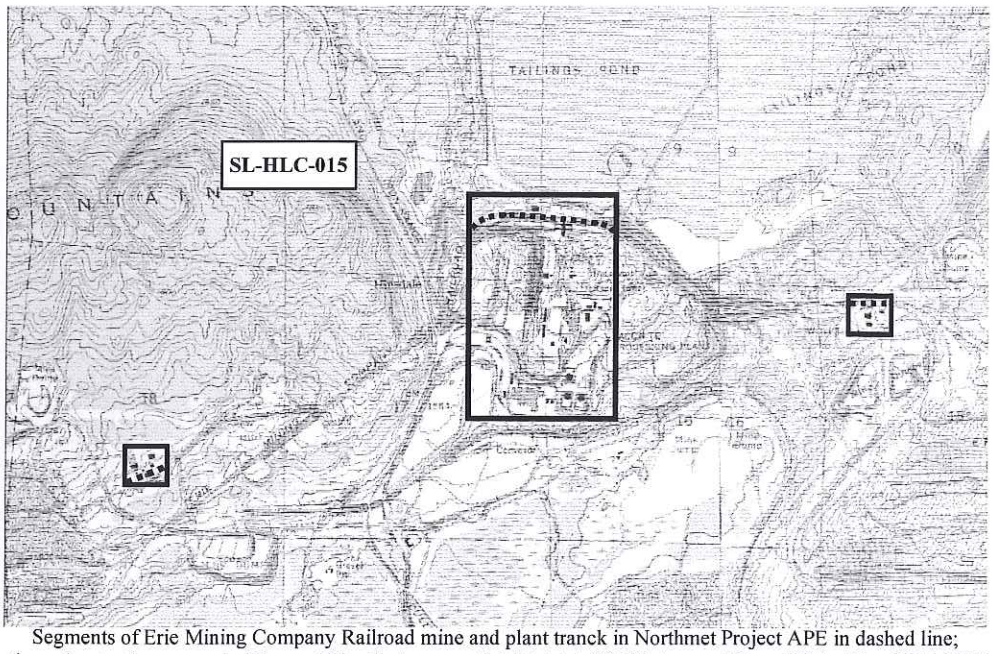
Bradley, Betsy H., Michael A. Justin, Chad V. Kirvan, Jennifer L. Hawkinson, Evelyn M. Tidlow, Christine N. Wiltberger, Milorad Paunovic, and Holly Halverson.
2003 *Draft Cultural Resources Survey, Evaluation and Effects Analysis Along TH 169, Itasca County Minnesota.* URS/BRW. Submitted to the Minnesota Department of Transportation.

Erie Mining Company (EMC)
1965 *Welcome to Erie.* Erie Mining Company, Hoyt Lakes, Minn.
1969 *Story of the Erie Mining Company.* Erie Mining Company, Hoyt Lakes, Minn.

Witzig, F.
1959 A Geographic Study of the Taconite Industry of Northeastern Minnesota. Unpublished dissertation. University Microfilms, Ann Arbor, Mich.

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

Erie Mining Company Railroad mine track facing east in Section 16 T59N R14, near general shops.
Date of photo: 11/05/07 Photographer: Carole Zellie



Segments of Erie Mining Company Railroad mine and plant tranck in Northmet Project APE in dashed line;
other mine track, spurs and sidings within plant area not highlighted (USGS Aurora, Minn. 1984; Allen, MN, 1984).

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Tailings Basin
Address Parts of Sections 3, 4, 5, 8, 9, 10, and 16, T59N, R14W; parts of Sections 32, 33, and 34, T60N, R14W
County St. Louis
Township Hoyt Lakes
Legal Description
USGS Aurora, MN 1984
UTM Z 15 15 565591E 5274426N (NAD 83)

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-016 p. 1/2
Review and Compliance #

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Tailings Basin
Current Use	
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

