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MONTANA RESOURCES

YANKEE DOODLE TAILINGS IMPOUNDMENT - CONSTRUCTION MANAGEMENT PLAN FOR 6,560 AMENDMENT DESIGN DOCUMENT

Rev	Description	Date
0	Issued in Final	September 13, 2024

Knight Piésold CONSULTING

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ABBREVIATIONS

ABA ..... Acid Base Accounting
ACI ..... American Concrete Institute
AIR ..... Annual Inspection Report
ANSI ..... American National Standards Institute
AP ..... Acid Potential
ARD ..... Acid Rock Drainage
ASME ..... American Society of Mechanical Engineers
ASTM ..... American Society for Testing and Materials
AWWA ..... American Water Works Association
CIR ..... Construction Inspection Record
CMP ..... Construction Management Plan
DCR ..... Design Change Request
DSR ..... Daily Site Report
EL ..... elevation
EOR ..... Engineer of Record
FI ..... Field Instruction
FRR ..... Field Review Record
ft ..... feet
GRI ..... Geosynthetic Research Institute
HDPE ..... High-Density Polyethylene
IFC ..... Issued for Construction
IRP ..... Independent Review Panel
ITP ..... Inspection and Test Plan
KP ..... Knight Piésold Ltd.
MCA ..... Montana Code Annotated
MDEQ ..... Montana Department of Environment Quality
MR ..... Montana Resources, LLC
NAG ..... Non-Acid Generating
NCR ..... Non-Conformance Report
NP ..... Neutralization Potential
OIT ..... Oxidative Induction Time
PAG ..... Potentially Acid Generating
psi ..... Pounds per square inch
QA ..... Quality Assurance
QC ..... Quality Control
RDS ..... Rock Disposal Site
RFI ..... Request for Information
SIR ..... Subgrade Inspection Record
TOMS ..... Tailings Operations, Maintenance and Surveillance
WED ..... West Embankment Drain
WET ..... Water and Environmental Services Ltd
WPR ..... Weekly Progress Report

YDTI ..... Yankee Doodle Tailings Impoundment

1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES

Montana Resources, LLC (MR) operates the Montana Resources open pit copper and molybdenum mine located in Butte, Montana. The mine includes the mill and processing facilities (the Concentrator) and a tailings storage facility called the Yankee Doodle Tailings Impoundment (YDTI). The YDTI comprises a valley-fill style impoundment created by a continuous rockfill embankment. The YDTI is currently permitted to a maximum embankment crest elevation (EL.) of 6,450 feet (ft). The existing Construction Management Plan (KP, 2018) outlines the technical specifications related to ongoing construction activities for the facility up to EL. 6,450 ft.

The EL. 6,450 ft embankment provides sufficient tailings storage capacity to support mining and ore processing until approximately 2034 (KP, 2024a). MR is preparing a permit amendment application (the 6,560 Amendment Application) to facilitate continued operation of the mine thereafter by aligning approval for tailings storage within the YDTI with the remaining ore reserves. The permit amendment application process requires the permit applicant (MR) to submit a Design Document when a new facility or existing facility expansion is proposed.

Knight Piésold Ltd. (KP) is developing the 6,560 Amendment Design Document (the Design Document) to support the 6,560 Amendment Application. The Design Document presents the plan to progressively raise the crest elevation of the YDTI embankments to a maximum design crest of EL. 6,560 ft in two or more lifts to support continued mining and ore processing. The Design Document comprises a series of technical reports covering the subject areas and content to meet the requirements specified in Montana State law as well as evaluating opportunities for continued risk reduction to enhance safety as part of the fundamental objective for on-going continuous improvement of the safety of the YDTI. The laws governing tailings storage facility design, operation and reclamation are contained within sections of Montana Code Annotated (MCA) Title 82 Chapter 4 Part 3 (MCA, 2023).

- Title 82: Minerals, Oil, and Gas
  - Chapter 4: Reclamation
    - Part 3: Metal Mine Reclamation

This Construction Management Plan (CMP) is structured to meet the compliance obligations as stipulated in MCA Title 82, Chapter 4 Part 3 Section 376 (2), (r) and (s), and has been prepared by KP for the continued construction of the YDTI (above crest EL. 6,450 ft). This CMP pertains to all construction related to the YDTI and includes earthworks, geotextiles, concrete structures, pipeworks and appurtenances, and geotechnical instrumentation. This CMP will become the governing construction management document when construction activities associated with the Design Document commence. This CMP may be updated periodically thereafter, if required during ongoing construction over the remaining life of the mine.

The principal objectives of this CMP are as follows:

- Provide initial technical specifications and to complement the design drawings for future construction of the YDTI.
- Set the parameters and levels of acceptability to be monitored during construction for Quality Control (QC) and Quality Assurance (QA) purposes.

- Describe the testing specifications and frequency of QC and QA sampling and testing.
- Describe the collection and submittal of all required quality records to demonstrate the construction has been completed as per the design documentation.
- Describe the degree of oversight, responsibilities, and qualifications of all the key parties.
- Describe the role of the Independent Review Panel (IRP) during and after construction.

1.2 DEFINITIONS

The following definitions are clarified for the purpose of this document:

- **'Yankee Doodle Tailings Impoundment or YDTI'** refers to all components of the YDTI, including the downstream Rock Disposal Sites (RDS) and any associated drainage features.
- **'Construction Management Plan'** refers to the most recent revision of this document prepared for the YDTI.
- **'The Drawings'** means the most recent Issued-For-Construction (IFC) revision of the construction drawings for the YDTI prepared and sealed by the Engineer of Record (EOR).
- **'Constructor'** refers to the entity responsible for construction of the YDTI including the relevant mine operations team of MR and all contractors and subconsultants of MR (e.g.: Intermountain Construction Services). A constructor subconsultant may also include construction management third parties (such as Water and Environment Technologies (WET) or others) that are assigned to oversee construction. Minimum Constructor experience requirements for specialist contractors are defined within this document when appropriate.
- '**Owner'** refers to the MR senior management group and technical services department, or an employee or sub-consultant nominated by the Owner.
- **'Engineer'** refers to the EOR for the YDTI, or an employee or sub-consultant nominated by the EOR. The nominated employee or sub-consultant will be employed by the EOR, or the EOR's design firm.

2.0 ROLES AND RESPONSIBILITIES

2.1 GENERAL

This section identifies the key roles and responsibilities of the parties involved in the design and construction of the YDTI. A general organizational chart, shown in Figure 2.1, shows the structure and relationships of the parties.

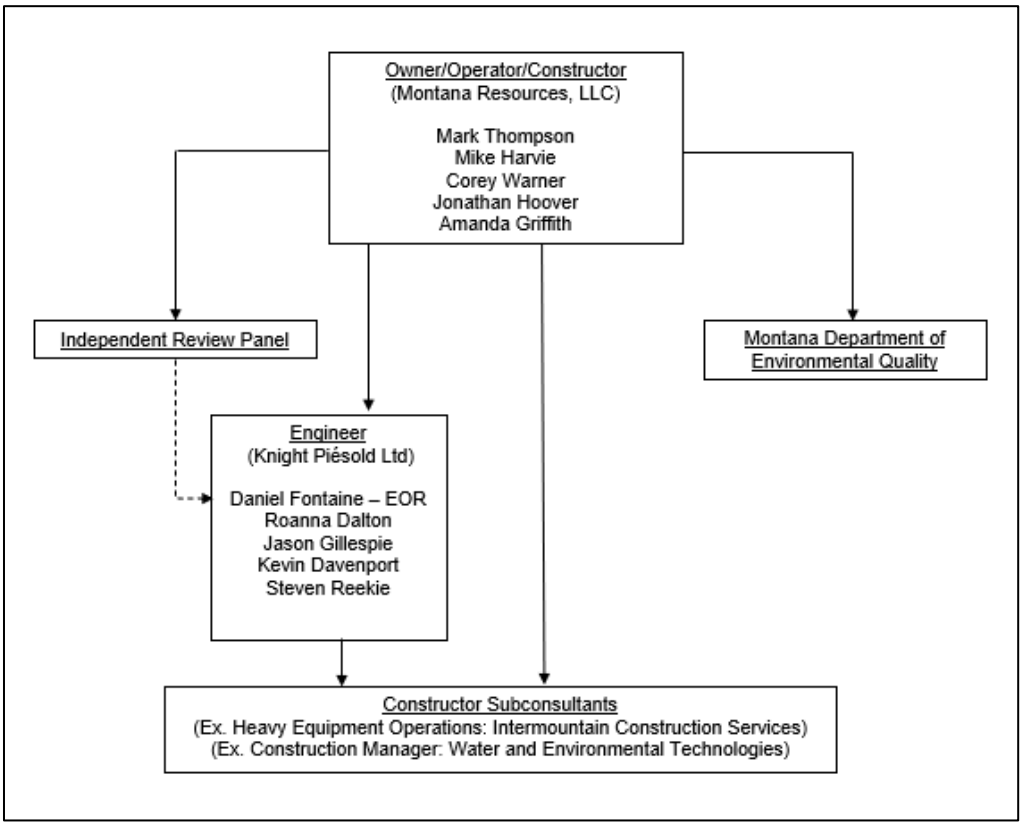


Figure 2.1 Construction Management Organizational Chart

A detailed description of the organization structure and identification of the roles and responsibilities of individual personnel within each organization is presented in the Tailings Operations, Maintenance and Surveillance (TOMS) Manual (MR/KP, 2023), which is reviewed and updated annually by the Owner and reviewed and certified by the Engineer.

2.2 MONTANA RESOURCES, LLC

MR is responsible for the construction, operation, and management of the mine and referred to as the 'Owner', 'Operator' and 'Constructor' of the YDTI. MR may subcontract contractors or consultants to assist in the construction and quality activities; however, responsibility and compliance with this document remains with MR.

2.3 REGULATORY ENVIRONMENT

The Montana Department of Environmental Quality (MDEQ) is the State regulatory agency responsible for tailings impoundments within Montana. Approved quality monitoring records collected during the construction program shall be submitted to the MDEQ in the annual report or construction completion report as required by the operating permit and outlined by MCA 82-4-378.

2.4 ENGINEER OF RECORD

The requirements for an EOR for the YDTI are described in MCA 82-4-381. The EOR for the YDTI is Mr. Daniel Fontaine, P.E. of KP. The EOR is required to be a Professional Engineer licensed in the State of Montana and cannot be an employee of the Operator or the permit holder. The EOR has the following responsibilities in relation to the preparation of the Design Document:

The EOR is responsible for the following:

- Review the design and other documents pertaining to the tailings storage facility.
- Certify and seal designs or other documents pertaining to the tailings storage facility submitted to the Montana DEQ.
- Complete an annual inspection of the tailings storage facility.
- Notify the operator when credible evidence indicates the tailings storage facility is not performing as intended.
- Immediately notify the operator and the MDEQ when credible evidence indicates that the tailings storage facility presents an imminent threat or a high potential for imminent threat to human health or the environment.
- Providing construction oversight as specified in the Construction Management Plan (this document) and quality assurance management during construction.

2.5 INDEPENDENT REVIEW PANEL

An IRP consisting of three independent review engineers or specialists is required when a new facility or existing facility expansion is proposed. The IRP is responsible for review of the Design Document, the underlying analyses, and assumptions for consistency with MCA 82-4-376.

The following international experts constitute the current IRP for the YDTI:

- Dr. Dirk Van Zyl, P.E. – Tailings and Geotechnical Specialist Engineer
- Dr. Leslie Smith, P.Geo – Hydrogeology Specialist
- Dr. Peter K. Robertson, P.E. – Tailings and Geotechnical Specialist Engineer

These three technical experts are the designated IRP for the Design Document. A fourth international expert Mr. James Swaisgood P.E., passed away in June 2024. He specialized in dam design and seismic assessment and was previously engaged as an IRP member to provide technical design review for the YDTI. Jim's contributions, advice and support to the project during his role as an IRP member from 2015 through to June 2024 are gratefully acknowledged.

