GEOLOGY, MINERALS, AND SOILS
RESOURCE REPORT

TWIN METALS MINNESOTA PROJECT
Environmental Review Support Document

Prepared for Twin Metals Minnesota, LLC
Prepared by

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REVISION RECORD

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REVISION NARRATIVE

DISCLAIMER

This document is a working document. This document may change over time because of new information, or further analysis or deliberation.

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LIST OF ABBREVIATIONS, ACRONYMS, AND SYMBOLS

TMM	Twin Metals Minnesota, LLC

1.0 INTRODUCTION

The Twin Metals Minnesota, LLC (TMM) Project (Project) is focused on designing, permitting, constructing, and operating an underground copper, nickel, cobalt, platinum, palladium, gold, and silver mining project. Located approximately nine miles (14 kilometers [km]) southeast of Ely, Minnesota, and 11 miles (18 km) northeast of Babbitt, Minnesota, the Project targets valuable state, federal, and private minerals within the Maturi deposit, which is a part of the Duluth Complex geologic formation.

All potential Project infrastructure locations presented herein are considered preliminary and are undergoing further design and engineering evaluations which will dictate final design and locations. Further information about TMM and the Project is located at http://www.twin-metals.com/.

The purpose of this document is to provide necessary information for the environmental review and permitting process. TMM retained [insert Consultant name] (insert abbreviated Consultant name) to complete [insert text].

2.0 SUMMARY

This report will:

- Describe the proposed action and alternatives;
- Establish the area where baseline conditions of geology, mineral, and soil resources need to be assessed;
- Define the methodology used to assess the baseline conditions;
- Describe the baseline conditions;
- Describe the methodology used to assess the impacts;
- Defining the area of effects of the impacts;
- Establish the indicators of effects to the baseline conditions;
- Describe the impacts of the proposed action and alternatives on the baseline conditions; and
- Reference relevant sections of the FSDD, SEAW, and / or federal documents to remind the reader there is a defined scope that is being followed.

3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 Proposed Action

- Reference the TMM Project Description and Alternatives document and indicate the proposed action is defined within this document.

3.2 Alternatives to the Proposed Action

- Reference the TMM Project Description and Alternatives document and indicate the alternatives to the proposed action are defined within this document.

3.3 No Action Alternative

- Reference the TMM Project Description and Alternatives document and indicate the no action alternative is defined within this document.

4.0 REGULATORY FRAMEWORK

Establish regulatory framework that is applicable to geology, mineral, and soil resources. This include state, federal, or tribal federal statutes or regulations and NEPA / MEPA requirements. This should also include regulatory definitions and how they are used by the Project. Specifically this resource report should discuss:

- State and federal mineral ownership and leases
- Policy of maximum ultimate recovery (43 CFR 3594.1)
- State of Minnesota School Trust Land

5.0 AFFECTED ENVIRONMENT

The affected environment will be deconstructed by features and / or activities of the proposed action and alternatives that would cause the potential effects to geology, mineral, and soil resources.

5.1 Area of Analysis

Area of analysis will be determined based on areas where there are potential impacts to the geology, mineral, and soil resources from the Project. Area of analysis will consider the construction limits, project features, and phases of the proposed action and alternatives.

5.2 Methods

Description of the methods used to identify, quantify, and qualify baseline conditions of geology, including lithology, structure, and alteration and mineralization within the area of analysis. This will be further built out to include:

5.2.1 Geology

Discuss sources used to develop baseline conditions of geology, including lithology, structure, and alteration and mineralization:

- Minnesota Geological Survey maps and reports.
- United States Geological Survey maps.
- Project-specific reports, documents, or maps.

5.2.2 Soils

Discuss sources used develop baseline conditions of soils, including:

- U.S. Department of Agriculture Natural Resources Conservation Service Soil Data Survey.
- USFS Terrestrial Ecological Unit Inventory.
- Project specific data:
    - Data from soil logs and monitor well installation;
    - Physical soil properties of soils present; and
    - Engineering properties of the soils.

5.2.3 Minerals

Discuss sources used to determine mineral rights and ownership.