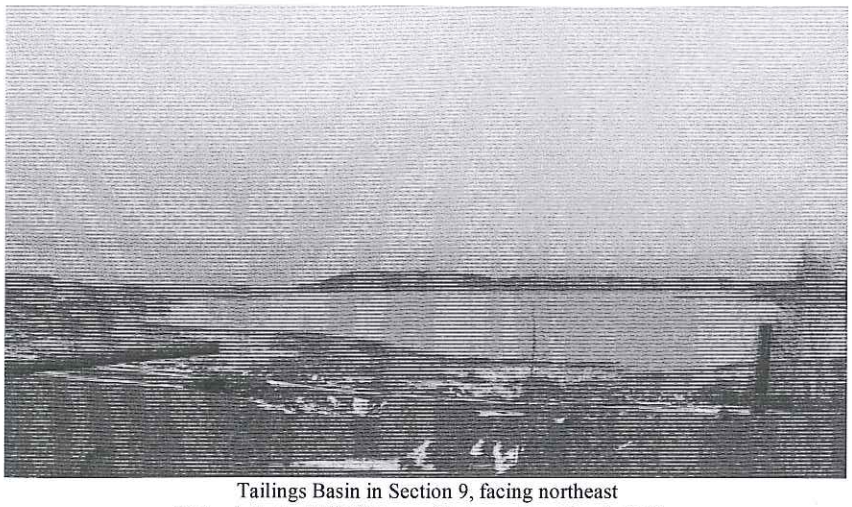
Description
After thickening, taconite tailings were pumped away from the concentration building into the tailings basin north of the plant site.

History
Taconite processing requires large areas for waste disposal. The tailings basin was expanded at various times during plant operation from 1957 to 2001. Three cells comprise the basin; 1E is approximately 875 acres, 2E is about 616 acres, and 2W totals approximately 1,447 acres. Basin features include pumping stations and a roadway along the basin dike. The tailings dam is modeled after the Phelps-Dodge copper mine dam at Morenci, Arizona (EMJ 1955:92).

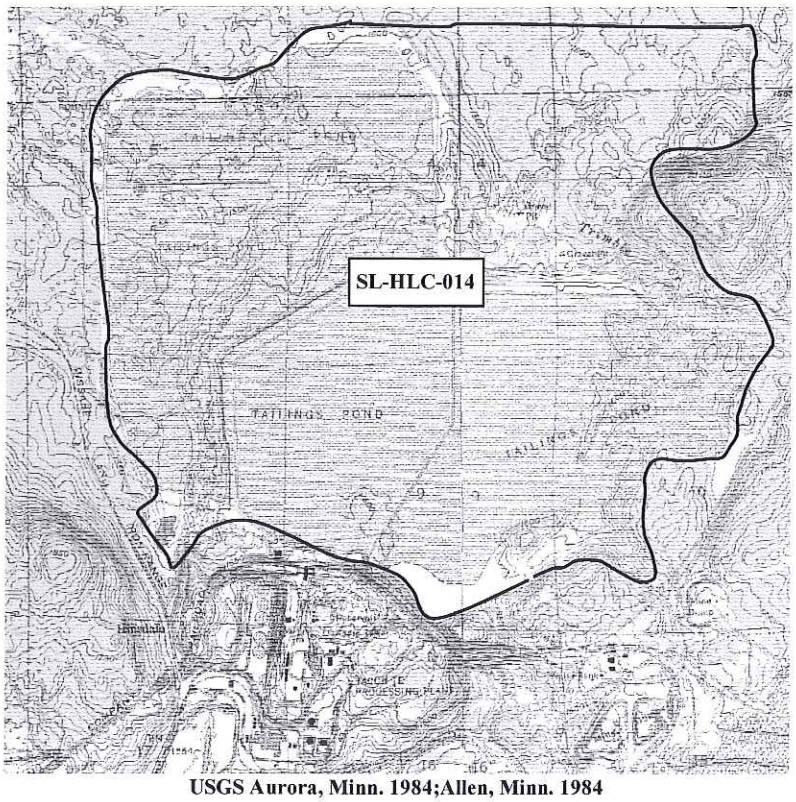
Significance and Evaluation
The tailings basin is a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The tailings basin appears to be of standard design and does not represent an advancement in technology and is not eligible for the NRHP under Criterion A or C. It is not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. The basin has not yielded, nor is it likely to yield information important in prehistory or history and is not eligible under Criterion D. The basin retains a good level of historic integrity, including qualities of location, design, setting, materials, and workmanship. The qualities of feeling and association are fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources
Engineering and Mining Journal (EMJ)
1955 "Teamwork on Taconite: the Story of Erie Mining Co's Commercial Taconite Project." March:73-93.