3.0 FACILITY DESCRIPTION

3.1 GENERAL

The YDTI is the tailings storage facility for the mine. The YDTI was originally constructed in 1963 using rockfill obtained from Berkeley Pit stripping operations and has been continuously expanded using rockfill from the Berkeley Pit (until 1982) and from the Continental Pit (beginning in 1986). The YDTI comprises a valley-fill style impoundment created by a continuous rockfill embankment which is divided into three embankments according to the general geometry of each limb. These embankments are the West Embankment, the East-West Embankment, and the North-South Embankment.

The design of the YDTI also includes three areas (two existing and one new) located immediately downstream of the embankments which have been identified as locations for surplus rockfill placement. MR will place surplus rockfill from mine operations in these areas throughout continued operations. The RDSs will enhance the stability of the YDTI and may provide opportunities for progressive reclamation of the mine site. The three RDSs are described as follows:

- North RDS, located downstream of the North-South Embankment.
- HsB RDS, located within the HsB area.
- West RDS, located along the north-west trending limb of the East-West Embankment in the area formerly referred to as the Northwest Dumps.

The general arrangement of the life of mine design layout for the YDTI and supporting mine infrastructure is provided on Figure 3.1.

3.2 COORDINATE SYSTEM

The design of the YDTI references the site coordinate system known as the ‘Anaconda Mine Grid’ established by The Anaconda Company in 1957. The Anaconda Mine Grid is based on the Anaconda Copper Company (ACC) Datum established in 1915. All elevations are stated in Anaconda Mine Grid coordinates with respect to the ACC Vertical Datum unless specifically indicated otherwise. The Montana Resources GPS Site Coordinate System is based on the ‘Anaconda Mine Grid’ and utilizes International Feet.

3.3 HISTORICAL CONSTRUCTION PRACTICES

The YDTI has been constructed by progressively placing rockfill to form free-draining rockfill embankments. The rockfill comprises pit-run material end-dumped with initial compaction from the mine haul fleet traffic and gradual settlement occurring thereafter. Ripping of the embankment surface to enhance vertical infiltration has been commonly completed prior to subsequent fill placement. The embankment design incorporates a zone of finer-grained material (alluvium) placed on the upstream face of the embankment to limit potential for tailings migration into the rockfill.

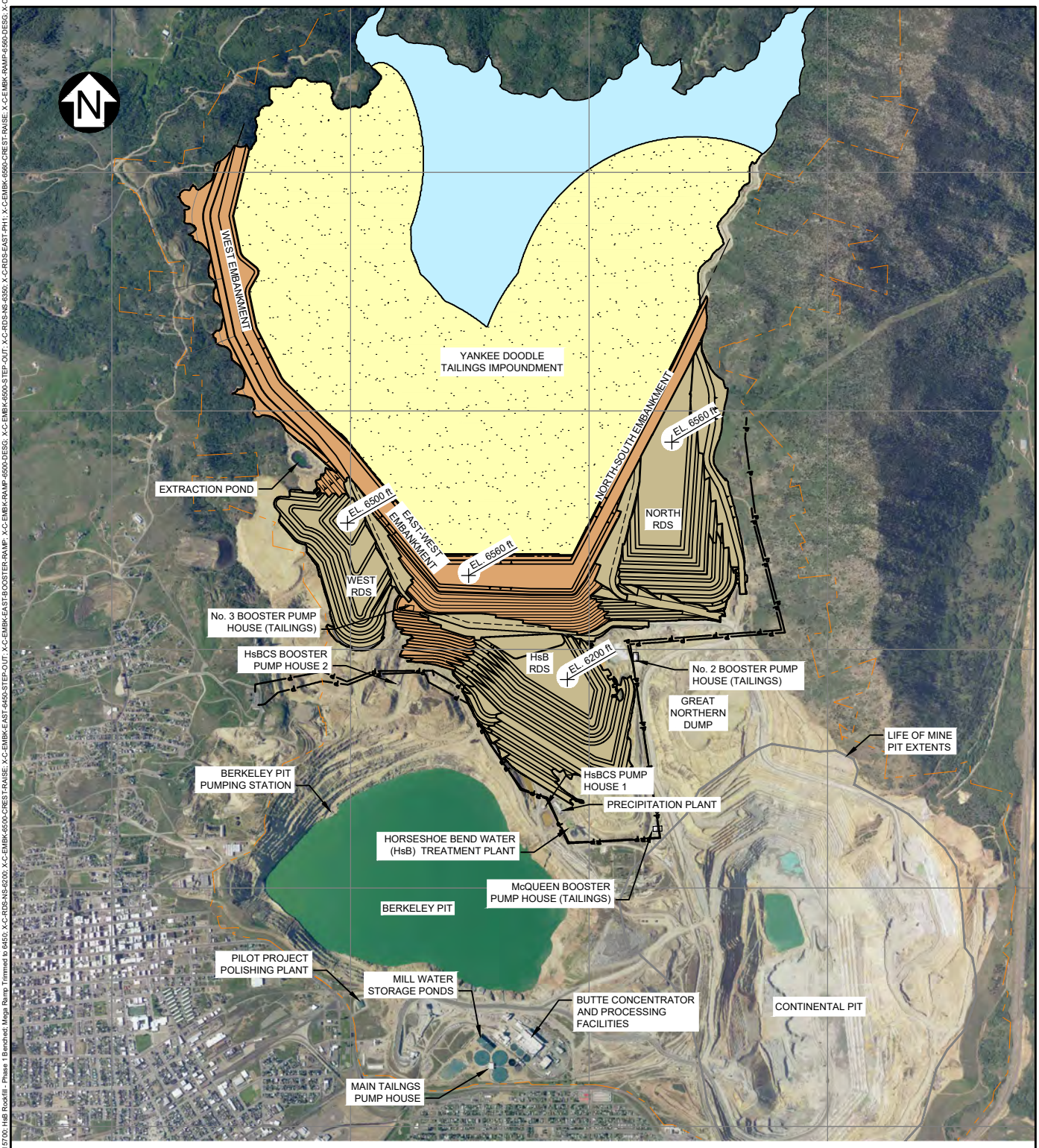
The West Embankment incorporates the West Embankment Drain (WED) and several other seepage control features to maintain hydrodynamic containment of YDTI seepage as the supernatant pond elevation rises above the lowest groundwater elevations in the West Ridge. The West Embankment also includes a

zone of material with relatively lower permeability and relatively lower acid generating potential along the downstream edge of the West Embankment.

3.4 PROPOSED FACILITY DEVELOPMENT

The continued construction of the YDTI embankments up to a maximum crest of EL. 6,560 ft will be completed with similar techniques and construction methodologies that have been adopted for past raises. The East-West and North-South Embankments will continue to be constructed as free-draining rockfill embankments using pit-run material end dumped and compacted with the mine haul fleet. Construction of the West Embankment, and extension of existing drainage features included with the WED, will continue using similar materials and methods as past raises. RDS will be progressively constructed using pit-run material end dumped in specified lifts and compacted with the mine haul fleet. Ripping of the placed materials surfaces will be completed prior to each subsequent lift to enhance vertical infiltration.

The proposed development of the YDTI is presented in the Life of Mine Design Report (KP, 2024a). Issued for Construction (IFC) drawings will be developed and issued progressively as required for the various phases of construction and will include additional technical specifications not outlined in this document. This CMP will be revised as required throughout the development of the YDTI along with issuance of the IFC drawings. The approximate YDTI development sequencing presented in the Design Document will be updated as required for the IFC designs, and activities attributed to the various phases may be adjusted or combined in the future as part of the ongoing development process.



LEGEND:

- EMBANKMENT FILL
- ROCK DISPOSAL SITE (RDS) \ RAMPS \ ROCKFILL
- TAILINGS
- SUPERNATANT POND
- OVERHEAD POWER LINES (PROPOSED) (NOTE 2)
- PROPERTY BOUNDARY

SCALE A: 1500 0 1500 3000 4500 6000 7500 ft

NOTES:

1. AERIAL IMAGE PROVIDED BY MONTANA RESOURCES, LLC IN JULY 2023.
2. HIGH VOLTAGE TRANSMISSION LINE IS APPROXIMATE AS PROVIDED BY MR IN SEPTEMBER 2023. LAYOUT BY NORTHWEST ENERGY.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	13SEP'24	ISSUED WITH REPORT	JRG	RMM	DDF

MONTANA RESOURCES, LLC

MONTANA RESOURCES

YANKEE DOODLE TAILINGS IMPOUNDMENT
GENERAL ARRANGEMENT
LIFE OF MINE DESIGN

Knight Piésold CONSULTING

P/A NO. VA101-126/24 | REF NO. 6

FIGURE 3.1 | REV 0

4.0 QUALITY MANAGEMENT SYSTEM

4.1 QUALITY CONTROL

The Constructor shall perform QC inspection, testing and documentation duties for all aspects of construction related to the YDTI. The purpose of the QC duties is to verify that the construction of the YDTI is of acceptable quality and meets the design intent as delineated on the Drawings and as described within this document. The frequency and specific requirements for each task are identified in the Inspection and Test Plans (ITPs) included in the subsequent sections of this document.

The Constructor shall perform the QC tasks listed below:

- **Inspect:** The Constructor will be responsible for field inspections of construction activities.
- **Test:** The Constructor will be responsible for carrying out QC testing on the materials.
- **Observe Hold Points:** Hold Point indicates a critical portion of the work that requires the Constructor to complete an activity before holding the works for inspection or testing. The Owner is required to communicate the Hold Points to the Constructor and to oversee that the work is held for inspection and testing.
- **Document:** The Constructor will be responsible for documenting inspections and for maintaining testing records.

Additional information related to QC documentation requirements is provided in Section 4.3.

4.2 QUALITY ASSURANCE

The Engineer will perform QA reviews, testing and documentation duties for all aspects of construction. The primary expectations of the QA role are to enhance the QC inspections and to verify the quality of QC processes as they are completed. The frequency and specific requirements for each task are identified in the ITPs included in the subsequent sections of this document.

The Engineer will perform the tasks listed below within the QA role:

- **Field Reviews:** The Engineer will conduct periodic field reviews of the Constructor's activities.
- **Documentation Reviews:** The Engineer will review the QC documentation prepared by the Constructor.
- **Approval:** The Engineer will review and verify that the works have been completed in accordance with the design intent. The Engineer will summarize required remedial actions or requirements for the Constructor that the Engineer determines are required to meet the design intent.
- **Document:** The Engineer will be responsible for documenting the Engineer's field reviews and for preparing QA reports.

Additional information related to QA documentation requirements is provided Section 4.3.

4.3 DOCUMENTATION

4.3.1 GENERAL

Appropriate documentation of QC and QA activities is a key component of the QC/QA program. Document templates for select QC and QA reporting requirements are provided in Appendix A. Any modifications to these templates by the Constructor are to be submitted to and approved by the Engineer prior to implementation.

Email or direct messaging (e.g. Microsoft Teams, text messaging, etc.) correspondence will generally not be considered an acceptable means of communicating design and construction information between the Owner, Constructor, and Engineer. Formalized communication is to be used to document such correspondences, through succinct revisions to relevant design drawing(s), field instructions, design memoranda or submittal responses.

A well-organized document control system of completed Quality Records shall be maintained by the Constructor and must be available for review at the request of the Owner and/or Engineer. An online document management system, such as Fulcrum (or equivalent), shall be used to share Quality Records.

4.3.2 DESIGN DOCUMENTATION DELIVERY

The design of the YDTI prepared by the Engineer will typically be communicated to the Owner and Constructor via the following documents:

- Construction Management Plan (CMP - this document)
- IFC design drawings sealed by the EOR (the Drawings)
- Field instructions (FI)
- Responses to quality documentation
- Design Memoranda

Construction or procurement of any given component of the works will not proceed until an IFC revision of a given detailed design drawing is issued. The work described in FIs and design memoranda will only commence following the issuance of a finalized (not draft) version of the document that is sealed by the Engineer.

4.3.3 QUALITY DOCUMENTATION AND RESPONSIBILITIES

General descriptions of each quality document, the required frequency, and the responsibility of each party is detailed in Table 4.1. Further information on the inspection and testing requirements are provided in the ITPs presented within Sections 5 to 10 of this report.