5.3 Existing Conditions

Discuss the baseline conditions of the geology, mineral, and soil resources. This should include:

- Geology
    - Regional
        - Lithology;
        - Structure; and
        - Alteration and mineralization.
    - Deposit
        - Lithology;
        - Structure; and
        - Alteration and mineralization.
- Soils
    - Sensitive soils
    - Discussion on the suitability of soils to serve as growth medium.
        - Factors used for determining the suitability for reclamation purposes

- Minerals (similar to what was presented in Appendix A of the MPO)
  - Mineral ownership
    - Figures and tables
  - Mineral resource authorizations and/or leases

6.0 IMPACT ASSESSMENT CRITERIA

6.1 Area of Analysis

Area of analysis will be determined based on areas where there are impacts to the geology, mineral, and soil resources by the proposed action and alternatives. Area of analysis should be the equal to or smaller than the area of analysis discussed in Section 5.1.

6.2 Methodology and Evaluation Criteria

Describe rationale for how impacts will be assessed by the implementation of the proposed action or alternatives.

6.2.1 Geology

Discuss the method to determine impacts to geology.

- removal of the ore
- blasting damage or fractures
- backfill

6.2.2 Soils

Discuss the method to determine impacts to soils.

- Overlay surface Project features and construction limits on area of analysis

6.2.3 Minerals

Discuss methods to determine minerals that are present within the area of analysis

Discuss the activities, features, and phases of the project and how the activities would affect minerals.

6.3 Indicators

This section will discuss how indicators were selected and what the indicators are.

- Change to the mineral resource in the Maturi deposit;

- Mineral utilization;
- Mineral left unutilized;
- Estimates on acres of soil disturbance – construction limits;
- Changes in soil quality; and
- Number and types of mining claims and leases.
    - Change in accessibility to mineral resources

6.4 Timeline for Analysis

Timeline for analysis of the impacts to soil will be during Project construction and impacts to geology and minerals from encumbrance will be permanent.

7.0 ENVIRONMENTAL CONSEQUENCES

Provide a high level summary of what is presented in the environmental effects. Section summarizes what environmental effects are and the effects of the proposed action and alternatives.

7.1 Discussion of Environmental Effects

Using the affected environment and the impact assessment an assessment of impacts to the geology, mineral, and soil resources will be conducted and described within this section.

The following items will be assessed and described for the proposed action, alternatives to the proposed action, and the no action alternative:

- Geology
    - Removal of 180 million tons of ore
    - Discussion of maximum ultimate recovery
        - Trade-off in the mine design between geotechnical stability and the potential for resource recovery
- Soils
    - Removal of soil from footprints of construction limits
    - Estimates on volume of soils removed and volume of soils stockpiled
    - Suitability of topsoil resources (growth medium) for reclamation;
    - Discussion of indirect impacts
        - Wind and water erosion of stockpiled/salvaged soils
        - Potential contamination of soils from spills or leaks
- Minerals
    - Construction of dry stack facility
        - prevent future utilization of bedrock or unconsolidated mineral resources located under these permanent facilities and
        - produce permanent changes to the existing topography
    - Describe impacts to mineral tenure

7.1.1 Proposed Action

Impacts associated with the proposed action will be described in this section.

7.1.2 Alternatives to the Proposed Action

Impacts associated with the alternatives to the proposed action will be described in this section.

This discussion will focus on differences in impacts between the alternatives and proposed action. Impacts that are the same between the proposed action and alternatives will be noted but not discussed in detail.

7.1.3 No Action Alternative

Impacts associated with the no action alternative will be described in this section.

8.0 AVOIDANCE, MINIMIZATION, MITIGATION, AND MONITORING MEASURES

Highlight environmental protection measures, best management practices, and mitigation plans that the proposed action and alternatives would reduce the potential for impacts from the Project. Information should be pulled from the TMM Project Description and Alternatives document.

8.1 Proposed Action

Avoidance, minimization, mitigation, and monitoring measures associated with the proposed action will be described in this section.

8.2 Alternatives to the Proposed Action

Avoidance, minimization, mitigation, and monitoring measures associated with the alternatives to the proposed action will be described in this section.

9.0 REFERENCES

TABLES

FIGURES

APPENDICES

APPENDIX [#A, B, C, D]

[APPENDIX TITLE]

APPENDIX [#A, B, C, D]

[APPENDIX TITLE]

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