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Tailings Basin in Section 9, facing northeast
Date of photo: 11/05/07 Photographer: Carole Zellie



USGS Aurora, Minn. 1984;Allen, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Mine Area No. 1 Shops
Address Section 18T59N, R15W
County St. Louis
Township Hoyt Lakes
Legal Description
USGS Aurora, MN 1984
UTM Z15 562354E 5271208N (NAD 83)

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # SL-HLC-017
Review and Compliance #

PROPERTY DESCRIPTION

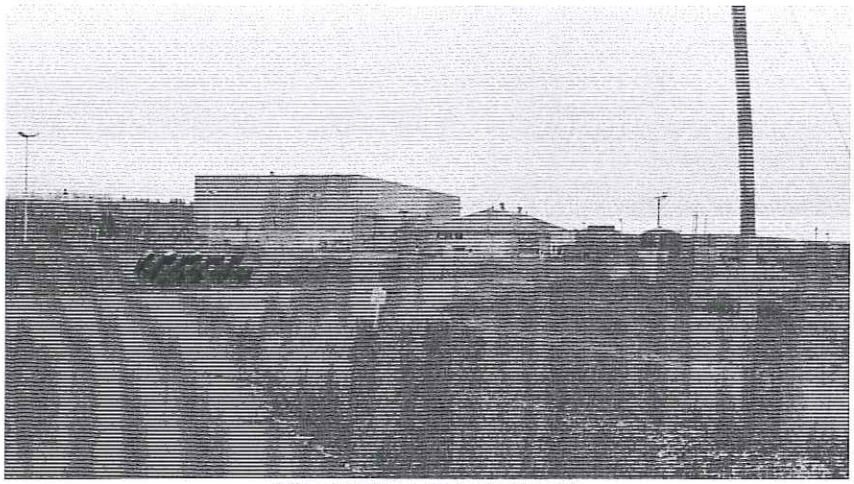
Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc.
Original Use	Shops
Current Use	
Property Type	Industry
Property Category	Mine
Construction Date	1957
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description
Area No. 1 Shops in Section 18 include include steel framed, metal-clad buildings with flat or gable roofs.

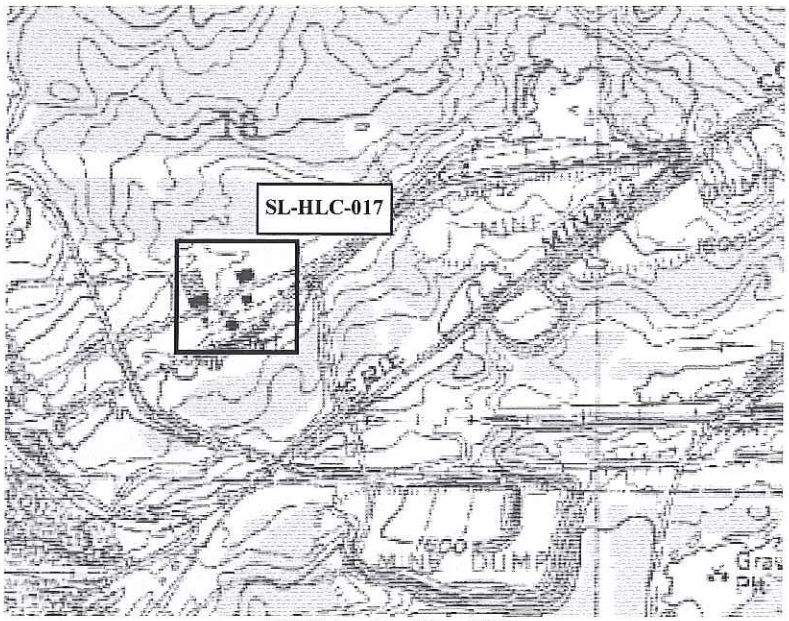
History
Mine Area No. 1 Shops provided fuel equipment rebuilding and repair, an electrical shop, boiler house, fire pump house, and an oil storage facility. The shops were enlarged in the late 1960s to accommodate larger trucks. Mine Area No. 1 was opened in 1957 by the Erie Mining Company as one of three initial open pits.