Table 4.1 Quality Documentation and Responsibilities Summary

Documentation Type	Description and Frequency	Constructor Requirement	Engineer Requirement
Request for Information (RFI)	An RFI is to be prepared by the Owner or Constructor to request design clarification or substitution. RFI's will be prepared on an as-required basis.	Prepare the RFI and submit to the Engineer.	Provide response following receipt of an RFI.
Design Change Request (DCR)	A DCR is prepared to document request for design changes.	DCRs may be written by the Owner or Constructor and submitted to the Engineer.	Prepare a response to the DCR.
Non-Conformance Report (NCR)	An NCR is to be prepared if a final product, material, or construction method is inconsistent with the design or specifications. The NCR shall identify the non-conformance, provide an explanation and if possible, suggest remedial actions. NCRs should be prepared on an as-required basis.	Prepare and submit the NCR to the Engineer.	Prepare response to the NCR which may detail required remedial actions, if any.
Submittals	Submittals are used to verify that procured materials, equipment, test results or construction methods meet the design intent. Submittals shall be prepared on an as-required basis and may include a package of information such as Quality Control testing records or manufacturer information.	Prepare Submittals and submit to the Engineer.	Prepare a response to the submittal that will include approval or outline required amendments.
As-built Survey	As-built surveys are intended to validate and confirm the design specifications are being met. Surveys are to be completed regularly as the construction works progress, or when requested by the Engineer.	Prepare the as-built survey and submit to the Engineer for review.	Engineer to review.
Subgrade Inspection Record (SIR)	SIRs will be prepared following inspection of the subgrade. The SIR will document the conditions of the subgrade and will provide approval for the commencement of fill placement or outline required remedial actions.	Prepare and submit SIR to the Engineer following each inspection.	Review and approve SIR prior to material placement.
Progress Reports	Progress reports will be prepared to document active construction works. The frequency will depend on site activities but may take the form of a Daily Site Report (DSR) or Weekly Progress Report (WPR).	Progress reports may be prepared by the Engineer or Constructor.	
Field Review Record (FRR)	A FRR will be prepared to document any general reviews of construction activities completed by the Engineer. The frequency and timing of field reviews will be dependent on the ongoing construction activities.	N/A	Prepare a FFR following a construction review.

Documentation Type	Description and Frequency	Constructor Requirement	Engineer Requirement
Quality Control Reports	Quality control reports shall be prepared to summarize construction progress and present results of Control and Record testing activities. Report frequency will be determined by the Engineer based on the schedule of construction activities. Relevant quality documentation may be requested by the Engineer during the construction activities to confirm design specifications are being met.	Prepare quality reports to summarize construction progress and present the results of Control and Record testing requirements for each month.	Engineer to review and provide feedback.
Construction Completion Reports	A completion report will be prepared to summarize the construction progress and quality documentation prepared. The report frequency will be determined by the Engineer based on when the construction works are substantially completed and/or on an annual basis. Documents are to be made available to the MDEQ as they become available. An online document management system shall be used to share Construction Completion Reports.	Provide necessary documents to complete reporting.	Prepare the Construction Completion Report(s).

5.0 EARTHWORKS

5.1 DECOMMISSIONING AND SALVAGE

Decommissioning and salvage shall consist of the complete removal of all detritus matter (e.g., historical pipes, construction materials, etc.,). Alignments of existing utilities shall be prepared on the Drawings by the Engineer based on information provided by MR. The Constructor shall remove all existing utilities, detritus matter and construction materials within the extent of the construction footprint prior to fill placement. If utilities or detritus matter are proposed to be left in place, the Constructer shall prepare the appropriate quality documentation submittal for response and approval by the Engineer. The submittal should detail the extent of removal efforts and the description of what is proposed to be left in place.

5.2 SUBGRADE PREPARATION

5.2.1 CLEARING, STRIPPING AND GRUBBING

The Constructor shall clear, strip and grub all natural ground surfaces to the limits as shown on the Drawings. Stripping and grubbing shall consist of the complete removal of all vegetation and organic matter and grubbing to remove all roots and stumps. Unsuitable material such as loose, soft or saturated soil is to be removed if encountered to uncover suitable subgrade for material placement. If portions of a subgrade do not meet specifications and are proposed to be left in place, the appropriate quality documentation is to be used to document the reasons and condition of material left in place (i.e. with an RFI).

5.2.2 ROCKFILL SUBGRADE PREPARATION

Subgrade preparation within the embankment and RDS footprints shall consist of trimming and levelling to a consistent surface suitable for fill material. The subgrade will be cross ripped prior to placing successive lifts and shall be kept clean of any loose debris and material. The subgrade will be inspected and approved by the Constructor or Engineer prior to fill placement.

Subgrade surfaces for rock drains, surface water ditches and water ponds are to be trimmed and shaped to form a uniform grade. Identified soft spots shall be removed by over excavating to a depth of at least 2 ft below the soft material and backfilling with select (particles larger than 24 inches removed) material compacted as per the fill material specifications. Select subgrade material removed during excavation of rock drains may be suitable for future construction use (i.e. Zone U) provided in meets the design specifications.

5.2.3 SLOPING SUBGRADE

Where a steep sloping subgrade is encountered (approximately 1H:1V or steeper), the subgrade shall be stepped or keyed-in by cutting vertical steps into the slope equal in height to the lift thickness of the fill being placed.

5.2.4 BEDROCK SUBGRADE

The bedrock surface shall be scaled using regular excavating equipment where a bedrock subgrade is encountered. Loose, shattered, and disintegrated rock, gravel or other deleterious material shall be removed prior to placing any fill materials.

5.2.5 GEOMEMBRANE AND GEOTEXTILE SUBGRADES

Subgrade preparation requirements for geomembrane and geotextile installations are described in subsequent sections.

5.3 EXCAVATION

The Constructor shall excavate within the lines and grades as shown on the Drawings where excavation is required. The excavation subgrade is to be prepared, inspected and approved by the Engineer prior to fill placement. All standing water, unsuitable materials, and loose, soft, saturated material shall be removed to the satisfaction of the Engineer. The Constructor shall be responsible for the safety, stability, maintenance, support, and protection of all temporary excavated surfaces until the completion of backfill.

5.4 MATERIAL SOURCES AND DESCRIPTIONS

5.4.1 MATERIAL SOURCES

5.4.1.1 MINE DEVELOPMENT MATERIAL SOURCES

Mine development is expected to provide sufficient material to supply the majority of the fill requirements; however, the gradation, durability and chemistry of the mine material is heterogeneous and will require proper planning and scheduling so that the supplied materials meet the specifications. The Constructor shall apply any necessary controls to supply the most appropriate material source for each material type (within the limits of practicability).

The Owner will work with the Engineer to develop mine extraction plans that give due consideration to the quality, quantity, and timing of extraction of materials that are expected to be available for use during YDTI construction. The Constructor shall carry out exploratory material source investigations on stockpiled or in-situ mine development material to characterize the materials where required.

5.4.1.2 EXTERNAL BORROW SOURCES

Pipestone Quarry is the only pre-approved external borrow source. All other proposed external material sources are to be approved by the Engineer prior to use.

The Constructor shall carry out borrow source investigations, test screenings and crushing, and other laboratory testing as required by the Engineer and defined in Table 5.2 to demonstrate the suitability of the external sources. Processed aggregates and pit run rockfill from Pipestone Quarry are to be used for the Zone 2A, 2B, 3A, N material types unless other sources are approved by the Engineer. The approval of any proposed alternative material sources shall be documented in the quality records for each applicable construction phase.

5.4.2 MATERIAL DESCRIPTIONS:

5.4.2.1 EMBANKMENT AND RDS MATERIALS

The construction materials for the embankment and RDS will be primarily sourced from mine development. Descriptions of these materials and their typical construction methods are as follows:

- **Zone U – Rockfill**: U material will be sourced from the Continental Pit and used in various construction areas, including the YDTI embankments, RDS, and general construction areas such as haul ramps and access roads. Zone U is intended to be constructed in a manner that promotes free draining behavior. U rockfill will typically be hauled and end-dumped using the mine haul fleet in specified horizontal lifts. Compaction will generally be completed by routing of the haul fleet traffic. Segregation will occur as the rock is end-dumped from the crest of each lift. The finer particles tend to accumulate near the top of the lift and the cobbles and boulders roll further down the slope and accumulate at the toe.
- **Zone D1 – Rockfill:** D1 material will be sourced from the Continental Pit and is intended to have a lower acid generating potential and a lower permeability (hydraulic conductivity) relative to Zone U material. D1 rockfill will be hauled and end-dumped by the mine haul fleet in specified horizontal lifts prior to spreading and compaction. Compaction requirements will be achieved by the mine haul fleet, or using a vibratory roller as outlined in subsequent sections. D1 rockfill will typically be used to construct the downstream zone of the West Embankment and is intended to act as an impediment to horizontal migration of perched seepage flow towards the downstream face of the embankment so tailings seepage flows are ultimately transferred into the WED.
- **Zone F – Earthfill:** Zone F will be end-dumped by the mine haul fleet and spread by dozer with a specified minimum thickness and target slope angle to construct a separation zone between the tailings and Zone U materials placed along the upstream face of the embankment. Zone F will consist of variable alluvium material and is intended to limit potential for tailings migration into the rockfill during ongoing tailings deposition within the YDTI.
- **Zone D2 – Earthfill**: Zone D2 will be placed to provide a capping layer on the downstream slope of the West Embankment. D2 material will typically consist of non-acid generating alluvium that is spread by dozer.

5.4.2.2 OTHER CONSTRUCTION MATERIALS

Additional construction materials have been used to construct components of the YDTI, specifically for construction of the WED, the Stage 1 HsB Drainage System and during instrumentation installations. These materials will continue to be used during the expansion of the embankment and the RDS drainage systems, and for ongoing protection and management of instrumentation. These materials may be sourced from either pit stripping operations or other approved external borrow sources such as Pipestone Quarry. Materials will be placed, spread, and compacted in controlled lift thicknesses using appropriately sized construction equipment. Typical construction methods for the materials are:

- **Zone 3A – Drain Rock:** Zone 3A comprises competent drainage aggregate placed in drainage systems. 3A material shall be resistant to chemical degradation/decrepitation from acid rock drainage.
- **Zone 2B – Transition:** 2B material is utilized in various elements of the RDS. Zone 2B typically surrounds the 3A material in rock drain construction to reduce potential for migration of finer particles from the overlying filter (Zone 2A) into the drain rock (Zone 3A). 2B material is also used as the erosion resistant material along the base of surface water ditches (SWD).

- **Zone 2A – Filter:** Zone 2A is placed around Zone 2B within rock drains to reduce potential for fines particles migrating into the adjacent Zone 3A materials. 2A material is also utilized as bedding material for pipelines, instrumentation conduits, and geosynthetic material subgrades.
- **Zone UA – Protective Capping:** Zone UA may be constructed to protect drainage features from the impact of large boulders during adjacent rockfill placement.
- **Zone N – Instrumentation Backfill:** Zone N will comprise backfill material for piezometer instrumentations. Additional care is to be taken during material placement to reduce the potential of damage to the instrumentation.

5.4.3 MATERIAL GRADATION SPECIFICATIONS

Fill materials shall meet the gradation specifications as detailed on the Drawings. Fill materials are to be well graded within the specified gradation limits.

5.4.4 ACID GENERATING POTENTIAL

It is expected that all material from the Continental Pit will be Potentially Acid Generating (PAG), with the possible exception of alluvial overburden materials (Zones D1 and D2). The degree of Acid Potential (AP) is expected to vary within different materials sourced from the mine and the Neutralization Potential (NP) is generally expected to be low.

The following specifications are provided regarding the acid generating potential of the fill materials:

- Zone D2 shall comprise of Non-Acid Generating (NAG) alluvium sourced from the mine development alluvium pre-stripping, alluvium stockpiles, or from other local borrow sources (e.g. within the expanding YDTI basin).
- Zone D1 shall comprise materials with a relatively low AP. An understanding of correlation between bench geology within the Continental Pit and AP shall be developed over time and used in planning embankment construction activities. The intent is to utilize the best available geological materials, such as leach capping or other relatively low AP geological units, to facilitate encapsulation of relatively higher AP materials within lower AP materials. Acid Base Accounting (ABA) or an equivalent test method shall be routinely conducted as a quality control test to inform material selection and guide mine planning.

