GEOCHEMISTRY VOL 1
BASELINE DATA AND METHODS

TWIN METALS MINNESOTA PROJECT
Environmental Review Support Document

Prepared for Twin Metals Minnesota, LLC
Prepared by

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REVISION RECORD

Revision	Date	Description	EDMS Download Date	Project Configuration Version
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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

- Provide a high-level summary of what is presented within this report.
- Describe how this report volume relates to the other volumes.
- 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 PURPOSE AND REGULATORY FRAMEWORK

4.1 Purpose

- Describe the purpose / reason for conducting mine materials characterization including the following:
    - Why characterization is conducted;
    - How characterization is conducted; and
    - How characterization results are used to support environmental impact assessments (described in other data package and resource report volumes) and Project designs (i.e., water management design).

4.2 Regulatory Framework

- Establish Regulatory Framework by discussing the following:
    - Regulatory requirements and guidance governing material characterization practices
        - Minn. R., 6132.1000, specifically sections that define a mine waste characterization program
    - Regulatory definitions
    - Water quality performance standards
        - Reference applicable sections of the *Water Resources Data Package*

5.0 GEOLOGY

- Reference the TMM Geology and Minerals Resource Report and summarize information pertinent to mine materials characterization.

    - Description of TMM block model and geologic units
    - Description of mine model and disturbance (or reference to section where this is described)

6.0 MINE MATERIALS CHARACTERIZATION METHODS

6.1 Testing Methods

- Description of the objectives or static and kinetic testing
- Description of phased approach to static and kinetic testing

6.1.1 Static Testing

- Define static testing and describe specific tests / parameters.
  - Acid-base accounting
  - Whole rock / trace element
  - Net acid generation
  - Mineralogy and petrology

6.1.2 Kinetic Testing

- Define kinetic testing and describe specific test methods / parameters.
  - Humidity cell testing
  - Diffusion testing

6.2 Sample Selection

This section will provide the rational for selecting samples and will define the samples selected for static and kinetic testing.

6.2.1 Waste Rock and Ore

- Number of samples
- Sample selection rationale
  - Unit, compositional representation, spatial representation, mine plan / degree of disturbance, and chemical composition

6.2.2 Tailings and Paste Tailings Backfill

- Sample sources
- Sample selection rationale
  - Compositional representation, particle size representation, and binders

6.3 Analytical Laboratory

6.4 Quality Control / Quality Assurance Procedures

- Describe quality control / quality assurance procedures including the following:
  - Data validation
  - Data management
  - Data reporting

7.0 MINE MATERIALS CHARACTERIZATION RESULTS

This section will discuss the acid rock drainage (ARD) and metal leaching (ML) potential of mine waste materials based on analytical results as well as references to work by others, where appropriate.

7.1 Static and Kinetic Testing Results

Mine Materials Characterization Program (MMCP) static and kinetic data reports will be referenced and appended.

7.2 Mine Waste and Ore Geochemistry

Describe geochemical characteristics of ore, waste rock and tailings based on the results of static and kinetic testing (i.e. ARD and ML potential).

7.2.1 Ore

7.2.2 Waste Rock

7.2.3 Tailings

8.0 REFERENCES

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FIGURES

APPENDICES

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[APPENDIX TITLE]

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