Significance and Evaluation
Mine Area No. 1 shops are a component of a taconite processing plant that was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The shops appear to be of standard design and do not represent an advancement in technology and are not eligible for the NRHP under Criterion A or C. The shops are not known to be associated with persons significant in local, state, or national history and is not eligible for the NRHP under Criterion B. They have not yielded, nor are they likely to yield information important in prehistory or history and are not eligible under Criterion D. The buildings and structures within the shop complex retain a good level of historic integrity, including qualities of location, design, setting, materials and workmanship. The qualities of feeling, and association are fair, due to the removal of the pelletizer. (Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM



Mine Area No. 1 shops, facing east
Date of photo: 11/05/07 Photographer: Carole Zellie



USGS Aurora, Minn. 1984

MINNESOTA HISTORY / ARCHITECTURE SURVEY FORM

PROPERTY IDENTIFICATION

Property Name Erie Mining Company
Hoyt Lakes Concentration Plant
Complex
Address Parts of Sections 8,9,15, 16,17, and 18, T59N, R14W
County St. Louis
Township Hoyt Lakes
Legal Description
USGS Aurora, MN 1984
UTM 15 564763E 5272262N (NAD83)

RECORDED BY
Carole S. Zellie, Landscape Research LLC
Date 7/13/2007
Survey Type Phase I
Survey Name Northmet Project, PolyMet Mining Inc.

MN SHPO Inventory # / Review and Compliance # SL-HLC-018

PROPERTY DESCRIPTION

Original Owner	Erie Mining Company
Current Owner(s)	PolyMet Mining Inc., Cliffs Erie
Original Use	Taconite production
Current Use	Vacant
Property Type	Industry
Property Category	Mine
Construction Date	1957-
Style	Industrial
Engineer	Anaconda Copper Mining Company
Builder	Foley Constructors
NRHP Status	Not previously evaluated
NRHP Eligibility Recommendation	Not eligible

Description

The Erie Concentration Plant complex includes eleven primary buildings and structures:

SL-HLC-003	Fine Crusher
SL-HLC-004	Conveyor and Drive House
SL-HLC-005	General Shops
SL-HLC-006	Reservoir
SL-HLC-007	Water Tower
SL-HLC-008	Concentrator Building
SL-HLC-009	Tailings Thickener Tanks
SL-HLC-010	Pelletizing Building
SL-HLC-011	Central Heating Plant
SL-HLC-012	Fuel Oil Tanks
SL-HLC-013	Pellet Stockpile and Stacker

The plant area is crossed by segments of Erie Mining Company Railroad Mine and Plant Track (SL-HLC-015) as well as plant roads. Shops for Mine Area No. 1 (SL-HLC-017) are located adjacent to Mine Area No. 1 west of the plant, and shops for Mine Area No. 2 are located adjacent to Mine Area No. 2 east of the plant. A tailings basin is located to the north of the plant (SL-HLC-016). An Administration Building (not inventoried) and guard shack are are located south of the plant.

History

The Erie Mining Company has been called "the largest single iron ore mining project and one of the biggest private construction projects ever undertaken" (*Iron News*, June 1957:3). Erie was one of two firms (with Reserve Mining Company, which began pellet production at the E. W. Davis Works in 1955) that led investment in commercial taconite production. The Erie plant was lauded as the "largest taconite concentrating and agglomerating structure ever built as a single unit" (Witzig 1959:84).