5.4.5 DURABILITY

The following specifications are provided regarding the durability of fill materials:

- Rock drain and surface water ditch materials (Zone 2A, Zone 2B and Zone 3A) are to be durable with a low susceptibility for long term degradation when in prolonged contact with acidic seepage water. Durability testing specifications for these materials will be provided by the Engineer on an as-required basis depending on the borrow source material that is being assessed.

5.5 FILL PLACEMENT

5.5.1 STOCKPILING

The Constructor shall stockpile construction materials in a manner such that excessive segregation will not occur. The stockpile area shall be approved by the Owner prior to stockpiling to delineate areas that will remain clear of haul traffic and to avoid other potential sources of contamination (such as wind-blown dust).

Topsoil and organic materials shall be stockpiled in areas designated by the Owner local to future reclamation areas.

5.5.2 FILL PLACEMENT AND COMPACTION

Fill materials (other than Zone U) shall generally be excavated, transported, placed and spread in a manner such that segregation is avoided. Materials shall contain a broad range of well-graded soils across each specified grain size envelope. Fill materials shall be placed according to the lift thickness and compaction specifications as detailed on the Drawings and in Table 5.1. The Constructor may propose alternative fill or compaction methods and complete test trials for review and approval by the Engineer prior to implementation.

Compaction is to be completed using the mine haul fleet, smooth drum vibratory rollers, or hand guided vibratory plate compactors as outlined in the compaction specifications. Traffic for compaction using the mine haul fleet is to be routed to promote even compaction across each lift. The smooth drum roller shall be equipped with a suitable cleaning device to prevent the accumulation of material on the drum during rolling. A minimum overlap of 1 ft shall be maintained between the surfaces traversed by adjacent passes of the roller drum. The Constructor shall provide the Engineer with the technical specification of the proposed equipment for review and approval prior to purchase or rental of the equipment. The Constructor shall adopt special compaction measures consisting of hand guided vibratory compactors to compact fill in narrow trenches, around pipes, structures and in other confined areas that are not accessible to the larger vibratory roller or haul fleet.

Table 5.1 Material Placement and Compaction Requirements

Zone and Material Type	Placing and Compaction Requirements
Zone F - Upstream Earthfill	Fill material shall consist of alluvium free of loam, tree stumps, roots, and other deleterious or organic matter. The material shall be end-dumped and spread along the upstream slope of each lift to create a continuous zone connecting to the layer along the previous lift. The final fill surface will be shaped by dozers with the surface track compacted during spreading. The material shall contain a broad range of well-graded soils across the specified grain size envelope.
Zone U - Upstream Rockfill	Fill material shall consist of hard, durable, fresh to moderately weathered rockfill material and shall be end dumped in up to 50 ft thick lifts. Fill material will be traffic compacted by the mine haul fleet, equally distributed over the entire layer width. The material shall contain a broad range of well-graded soils across the entire specified grain size envelope. Compacted running surfaces will be cross ripped prior to placing successive lifts.
Zone UA - Protective Cap	Fill material shall consist of hard, durable, and fresh to moderately weathered rockfill and shall be placed and spread in up to 5 ft thick lifts. Fill materials will be dozer compacted. The material shall contain a broad range of well-graded soils across the specified grain size envelope. Compacted running surfaces will be cross ripped prior to placing successive lifts.
Zone D1 - Downstream Rockfill	Fill material shall consist of hard, durable, fresh to moderately weathered rockfill with a relatively low acid generating potential. Fill material shall contain as little potentially acid generating material as practicable. The fill shall be placed in a manner to prevent segregation. Material shall contain a broad range of well-graded soils across the entire specified grain size envelope. Material shall be placed and compacted using one of the following approved methods: (1) Materials shall be placed in maximum 3 ft thick lifts prior to compaction. Fill materials shall be traffic compacted during placement with 40-ton (CAT 740 or similar) haul fleet, equally distributed over the entire layer width, and subsequently compacted using 6 passes of a smooth drum vibratory roller with a drum weight of 12.5 tonnes (13.8 US tons). (2) Materials shall be placed and traffic compacted by the 240 ton (CAT 793D) mine haul fleet in approximately 5 ft thick lifts, with compaction effort equally distributed over the entire layer width. Compacted material lifts may vary by +/- 1 ft throughout the lift area, provided that less than 10% of the lift area exceeds the lift tolerance (i.e. is greater than 6 ft in thickness). Additional method specifications can be considered, including different compaction techniques or lift thicknesses. Any potential revisions to the approved method specifications may require verification by completing a test fill at the direction of the Engineer.
Zone D2 - Downstream Earthfill	Fill material shall consist of non-acid generating alluvium free of loam, tree stumps, roots and other deleterious or organic matter. Material shall be placed and spread in 3 ft thick lifts with 2 passes of the specified smooth drum vibratory roller.
Zone N - Instrumentation Bedding	Fill material shall consist of hard, durable, fresh or non-weathered material. Fill material is to be placed in minimum 1 ft thick lifts with nominal compaction.
Zone 2A - Filter Material	Filter material shall consist of hard, durable, fresh or non-weathered material. Filter material to be placed and spread in maximum 2 ft thick lifts and compacted with 2 passes of the specified smooth drum vibratory roller or as directed by the Engineer.
Zone 2B - Transition Material	Transition material shall consist of hard, durable, fresh or non-weathered material. Transition material to be placed and spread in maximum 2 ft thick lifts and compacted with 2 passes of the specified smooth drum vibratory roller or as directed by the Engineer.
Zone 3A - Drain Rock	Drain rock shall consist of hard, durable, fresh or non-weathered rockfill. Drain rock is to be placed and spread in maximum 3 ft thick lifts and compacted with 2 passes of the specified smooth drum vibratory roller or as directed by the Engineer.

Note(s):

1. Material placement and compaction requirements were adopted from drawing MR-C4011 Rev B. Requirements presented in this table shall be superseded by the most recent revision of design drawing MR-C4011.

5.5.3 FILL PLACEMENT DURING FREEZING CONDITIONS

The Constructor shall place fill materials in freezing conditions only if the materials can be placed and compacted to the densities that would normally be achieved if freezing conditions did not prevail.

The specifications for placing all fill materials (with the exception of U material) during freezing conditions are summarized below.

- Ice and snow and loose frozen fill materials must be removed from compacted fill surfaces or prepared foundations prior to placing any new fill materials.
- Fill materials can be placed on previously placed and compacted frozen fill or approved frozen foundations provided that the surfaces are cleaned as per the above bulleted item.
- Where the previous compacted surface of any layer is too smooth to bond properly with the succeeding layer it shall be scarified or otherwise roughened to provide a bonding surface before the next layer is placed.
- Only thawed fill can be placed. No frozen materials are to be incorporated into fill materials at any time.
- The fill materials must be immediately spread and compacted after placement and before freezing.
- Fill placement and compaction should occur rapidly and in relatively small areas. The exposed surfaces shall be kept to a minimum so as to minimize the potential for fill materials to become frozen before they are compacted.
- Fill materials shall not be placed when it is snowing significantly or when there is accumulation of snow (over 4 inches) or ice on surfaces to be covered by the succeeding layers of fill.

The specifications for placing U material during freezing conditions differ from the specifications for the other material zones due to the placement methodology and large lift thickness. The specifications are summarized below:

- U material may be placed over ripped surfaces that are either frozen or covered with a layer of snow provided that the accumulated loose snow does not exceed 12 inches (1 ft) thickness. Surfaces shall be cleared or allowed to melt prior to fill placement if compact snow or ice is present and/or if loose snow depth exceeds 12 inches (1 ft).

5.5.4 FILL MATERIAL QUALITY CONTROL TESTING

QC laboratory testing shall be carried out on fill material samples to confirm the materials meet the specifications and design intent and to identify potential non-conformances. The testing shall comprise both ‘Control’ and ‘Record’ tests.

Control Tests: Control testing shall be carried out on samples of fill materials sampled from the mine development, borrow areas, stockpiles and/or from the fill after spreading and prior to compaction.

Record Tests: Record testing shall be carried out on samples of fill materials sampled from fill materials compacted in place (i.e. after compaction).

The fill material testing schedule for each material is summarized in Table 5.2. Control and Record testing shall be carried out in accordance with the frequencies and test methods specified. Test frequencies identified may be revised following review of ongoing test results throughout construction. The laboratory test certificates shall be provided to the Engineer for review.

In addition to the QC testing schedule, the Engineer will periodically carry out or direct the Constructor to carry out QA testing on the fill materials to verify the quality in the process by which the materials are being selected and produced. The QA testing shall be undertaken as directed by the Engineer, depending on review of the QC testing results submitted by the Constructor.

Table 5.2 Quality Control Fill Material Testing Schedule

Material Type	Control Test		Record Test	
	C1	C2	R1	R2
	1 PER	1 PER	1 PER	1 PER
Zone F - Upstream Earthfill	20,000 (36,000)	-	-	20,000 (36,000)
Zone U - Upstream Rockfill	400,000 (720,000)	400,000 (720,000)	-	400,000 (720,000)
Zone UA - Protective Cap	4,000 (7,200)	-	-	4,000 (7,200)
Zone D1 - Downstream Rockfill	40,000 (72,000)	40,000 (72,000)	40,000 (72,000)	40,000 (72,000)
Zone D2 - Downstream Earthfill	40,000 (72,000)	40,000 (72,000)	40,000 (72,000)	40,000 (72,000)
Zone N - Instrumentation Bedding	2,000 (3,000)	-	-	2,000 (3,000)
Zone 3A - Drain Rock	4,000 (6,000)	-	-	4,000 (6,000)
Zone 2B - Transition Material	2,000 (3,000)	-	-	2,000 (3,000)
Zone 2A - Filter Material	2,000 (3,000)	-	-	2,000 (3,000)

Test Methods

C1 – Particle Size Distribution using Eyesight Scanner Fragmentation Analyses to ASTM D6913/D7928 and/ or Sieve Analysis testing to ASTM C136/C117.

C2 – Acid Base Accounting (ABA) Acid Production Potential and Neutralization Potential Testing.

R1 – Moisture Content Determination to ASTM D2216.

R2 – Particle Size Distribution using Eyesight Scanner Fragmentation Analyses to ASTM D6913/D7928 and/ or Sieve Analysis testing to ASTM C136/C117.

Note(s):

1. Testing frequency is “1 per” the number of cubic yards (short tons in brackets) of material indicated in the table.
2. The short ton calculations are based on a density of 3,000 lb per cubic yard for Zone N, 3A, 2B, 2A materials; and 3,600 lb per cubic yard for Zone F, U, UA, D1 and D2.
3. Laboratory testing shall be undertaken according to the approved test methods unless written authorization of an alternative test method is provided.
4. A minimum of 1 Control and Record test is to be collected for each component of the drainage systems regardless of material quantities (i.e. smaller surface water ditches).

5.5.5 PROTECTION AND MAINTENANCE

The Constructor shall maintain any placed fill in a neat and workmanlike condition. The Constructor shall take such steps as are necessary to avoid ponding of water on the fill or contamination of the fill by traffic

or other causes. Outside of stockpile areas, the placed fill shall be kept free from garbage, rejected or unsuitable fill, or waste materials.

The Constructor shall do whatever is necessary to prevent surface runoff or water from any other source from eroding fill materials placed for the work and shall immediately repair any damage resulting from such erosion. Any repairs shall be carried out using the same standards for quality and workmanship as defined herein for the portion of the work being repaired.

5.5.6 EARTHWORKS AS-BUILT SURVEY

The Constructor shall provide the Owner and Engineer with copies of the as-built records of all placed fill.

The Constructor shall present the as-built survey on as-built drawings in AutoCAD .dwg file format, complete with X, Y, and Z coordinates (northing, easting and elevation). The as-built drawing shall contain at a minimum:

- Fill levels at 50-ft chainage points shown (toes and crests)
- Fill zone boundaries at 50-ft chainage points
- Final excavated surfaces, including shoulders and toes
- Final clearing and stripping and grubbing limits
- Top of pipe surveys for all installed pipes
- All buried services, instrumentation, etc.
- Investigation locations.
- Haul road locations.

The as-built data shall be collected by a combination of ground survey and remote sensing (such as LiDAR, satellite terrain survey). As-built survey frequency will be dependent on the ongoing construction activities and may be requested by the Engineer. Survey of the embankment, supernatant pond bathymetry, and beach shall be completed annually (at minimum) and combined to create a composite map of the facility.

5.6 EARTHWORKS INSPECTION AND TEST PLAN

The ITP detailed in Table 5.3 identifies the frequency and type of inspection, testing and documentation for the Earthworks components of the project.

Table 5.3 Earthworks Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point Requirement
Decommissioning and salvage	Minimum weekly Constructor Inspection.	None	Constructor to prepare Submittal to seek approval for any infrastructure to remain in place. Engineer to review Submittals and provide response.	None
Clearing, Stripping and Grubbing	Minimum weekly Constructor Inspection.	None	None	None
Subgrade Preparation	Minimum weekly Constructor Inspection. Engineer inspection of prepared subgrade[1]	Proof rolling to the satisfaction of the Engineer.	Constructor to prepare SIR for Engineers approval. Constructor to prepare survey of limits of completed area.	Constructor to Hold for Engineer Approval
Selection of External Borrow Sources	The Constructor and the Engineer will complete an analysis of the borrow sources.	Constructor to complete laboratory testing at the direction of the Engineer to assess the suitability of the borrow sources.	Constructor to prepare a Submittal comprising laboratory test results. Engineer to prepare an approval response to the Submittal.	Constructor to Hold for Engineer response to Submittal prior to production of engineered fills.
Fill Placement – Zone U, UA, D1, F D2, 2A, 2B, 3A, and R1/R2	Daily Constructor inspection. Remote monitoring and minimum quarterly Engineer Field Review.	QC material testing by Constructor as per Table 5.2. QC material testing schedule.	Constructor to prepare WPR to document construction progress and fill placement. Constructor to prepare Monthly Submittal of QC documents and as-built surveys. Engineer to review submittals and provide feedback if required. Engineer to prepare FRR (if required).	None
Stockpiled Materials	Daily Constructor Inspection	QC material testing by Constructor as per Table 5.2. QC material testing schedule.	Constructor to collate Control laboratory tests and provide results to Engineer for review.	None
Construction during adverse conditions (frozen fill, excessive snow or rain etc.)	Daily Constructor Inspection	None	Constructor to summarize conditions and construction observations in WPR.	None

Note(s):

1. If the Engineer is not available on site at the time of the required subgrade inspection, an Owner or Constructor representative may be nominated to complete a proxy inspection of the area at the direction of the Engineer.

5.7 CONSTRUCTION TOLERANCES

The Constructor shall prepare the foundations and excavated slopes and construct the various embankment fill zones to the lines and grades as shown on the Drawings, within the tolerances specified in Table 5.4.

Table 5.4 Earthworks Construction Tolerances

Description	Maximum Permissible Deviation	
	Horizontal Line[1]	Vertical Grade[2]
Rock drain subgrade	± 24 inches	± 4 inches
Excavation slopes	± 24 inches	± 24 inches
Fill slopes	± 24 inches	-
Embankment crest	± 24 inches	+ 24 inches - 0 inches
Zone U, Zone D1	± 24 inches	+ 24 inches - 0 inches
Zone D2, Zone F	± 24 inches	+ 12 inches - 0 inches
Surface water ditch subgrade[1]	± 24 inches	± 4 inches
Zone 2A, 2B and Zone 3A	± 24 inches	+ 12 inches - 3 inches

Note(s):

1. The maximum permissible line deviation is an allowance for total deviation of the individual lines in the design (i.e. Centerline, crest line) provided the measurements of the sections meet the minimum specifications provided on the drawings.
2. The maximum permissible deviation for grade is an allowance for undulations at any point along the design line.

5.8 CONSTRUCTION DEWATERING

The Constructor shall provide, maintain, and operate any temporary drainage and/or pumping facilities required to control ground and surface water to keep excavations, construction and work areas dry and in a stable condition. The dewatering operations shall be accomplished in a manner that will not adversely affect the stability of the excavated slopes and will not cause erosion and softening of adjacent materials.

The discharge from any dewatering system shall be directed to existing drainage systems, appropriate sediment control facilities or to the YDTI in a manner which will not cause sediment discharge to the environment.

The Constructor shall be responsible for erosion protection and prevention of water pollution during the work.

6.0 GEOTEXTILE

6.1 SCOPE OF WORK

The portion of work specified in this section shall consist of supplying all labor, supervision, equipment and materials necessary to install and protect the geotextile materials as shown on the Drawings, or as required by the Engineer. Manufacturer specifications for the geotextile products are to be reviewed in conjunction with this report.

6.2 SUBMITTALS

A copy of the manufacturer's geotextile specification and technical documentation shall be submitted to the Engineer for approval prior to procurement.

Copies of the manufacturer's QC certificates for the product shall be submitted to the Engineer prior to installation of the product. The quality control certificates shall include roll numbers and identification, results of the quality control tests and descriptions of the test methods used.

6.3 DELIVERY, HANDLING AND STORAGE OF GEOTEXTILES

Delivery, handling and storage of geotextile material shall be in accordance with the manufacturer's instructions. Geotextile shall be packaged and shipped in standard roll lengths and widths. The geosynthetics shall be kept free of dirt, solvents, debris, rodents, and other conditions that, in the opinion of the Engineer, would affect the performance of the materials. The manufacturer's label must remain intact until the time of installation.

Geotextiles shall be kept dry and wrapped such that it is protected from the elements during shipping and storage. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding 14 days. The geotextile shall be labelled as per ASTM D4873.

6.4 GEOTEXTILE SPECIFICATION

Geotextile material shall be non-woven needle punched material that meets the test methods and specifications defined in Table 6.1. Geotextile specifications may be revised by the Engineer on the Drawings based on the application.

Table 6.1 Geotextile Specifications

Tested Property	Test Method	Minimum Average Value
Weight	ASTM D3776	300 gm/m^2 (0.03 oz/yd^2)
Grab Strength	ASTM D4632	1,112 N (250 lbs)
Elongation at Break	ASTM D4632	50%
Apparent Opening Size	ASTM D4751	150 Micron
Puncture	ASTM D6241	535 N (120 lbs)
Trapezoidal Tear Strength	ASTM D4533	445 N (100 lbs)
UV Resistance (at 500 hours)	ASTM D7238	70% Strength Retained

Geotextile shall consist of a material composed of at least 85 percent by weight of polyolefins, polyesters, or polyamides. It will be resistant to chemical attack, rot and mildew, and will have no tears or defects, which adversely alter its physical properties. Any deviations in supplier specifications and above specifications are to be approved by the Engineer through a formal geosynthetics approval document.

6.5 GEOTEXTILE SUBGRADE PREPARATION

The surface of any area which shall be lined with geotextile materials shall be trimmed and dressed to form a surface which is firm, dry, smooth, and free from sharp rock fragments which could puncture or damage the geotextile products.

All finished prepared subgrade surfaces on which geosynthetics are to be placed shall be rolled with a smooth drum roller to bed gravel particles into the soil matrix. Bucket compaction via excavator may be applied in areas where roller compaction is not possible and will be subject to Engineer approval. This typically occurs along drain and ditch side slopes. The subgrade is to be inspected and approved by the Engineer prior to the placement of any geosynthetics as per the Geotextiles ITP (Table 6.2). Surfaces not in compliance with the specifications shall be rectified by the Constructor.

6.6 INSTALLATION PROCEDURES

The geotextile shall be handled in such a manner that it is not damaged during transport and installation.

The geotextile shall be laid flat and smooth on the prepared subgrade so that it is in direct contact with the subgrade. The geotextile shall be free of tensile stresses, folds and wrinkles so that the overlying materials will not excessively stretch or tear the fabric. On slopes steeper than 10H:1V, the geotextile shall be laid with the machine direction of the fabric parallel to the slope direction. Anchoring of the terminal ends of the geotextile shall be accomplished through the use of key trenches or aprons at the crest and toe of the slope as outlined in the Drawings.

Successive and adjacent sheets shall be overlapped a minimum of 12 inches in such a manner that the upslope sheet overlaps the downslope sheet (i.e., in a roof tile effect). The overlying material placement shall begin at the toe and proceed up the slope. The overlaps shall be heat bonded or ballasted with rockfill material immediately after installation to protect against uplift. Where the overlaps are heat bonded, ballast material shall be applied to the installed geotextile.

The geotextile shall be covered as soon as possible after installation and inspection. Installed geotextile shall not be left exposed for more than 7 days. Material overlying the geotextile shall be carefully placed to avoid wrinkling or damage to the geotextile.

Manufacturer specifications for the geosynthetic products are to be reviewed in conjunction with this report.

6.7 AS-BUILT SURVEY

The Constructor shall present the as-built survey in AutoCAD .dwg file format, complete with X, Y, and Z coordinates (northing, easting and elevation) detailing the locations and limits of the installed geotextile.

6.8 GEOTEXTILE INSPECTION AND TEST PLAN

The ITP detailed in Table 6.2 identifies the frequency and type of inspection, testing and documentation for the geotextile procurement and installation.

Table 6.2 Geotextile Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point Requirement
Procurement	Constructor inspection following receipt of product.	None	Constructor to prepare submittal of manufacturer's technical information and QC documentation. Engineer to provide a response to the Constructor submittal.	Constructor to hold procurement and installation of product until approval of submittal by the Engineer.
Subgrade Preparation	Minimum weekly Constructor Inspection. Engineer Approval of prepared subgrade[1]	Proof rolling to the satisfaction of the Engineer.	Constructor to prepare SIR for Engineers approval. Constructor to prepare survey of limits of completed area.	Constructor to Hold for Engineer Approval.
Installation	Daily Constructor Inspection. Remote monitoring and daily to monthly Field Reviews by the Engineer[1]	None	Constructor to provide geotextile QC documentation. Engineer to QC documentation in construction completion report.	None

Note(s):

1. The engineer will prepare field review documentation to record observations during geotextile installation. If the Engineer is not available on site at the time of installation, an Owner or Constructor representative may be nominated to complete a proxy inspection of the installation at the direction of the Engineer.

7.0 GEOMEMBRANE LINERS

7.1 SCOPE OF WORK

The portion of work specified in this section shall consist of supplying all labor, supervision, equipment and materials necessary to install and protect the high-density polyethylene (HDPE) geomembrane materials as shown on the Drawings, or as required by the Engineer. Manufacturer specifications for the geosynthetic products are to be reviewed in conjunction with this report.

7.2 SUBMITTALS

A copy of the manufacturer's geomembrane specification and technical documentation shall be submitted to the Engineer for approval prior to procurement.

Copies of the manufacturer's QAQC installation manual and certificates shall be submitted to the Engineer prior to installation of the product. The quality control certificates shall include roll numbers and identification, manufacture dates, results of the quality control tests and descriptions of the test methods used. The QC tests shall be undertaken on samples taken from the rolls proposed for the works and include all test methods listed in Table 7.1.

The Constructor shall submit a proposed panel layout drawing for HDPE geomembrane deployment for review and approval by the Engineer prior to commencing installation.

7.3 GEOMEMBRANE QUALIFICATIONS

Installation of the geomembrane is to be undertaken by an approved specialist Constructor who is responsible for the field handling, transporting, storing, deploying, seaming and testing of the geomembrane seams.

The Constructor shall have completed a minimum of 1,000,000 square feet of HDPE flexible lining material installation. A project Superintendent or Installation Supervisor shall be provided by the Geosynthetics Constructor and shall be in charge of the installation.

7.4 DELIVERY, HANDLING AND STORAGE OF GEOMEMBRANE

Delivery, handling and storage of geomembrane material shall be in accordance with the manufacturer's instructions. Geomembrane shall be packaged and shipped in standard roll lengths and widths.

The geosynthetics shall be kept free of dirt, solvents, debris, rodents, and other conditions that, in the opinion of the Engineer, would affect the performance of the materials. The manufacturer's label must remain intact until the time of installation. The geomembrane shall be labelled in accordance with ASTM D4873.