The Erie plant site was placed on a knob of the Giant's Range Granite, approximately eight miles northeast of Aurora, and six miles north of Hoyt Lakes. Trunk Highway 135 north of Aurora leads to the plant road that intersects with the Hoyt Road (County Highway 666) about 1.2 miles from the main gate. This road connects Hoyt Lakes with the plant.
The plant buildings were placed on terraces excavated at the foot of the Embarrass Mountains at an elevation of 1,750 feet, which drops about 200 feet within a mile to the north (Figure 7). Wetlands originally occupied much of the terrain to the south. Second Creek, a tributary of the Partridge River, drained the site from Section 21, T59N, R14W. The Partridge River drained Whitewater and Colby Lakes five miles to the south. Numerous small streams dissected the area. Spring Mine Lake was northeast of the plant site in Section 11, T59N, R14W 11, R14W.

Anaconda Copper Mining Company produced approximately 8,000 drawings for the original plant design for the Pickands Mather Mining Company, the initial manager of the Erie Mining Company. Foley Constructors of Minnesota was the general contractor. Anaconda's experience with plants in Chile, Mexico, and the United States was reflected in plant layout and equipment design. The four-year construction project involved more than 6,000 workers and 65,000 tons of structural steel and 400,000 cubic yards of concrete. The plant construction process was meticulously drawn and detailed, with a comprehensive

archive of drawings maintained throughout the period of plant operation. The initial project cost totaled more than $300 million (*EMJ* 1955:83;92). The plant design provided for 24-hour-per-day, 365-day per year operation with 2,800 employees mining 22,500,000 tons of crude taconite ore per year (*EMJ* 1955:92). Daily capacity was rated at 63,000 tons.

Pelletizing technology, developed by necessity to utilize low-grade ore, "turned out to be a breakthrough, one whose full benefits could not be duplicated when using high-grade hematites" (Kakela 1982:526). The productivity of the Mesabi's three taconite plants in the early 1960s brought prosperity to the range and corporations appealed to voters to amend the state constitution to provide tax stability. In 1966 there were eleven plants in operation on the Mesabi including Erie, which immediately made a $50 million expansion to increase annual pellet production capacity to 10.3 million tons. Expansion in the 1960s at Erie was praised as a "foundation stone" for "rebuilding the mining industry to enormous proportions" (*New York Times* 15 Nov. 1964:49).

Significance

The Erie Mining Company plant was the second large-scale operation on the Mesabi Iron Range. The recent demolition of the pelletizing plant (SL-HLC-010), however, resulted in an important break in the processing system that significantly alters the historic integrity of the plant complex. The Concentrator Building (SL-HLC-008) is recommended individually eligible for the NRHP under Criterion A in the areas of Industry and Engineering, and also under Criterion C in the area of Engineering. Segments of the Erie Mining Company Railroad Mine and Plant Track (SL-HLC-015) are also recommended as eligible under Criterion A, with commerce and transportation the applicable areas of significance.

(Minnesota Historic Contexts: Minnesota's Iron Ore Industry, 1880s-1945)

Sources

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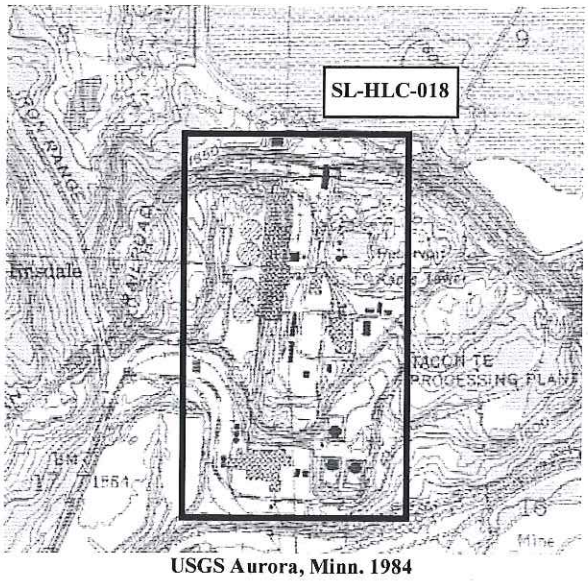
Erie Mining Company Plant, looking northeast, ca. 1993 (Polymet Mining)



USGS Aurora, Minn. 1984