7.5 GEOMEMBRANE SPECIFICATION

The geomembrane liner shall be of high-quality formulation, containing approximately 97% polymer and 3% carbon black with anti-oxidants and heat stabilizers. It shall be resistant to ultraviolet rays. The geomembrane shall be an HDPE material manufactured of new, first-quality products designed and

manufactured specifically for the purpose of liquid containment in hydraulic structures. The finished material shall be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.

HDPE geomembrane materials shall meet or exceed the test methods and specifications presented in Table 7.1. Geomembrane specifications may be revised by the Engineer on the Drawings based on the application.

Table 7.1 HDPE Geomembrane Specifications

Tested Property	Test Method	Minimum Average Value
Thickness	ASTM D5199	80 mil (2.0 mm)
Density	ASTM D792	0.940 g/cm^3
Tensile Strength at Break	ASTM D6693	57 N/mm (327 lbs/in-width)
Elongation at Break	ASTM D6693	700%
Tear Resistance	ASTM D1004	257 N (58 lb)
Puncture Resistance	ASTM D4833	711 N (160 lbs)
Stress Crack Resistance	ASTM D5397	1000 hr
Carbon Black Content	ASTM D4218	2-3%
Carbon Black Dispersion	ASTM D5996	100% Cat 1
Oxidative Induction Time (OIT): (a) Standard OIT (b) High Pressure OIT	 ASTM D8117 ASTM D5885	 100 (min) 400 (min)
Oven Aging at 85°C (a) Standard OIT (b) High Pressure OIT	 ASTM D5721 ASTM D8117 ASTM D5885	 55 (% retained after 90 days) 80 (% retained after 90 days)
UV Resistance: (a) High Pressure OIT	 ASTM D7238 ASTM D5885	 50 (% retained after 1600 hrs)

The manufacturer of the geomembrane shall take random samples of the geomembrane material from each fabricated roll during manufacture. Samples shall be tested by a qualified laboratory by methods specified above. The test results shall be supplied to the Engineer and the rolls of material shall be clearly identified and correlate to the test results provided.

Product data sheets shall be formally submitted to the Engineer for review and approval prior to procurement of the geomembrane liner.

7.6 GEOMEMBRANE SUBGRADE PREPARATION

Subgrade preparation to be completed as per Section 6.5.

7.7 INSTALLATION PROCEDURES

7.7.1 MATERIAL HANDLING

The geomembrane shall be installed on the areas shown on the Drawings or as directed by the Engineer. The geomembrane shall be handled in such a manner that it is not damaged during transport and installation. Loading, unloading and storage of geomembrane shall follow manufacturer's procedure. Prior to deployment of geomembrane, the Constructor shall inspect, certify and accept, with the Engineer, all

surfaces on which the geomembrane is to be placed. Surfaces not in compliance with the specifications shall be rectified by the Constructor.

7.7.2 GEOMEMBRANE PLACEMENT AND SEAM WELDING

The geomembrane shall be placed in accordance with the manufacturer's instructions and as per the approved panel layout. The Constructor shall provide adequate temporary anchoring devices to prevent damage due to winds. The liner shall be installed in a relaxed condition and shall be free of tension or stress upon completion of the installation. All necessary precautions, including provisions for installing extra material, shall be taken to avoid trampolining of any liner which will remain exposed.

Horizontal field seams on slopes steeper than 10H:1V are not permitted. Seams shall be made by lapping the uphill material over the downhill material with sufficient overlap. A minimum of three feet is required from the toe of the slope to any horizontal seam on flat areas.

Care shall be taken by the Constructor in the preparation of the areas to be welded. The area to be welded shall be cleaned and prepared prior to welding. All sheeting shall be joined using dual-track fusion welding processes with repairs completed using extrusion welding.

The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material so that changes in weather conditions will not affect the integrity of the weld. Welding equipment and accessories shall meet the following requirements:

- Gauges showing temperatures in apparatus such as extrusion welder or fusion welder shall be present.
- Power source must be capable of providing constant voltage under combined line load.

No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped, and extrusion welded. All welds on completion of the Work shall be tightly bonded. Any membrane area showing distress due to excessive scuffing or puncture from any cause shall be replaced or repaired.

The Constructor shall consider the possibility of rapid weather changes which could resulting in delays in construction of field seams. Jointing of panels and repairs will only be permitted under weather conditions allowing such work within the warranty limits imposed by the liner manufacturer.

No geomembrane material shall be seamed when the liner temperature is less than 32 degrees Fahrenheit (F) unless the following conditions are met:

- The Constructor can demonstrate using prequalification test seams that field seams comply with the project specifications, the safety of the crew is ensured, and geomembrane material can be fabricated (i.e. pipe boots, penetrations, repairs, etc.) at sub-freezing temperatures.
- The Constructor shall submit to the Engineer for approval detailed procedures for seaming at low temperatures including the following:
  - Preheating of the geomembrane.
  - The provision of a tent or other shelter if necessary to prevent heat losses during seaming and rapid heat losses subsequent to seaming.
  - Number of test welds to determine appropriate seaming parameters.

No geomembrane material shall be seamed when the liner temperature is above 170 degrees F as measured by an infrared thermometer or surface thermocouple, unless otherwise approved by the Engineer.

7.8 AS-BUILT SURVEY

The Constructor shall present the as-built survey in AutoCAD .dwg file format, complete with X, Y, and Z coordinates (northing, easting and elevation) detailing the locations of the installed geomembrane. The Constructor shall also submit an installed panel layout drawing for HDPE geomembrane to the Engineer following completion of the installation.

7.9 GEOMEMBRANE INSPECTION AND TEST PLAN

7.9.1 GENERAL

All seams completed in the field, patches and extrusions shall be inspected, tested, and recorded. A Constructor quality control technician shall inspect each seam, marking their initials and the date inspected at the end of each panel. Any area showing a defect shall be marked and repaired in accordance with the geomembrane repair procedure described in Section 7.10.

All field sampling and testing shall be completed by the Constructor with QC documentation reviewed by the Engineer.

The field installation testing program shall consist of periodic visual observations, continuity, and strength tests. These inspections and tests are to be made routinely and are automatic regardless of other types of testing required. The program shall include:

- Visual observations:
  - Visually check field seams for squeeze out, footprint, melt and overlap.
  - Check machines for cleanliness, temperature and related items.
  - Any area of the seam or panel showing a defect shall be marked and repaired in accordance with the applicable repair procedures.

Non-destructive testing is required for all field seams and repaired areas. Inter-seam pressure or “air testing” and testing using vacuum box are considered acceptable methods.

- The test procedures for inter-seam pressure or air testing are as follows:
  - Insert a pressure gauge/needle assembly into the end of the seam and seal.
  - Apply air pressure to the void between the two seams according to the following schedule in Table 7.2.

Table 7.2 HDPE Geomembrane Air Channel Seam Testing Requirements

HDPE Initial Pressure Schedule			
Material HDPE Thickness	Pressure Range (psi)		Allowable leak down after 5 minutes (psi)
	Minimum	Maximum	
80mil	28	30	4

- The initial start pressure is read after a 1-minute relaxing period, which allows the air to reach ambient liner temperature; the ending pressure is read after 3 minutes.
- The results of the leak test shall be marked at the test location and shall be recorded by the Constructor. If the test fails, the location of the leak shall be found and repaired or the entire seam shall be repaired and retested.

- The test procedures for vacuum box testing are as follows:
  - Mix a solution of liquid detergent and water and apply an ample amount to the area to be tested. If a seam contains excess overlap or loose edges it is to be trimmed before testing.
  - Place a translucent vacuum box over the area and apply a slight amount of downward pressure to the box to the seal strip to the liner.
  - Apply a vacuum (3 psi to 5 psi) to the area. The location of any leaks will become evident by bubbles and liner defects shall then be repaired.

The ITP detailed in Table 7.3 summarizes the frequency and type of inspection, testing and documentation for the Geomembrane procurement and installation.

Table 7.3 Geomembrane Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point Requirement
Procurement	Constructor inspection following receipt of product	None	Constructor to prepare submittal of manufacturers technical information and QC documentation. Engineer to provide a response to the Constructor submittal.	Constructor to hold procurement of product until approval of submittals by the Engineer.
Geomembrane Subgrade Preparation	Minimum twice weekly Constructor Inspection. Engineer approval of prepared subgrade[1].	None	Constructor to prepare SIR for Engineers approval. Constructor to prepare survey of limits of subgrade area.	Constructor to Hold for Engineer Approval.
Installation	Daily Constructor Inspection	Testing as per Section 7.	All tests to be documented and results recorded and submitted to the Engineer for review. Constructor to prepare Progress Reports and submittal of QC documents. Engineer to review submittals and Progress Reports. Engineer to prepare Progress Report or FRR if present at the time of installation.	N/A
Seam Welding	Review by Engineer[1]	Visually check seams for: squeeze out, footprints, melting, and overlap as listed in Section 7. Inspect machines for cleanliness, temperature and related items	All seams shall be inspected by Constructor quality control technician, marking initials and date of inspection. Any area showing defect shall be repaired according to repair procedures listed in Section 10.	N/A
Non-Destructive and Destructive Testing	Review by Engineer[1]	Field testing to be completed according to manufacturer's procedures by the Constructor and as listed in Section 7.8	Proof of testing and QC results to be supplied to the Engineer.	N/A

Note(s):

1. If the Engineer is not available on site at the time of installation, an Owner or Constructor representative may be nominated to complete a proxy review of the installation at the direction of the Engineer.

7.9.2 STRENGTH TESTING

Trial welds shall be completed under the same conditions and using the same materials, pre-seaming and seaming techniques as used to fabricate field seams. The trial weld samples shall be a minimum of 3 ft long by 1 ft wide, marked with the date, technician's name, ambient temperature and welding machine number and temperature. Two (2) coupons from each end of the test weld (4 coupons in total) shall be tested for peel and bonded seam strength using a calibrated tensiometer, in accordance with the applicable ASTM or Geosynthetic Research Institute (GRI) standards, as appropriate. Trial weld specimens shall be evaluated in accordance with the following:

- Shear test specimen for both fusion and extrusion welds shall, at a minimum, meet strength of 95% of the tensile yield strength of the HDPE liner, as specified in Table 7.1.
- Both tracks of dual-track fusion welds shall be tested for peel adhesion. If either track fails, the test specimen is considered to have failed.
- Peel strength of fusion welds to meet 65% of the tensile yield strength of the HDPE liner, as specified in Table 7.1.
- Peel strength of extrusion welds to meet 60% of the tensile yield strength of the HDPE liner.

If one or more coupons fail the specimen will be considered a failure. Each coupon must fail in the parent material and not in the weld. Seam separation equal to or greater than 25% of the track width shall be considered a failing test.

If failing test results occur, an additional trial weld shall be immediately conducted. If the additional trial weld fails, then the welding machine shall be rejected and not used until the deficiencies are corrected and a successful test seam can be produced.

The minimum frequency for obtaining trial weld samples from each of the welding machines in operation is the following:

- Prior to the beginning of seaming operations
- After every four hours of seaming operation
- After repairs have been made to the seaming equipment
- By each technician using the seaming equipment
- As required by the Engineer

For destructive testing of field seams the following procedures are to be used:

- Destructive samples may be obtained from field seams or repaired areas by cutting perpendicular to the seams. The sample should be approximately 2 ft long by 1 ft wide. This sample shall be cut into two samples of 1 ft by 1 ft and labeled with the welder identification, date and location. One of the samples will be retained by the Engineer and one of the samples will be tested by the Constructor, using a calibrated tensiometer, in accordance with the applicable ASTM or NSF 54 standards as appropriate.
- The frequency for obtaining destructive test samples shall not be less than one sample per 500 ft of field seams. Coupons from the destructive sample shall be tested for peel and bonded seam strength, in accordance with ASTM D6392. If one or more of the coupons fails, the sample will be considered a failure. Destructive test samples shall be assessed using the same requirements as specified for trial welds.

- In the event of a failing test result, additional samples, on either side of the failure, shall be tested to isolate the portion of the weld that shall be “capped”. Alternatively, the entire seam can be re-welded and retested.

7.10 GEOMEMBRANE REPAIR PROCEDURE

The Constructor shall be responsible to repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test.

Before completion of any repairs an agreement upon the appropriate repair method shall be decided between the Engineer and the Constructor. The following repair methods may be implemented:

1. Patching: Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
2. Abrading and Re-welding: Used to repair short section of a seam.
3. Spot Welding: Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.
4. Capping: Used to repair long lengths of failed seams.
5. Remove the unacceptable seam and replace with new material.
6. The following procedures shall be observed when a repair method is used:
7. All geomembrane surfaces shall be clean and dry at the time of repair.
8. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
9. Extend patches or caps at least 6 inches for extrusion welds and 4 inches for wedge welds beyond the edge of the defect, and around all corners of patch material.

Upon completion the quality of the repair is to be logged and verified by the Constructor using non-destructive testing methods outlined in the Specifications.

8.0 CONCRETE

8.1 SCOPE OF WORK

The portion of the work described in this section will consist of the construction of the concrete components of the work as shown on the Drawings. Specific details relating to the individual concrete components will be included on the applicable Drawings and are to be reviewed along with this document prior to any concrete placement.

8.2 APPLICABLE SPECIFICATIONS AND REGULATIONS

All materials procured by the Constructor shall be new or otherwise approved by the Engineer prior to installation. New and/or materials already existing on site are subject to approval by the Engineer prior to procurement. They shall comply with the latest applicable publications for concrete components including, but not limited to, the following:

- American Concrete Institute (ACI) 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
- ACI 305.1 - Specification for Hot Weather Concreting
- ACI 306.1 - Guide to Cold Weather Concreting
- ACI 308.1 - Specification for Curing of Concrete
- ACI 309R - Guide for Consolidation of Concrete, and
- ACI 315 - Details and Detailing of Concrete Reinforcement.
- ACI 347 – Guide to Formwork for Concrete
- ASTM A615 – Standard Specification for Deformed and Plan Carbon-Steel Bars for Concrete Reinforcement

8.3 CONCRETE FORMWORK AND FALSEWORK

Design and engineering of formwork, shoring and falsework is the responsibility of the Constructor. A qualified Professional Engineer or approved designer must be retained to provide complete designs, drawings and instructions for forms, falsework, shoring, and re-shoring for the project.

Formed surface finishes are to be detailed on the specific concrete Drawings. All concrete corners (exposed or un-exposed) shall have a 1-inch chamfer formed from a 1 x 1-inch triangular timber strip, unless specified otherwise on the Drawings.

Formwork should not be removed until the concrete has attained sufficient strength to prevent damage by removal of the forms or by subsequent construction activities and associated loads, such as nearby backfilling and compaction. Formwork for foundations are not to be removed for a minimum of 48 hours after placing concrete.

Formwork inspections are not considered hold points of the design and remain the responsibility of the Constructor; however, the Engineer may inspect forms prior to placing concrete solely for the purpose of reviewing cleanliness, and for general conformance with the Drawings, as outlined in Table 8.1. Such inspection will not relieve the Constructor of the responsibility to construct and erect forms safely.

8.4 CONCRETE STEEL REINFORCEMENT

The Constructor shall be responsible for correctness of measured dimensions and report to the Engineer, in writing, all discrepancies between measurements and those shown on the Drawings prior to commencing Work. Detailing of reinforcement, such as bar size and spacing, minimum concrete to reinforcement cover, splice and lap length, and embedment depth, will be included on specific reinforcement and structural drawings. Special requirements, such as accommodation of inserts, blockouts, conduits and openings will be detailed on the Drawings. The Constructor is to provide the Engineer with reinforcement shop drawings, if requested, to allow review and approval prior to the procurement. The Constructor is to confirm with the Engineer whether a shop drawing review is required prior to placement

The Engineer's approval of the installed reinforcement must be obtained before placing concrete, with all reinforcement steel in place for the section of work being constructed, as outlined in Table 8.1.

8.5 CAST-IN-PLACE CONCRETE

The Constructor is to submit a copy of the proposed concrete mix design(s) to the Engineer, if requested, before any concrete is placed on site. The minimum compressive strength shall be as specified on the Drawings. The Constructor shall appoint a quality control officer and/or independent testing agent, who will carry out the quality control and assurance testing as outlined in the design Drawings or technical specification. Concrete placement, finishing, tolerances, curing, and repair procedures will be outlined on the Drawings or accompanying technical specifications.

The Engineer's approval shall be obtained for the correctness of all reinforcement and formwork (as it relates to the overall dimensions and cover) before placing concrete, as outlined in Table 8.1. All reinforcement steel must be in place for the section of work being constructed prior to the Engineer review. Incomplete work will not be accepted for placing concrete.

8.6 AS-BUILT SURVEY

The Constructor shall present the as-built survey of all concrete components in AutoCAD .dwg file format, complete with X, Y, and Z coordinates (northing, easting and elevation). The as-built survey shall contain the location and alignment of all concrete structures, including both the base and top surfaces of the structure. As-built survey is to document any deficiencies such as cracking or honeycombs. As-built survey frequency will be dependent on the ongoing construction activities and may be requested by the Engineer.

8.7 CONCRETE INSPECTION AND TEST PLAN

The ITP detailed in Table 8.1 identifies the frequency and type of inspection, testing and documentation for the concrete construction. Specific inspection and testing requirements will be included on the Drawings and/or in further revisions of this document.

Table 8.1 Concrete Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point requirement
Reinforcement Procurement	Constructor inspection following receipt of product.	None	Shop drawing review by Engineer if requested.	None
Subgrade Preparation	As per Earthworks Inspection and Testing Plan.			
Reinforcement and Formwork Placement	Engineer Field Review of reinforcement as per Section 8.4[1].	None	Engineer to prepare FRR detailing the reinforcement installation.	Constructor to Hold for Engineer Approval.
Concrete Pour	Engineer Field Review of concrete unless alternate instruction given during review of reinforcement[1].	Concrete testing requirements to be defined on Drawings as required. Testing to be completed by the Constructor.	Constructor to prepare Submittal of concrete suppliers QC documents. Engineer to provide a response to the Constructor's submittal Engineer to prepare FRR (if required).	Constructor to Hold for Engineer Approval unless alternate instruction given during review of reinforcement[1].

Note(s):

1. If the Engineer is not available on site, an Owner or Constructor representative may be nominated to complete a proxy review of the area at the direction of the Engineer. Proof of the review, if carried out by Others including concrete records and photographs, shall be submitted as part of the quality documentation.

9.0 PIPEWORKS AND APPURTENANCES

9.1 SCOPE OF WORK

The portion of the work described in this section consists of the procurement, installation, inspection and testing of all equipment and materials necessary to install the pipework and appurtenances as shown on the Drawings including the supply and install of all pipeworks, fittings, pumps, motors, and instrumentation including flow meters, pressure transducers and air valves.

9.2 APPLICABLE SPECIFICATIONS AND REGULATIONS

All materials procured by the Constructor shall be new or otherwise approved by the Engineer prior to installation. New or materials already existing on site are subject to approval by the Engineer prior to procurement. They shall comply with the latest applicable standards for pipeworks as outlined on the Drawings which may include, but are not limited to, the following:

- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)

Any contradictions between standards shall be submitted to the Engineer for decision.

9.3 SUBMITTALS

The Constructor shall submit to the Engineer copies of the manufacturer's catalogues prior to procurement of the pipework and appurtenances. Manufacturer documentation shall include material specifications, performance data, dimensions, pressure ratings, storage and handling requirements, installation procedures, inspection and test plans, operation and maintenance manuals, where applicable.

9.4 DELIVERY, HANDLING AND STORAGE

Pipe, pumps, fittings, valves and other appurtenances shall be loaded and unloaded as specified by manufacture guidelines. Necessary storage requirements outlined within manufacturer documentation shall be followed unless otherwise specified.

9.5 PIPE & FITTINGS SPECIFICATIONS

Locations and specifications for HDPE and steel pipelines and fittings will be provided on the Drawings or in technical specifications. This will include installation lines and grades, joining methods, construction tolerances and specific inspection and testing requirements.

9.6 OTHER APPURTENANCES

The Drawings and accompanying performance specifications will outline the locations and specifications for other appurtenances, which may include but are not limited to:

- Pumps and motors
- Control and isolation valves
- Combination air valves
- Instrumentation components

9.7 AS-BUILT SURVEY

The Constructor shall present the as-built survey in AutoCAD .dwg file format, complete with X, Y, and Z coordinates (northing, easting and elevation). The as-built survey shall contain at a minimum:

- Pipeline alignment and locations
- Locations of valves, drains, pipe bends, etc., if applicable
- Pipeline and sump locations, including inverts for each

9.8 PIPEWORKS AND APPURTENANCES INSPECTION AND TEST PLAN

The ITP detailed in Table 9.1 identifies the general frequency and type of inspection, testing and documentation for the pipeworks and appurtenances procurement, installation, and commissioning. Specific inspection and testing requirements will be included on the Drawings or further revisions of this document.

Table 9.1 Pipeworks and Appurtenances Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point Requirement
Procurement	Constructor inspection following receipt of product.	None	Constructor to prepare submittal of manufacturer's technical information and QC documentation. Engineer to provide a response approving the product.	Constructor to hold procurement of product until approval of submittal by the Engineer.
Pipework Installation and Commissioning	Daily Constructor Inspection. Daily to monthly Engineer Field Review (see note 1).	QC testing by the Constructor as per the Drawings.	Constructor to prepare Submittal of QC documents. Constructor to prepare as-built survey of installed pipeworks. Engineer to review submittals and document in the QA report.	None
Pump Installation and Commissioning	Daily Constructor Inspection. Daily to monthly Engineer Inspection (see note 1).	Commissioning and testing as per manufacturer's instructions.	Constructor to prepare as-built survey of completed installations.	None

Note(s):

1. Field reviews during construction will be completed by the Engineer as required depending on the level of on-going construction.

10.0 GEOTECHNICAL PERFORMANCE MONITORING

10.1 GENERAL

Evaluation of YDTI performance during ongoing construction will rely on monitoring and assessment of data provided by in-situ geotechnical instrumentation and remote sensing techniques. The pre-existing dam safety monitoring programs may be sufficient for monitoring construction influence during some or all construction phases. Supplementary focused construction monitoring programs may be enacted, if needed to adequately monitor pore water pressure and displacements (surface and subsurface), within and in proximity to active construction areas. These programs would be intended to supplement the existing YDTI dam safety monitoring as prescribed in the TOMS Manual (MR/KP, 2023), while construction is active and as influence from construction dissipates following substantial completion of construction. High-level construction monitoring program requirements are summarized herein along with protocols for installation and maintenance of geotechnical instrumentation.

10.2 FOCUSED CONSTRUCTION MONITORING PROGRAM

The scope and objectives of the supplemental focused construction monitoring programs are generally consistent with to those established for EL. 6,450 ft raise construction between approximately June 2021 and March 2023. Components of the construction monitoring program may include:

- **On-site construction supervision** by an MR or KP field engineer with duties including daily and weekly visual inspection, construction progress monitoring, and QA/QC activities.
- **Piezometric monitoring** using pre-defined thresholds and an associated Trigger-Action Response Plan (TARP) for select monitoring instruments beneath and downstream of the construction area(s), which shall be designated as Construction Performance Parameters (CPPs).
- **Embankment and foundation deformation monitoring** completed using at least the following methods with coverage within and in proximity to active construction area(s).
    - Crack mapping and progression monitoring (i.e., new cracking, length/aperture/offset change)
    - Surface displacement monitoring using survey-monuments outfitted with Global Navigation Satellite System (GNSS) receivers or surveyed manually using Differential Global Positioning Survey (DGPS) using a total station.
    - Surface displacement monitoring using inSAR bulletin analyses (completed every 22-days) and phase-based long-term inSAR assessments (completed approximately monthly), while snow-free conditions are present,
    - Periodic review of inclinometer data for assessment of subsurface deformation magnitudes/rates.
    - Periodic review of Geo4Sight data for assessment of subsurface displacement magnitudes/rates.

Minimum monitoring frequencies for each of the above surveillance and monitoring methods will be specified by the Engineer prior to commencement of construction, if a supplemental construction monitoring program is determined to be required. When focused construction monitoring programs are enacted, data shall be analyzed and summarized at least monthly by KP to verify YDTI performance throughout construction. The focused construction monitoring program may be discontinued following substantial completion of construction and once the Engineer is satisfied that conditions can be adequately monitored and reported within the routine dam safety monitoring programs.

10.3 INSTRUMENT INSTALLATION REQUIREMENTS

Installation of additional instrumentation may be required to adequately monitor and assess facility performance during construction and ongoing operations. The following instrumentation installations may be required, at the discretion of the Engineer and as outlined on the Drawings:

Vibrating Wire Piezometers: Nested and or multi-point vibrating wire piezometers installed within drillholes to measure the piezometric pressures within rockfill and foundation materials.

Standpipe Piezometers: Standpipe piezometers installed within drillholes and raised concurrently with construction to measure the piezometric pressures and allow water quality monitoring, if required. Vertical installations should provide a robust installation that is more resistant to rockfill settlement and allows damaged VWP sensors to be replaced without drilling.

Survey-Monuments (GNSS and/or DGPS): Survey-monuments installed to monitor surface displacements within and in proximity to active embankment construction. Monuments may be surveyed using GNSS and/or DGPS methods, at the discretion of the Engineer.

Pin Extensometers: Pin extensometers installed across embankment cracks, should these be observed, to monitor changes in aperture and or vertical offset. Measurements of pin-to-pin distance shall be completed using a survey or measuring tape.

Inclinometers: Inclinometers with VWPs installed within drillholes to allow monitoring of subsurface deformation rates and pore water pressures. These sites may be co-located with survey-monuments to collect settlement and collar wander data at each location.

10.4 SUBMITTALS

The Constructor shall submit to the Engineer one copy of the manufacturer's catalogues prior to procurement of the geotechnical instrumentation. Catalogues are to include detailed information on product specifications, performance data, dimensions and pressure ratings, storage and handling requirements, installation and splicing procedures, name and location of manufacturer's representative, inspection and test plans, operation and maintenance manuals.

10.5 INSTALLATION PROCEDURES

Instrument installation procedures vary depending on the installation type, installation specifications (e.g., depth, sensor placement, consumables used) and based encountered ground conditions. The Engineer will provide detailed installation procedures for each installation (or installation type) prior to commencement of an instrument installation campaign. Any instrumentation installation procedures specified by the Engineer shall be followed by the Constructor unless alternative procedures are approved in writing by the Engineer. The following is a high-level summary of the minimum information to be documented by the Constructor for common instrument installation types (note that these shall be confirmed by the Constructor with the Engineer prior to implementation):

- Location or drillhole ID
- Description of location (e.g., "Crest of East-West Embankment, Section 28+00NW")
- Description of instruments installed (e.g., "Survey-Monument with GNSS Receiver")
- Reference to installation request or document

- Specifications of instruments installed, such as:
  - **VWPs:**
    - Sensor make, model, serial number(s),
    - Full-scale pressure rating(s) and cable length(s),
    - Sensor installation depths,
    - Field zero and open hole readings (date/time, b-units, temperature, barometric pressure)
    - Data logger make, model, and serial number
  - **Inclinometers:**
    - Casing make, model, nominal diameter, and quantity,
    - End cap type (e.g., solid, grout-through cap, anchor, grout-through anchor),
    - A+ groove orientation
    - Instrumentation make, model, and serial number (if applicable; e.g. Shape-Array, IPI)
    - Data logger/telemetry gateway make, model and serial number (if applicable)
  - **Survey-monuments:**
    - Monument description (e.g., “cement-filled tire with steel riser post”),
    - Monument coordinates,
    - Riser height (if applicable),
    - GNSS receiver make, model and serial number,
    - Data logger/telemetry gateway make, model, and serial number.

Checks of instrumentation functionality shall be carried out prior to and while finalizing the installation (e.g. grouting). The Engineer and/or Constructor will verify the installation of monitoring equipment as part of the installation process.

10.6 AS-BUILT SURVEY

The Constructor shall provide the Engineer with copies of the as-built survey data for installations of geotechnical instrumentation. The Constructor shall also provide as-built drawings in AutoCAD.dwg file format, complete with X, Y, and Z co-ordinates (northing, easting, and elevation).

The as-built drawings shall contain as a minimum:

- Location and elevations of piezometer tips and lead alignments
- Location and elevations of survey-monuments
- Location, ground elevation, casing stick-up length, and A+ groove orientation for inclinometers
- Data logger and/or telemetry gateway locations

10.7 GEOTECHNICAL INSTRUMENTATION INSPECTION AND TEST PLAN

The ITP detailed in Table 10.1 identifies the frequency and type of inspection, testing and documentation for the Geotechnical Instrumentation procurement, installation, and commissioning.

Table 10.1 Geotechnical Instrumentation Inspection and Test Plan

Activity	Inspection Requirement	Testing Requirement	Documentation Requirement	Hold Point requirement
Procurement	Constructor inspection following receipt of product.	None	Constructor to prepare submittal of manufacturer's technical information and QC documentation. Engineer to provide a response to the Constructor's submittal.	Constructor to hold procurement of product until approval of submittal by the Engineer.
Pre-Installation Calibration and Functionality Verification	None	Constructor to complete pre-installation calibration and/or verification of functionality (as applicable) for geotechnical instrumentation.	Constructor to prepare submittal of the calibration and/or functionality verification documentation. Engineer to provide a response to the Constructor's submittal.	None
Instrumentation Installation and Commissioning	Daily Constructor Inspection. Ad-hoc Engineer installation monitoring.	Commissioning and testing as per the manufacturer's instructions.	Constructor to prepare as-built survey of installed instrumentation. Installation progress report by the Constructor or Engineer (DPR, WPR, FRR)	Confirmation of functionality prior to finalizing installation (grouting, etc.)

11.0 SITE RECLAMATION

Site reclamation is to be undertaken as per reclamation plans and objectives as agreed with the Montana DEQ. Frequency and documentation of testing and inspections are to be met as per the reclamation requirements. It is understood that progressive embankment reclamation and re-vegetation will be completed concurrently with the construction when and where possible.

12.0 REFERENCES

ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

ACI 305.1 - Specification for Hot Weather Concreting

ACI 306.1 - Guide to Cold Weather Concreting

ACI 308.1 - Specification for Curing of Concrete

ACI 309R - Guide for Consolidation of Concrete

ACI 315 - Details and Detailing of Concrete Reinforcement

ACI 347 – Guide to Formwork for Concrete

Knight Piésold Ltd. (KP, 2018). Yankee Doodle Tailings Impoundment – Construction Management Plan (KP Reference No. VA101-126/12-5 Rev. 3), dated May 1, 2018.

Knight Piésold Ltd. (KP, 2024a). Yankee Doodle Tailings Impoundment – Life of Mine Design Report for 6,560 Amendment Design Document (KP Reference No. VA101-126/24-4 Rev. 0), dated September 13, 2024.

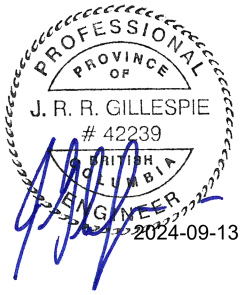
Montana Code Annotated (MCA), 2023. Title 82: Minerals, Oil, and Gas, Chapter 4: Reclamation, Part 3: Metal Mine Reclamation. Accessed: June 2024. Available at: http://leg.mt.gov/bills/mca_toc/82_4_3.htm

Montana Resources and Knight Piésold Ltd. (MR/KP, 2023). Yankee Doodle Tailings Impoundment – Tailings Operations, Maintenance and Surveillance (TOMS) Manual, Reference No. VA101-126/29-3 Rev. 6, December 4, 2023.

13.0 CERTIFICATION

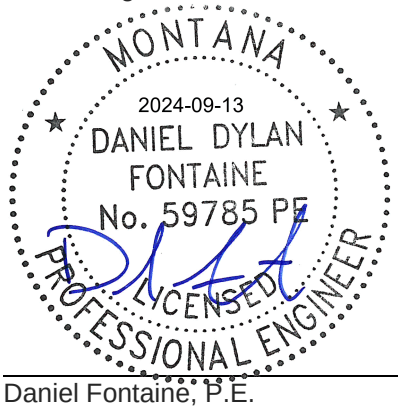
This report was prepared and reviewed by the undersigned.

KNIGHT PIÉSOLD LTD.
PERMIT NUMBER
1001011
EGBC PERMIT TO PRACTICE



Prepared:

Jason Gillespie, P.Eng.
Senior Engineer



Reviewed:

Daniel Fontaine, P.E.
Specialist Engineer | Associate
YDTI Engineer of Record

Approval that this document adheres to the Knight Piésold Quality System: DDF

APPENDIX A

QA and QC Reporting Documentation Templates

Appendix A1	Subgrade Inspection Report Template
Appendix A2	Field Review Record Template
Appendix A3	Daily Site Report Template
Appendix A4	Weekly Site Report Template
Appendix A5	Request for Information Template
Appendix A6	Design Change Request Template
Appendix A7	Non-Conformance Report Template
Appendix A8	Monthly Quality Report Template

APPENDIX A1

Subgrade Inspection Report Template

(Pages A1-1 to A1-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date: Month DD, YYYY **File No.:** VA101-126/24

SIR. No.: SIR-0X

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	Inspectors Name

1.0 GENERAL

1.1 INSPECTION STAFF AND DATE

Subgrade Inspector: XX, Company

Inspection Date: Month DD, YYYY

1.2 WEATHER

Description of weather conditions during the inspection

2.0 LOCATION AND AREA FOR APPROVAL

Location of sub-grade inspection

3.0 SUBGRADE DESCRIPTION

Description of materials, conditions etc

4.0 APPROVAL / RECOMMENDATIONS FOR APPROVAL

Approval area description

5.0 PHOTOS

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Photo 1 Description

Knight Piésold CONSULTING

APPENDIX A2

Field Review Record Template

(Pages A2-1 to A2-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date:	Month DD, YYYY	**File No.:**	VA101-126/25
		FRR. No.:	0XX

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	Reviewer Name

1.0 INTRODUCTION

Description of field review - who it was conducted by, date of review, and locations reviewed. Summarize areas visited and observed.

YDTI:

- Embankment Limb - General construction progress
  - Description of construction progress

RDS - X:

- North South RDS – General construction progress
  - Description of construction progress

2.0 DESCRIPTION OF CONSTRUCTION ACTIVITIES

2.1 YDTI CONSTRUCTION

Embankment Limb:

- Description of construction

2.2 X ROCK DISPOSAL SITE

Construction activities related to the X RDS were ongoing at the time of review. General construction updates and areas reviewed include the following:

Subcategory

- Description of construction

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

3.0 PHOTO LOG

Photo 3.1 Photo Description

APPENDIX A3

Daily Site Report Template

(Pages A3-1 to A3-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date:	Month DD, YYYY	**File No.:**	VA101-126/24

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	Inspectors Name

1.0 GENERAL

1.1 SITE INSPECTION STAFF:

Site Inspectors: Name, Company

1.2 HEALTH AND SAFETY

- Description of any relevant health and safety

1.3 MEETINGS AND CORRESPONDENCE

- Description of any meetings or relevant correspondence

1.4 WEATHER

- Description of weather

2.0 CONSTRUCTION ACTIVITIES

2.1 WEST EMBANKMENT

- Description of works

2.2 EAST-WEST EMBANKMENT

- Description of works

2.3 NORTH-SOUTH EMBANKMENT

- Description of works

2.4 NORTH RDS

- Description of works

2.5 HSB RDS

- Description of works

2.6 WEST RDS

- Description of works

3.0 PHOTOS

Photo 1 Description

APPENDIX A4

Weekly Site Report Template

(Pages A4-1 to A4-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date:	Month DD, YYYY	**File No.:**	VA101-126/24
Week:	Month DD – DD, YYYY	**WPR. No.:**	WPR-0X

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	Inspectors Name

1.0 INSPECTION SUMMARY

Inspection Area	Inspection Completed (Y/N)	Active Primary Construction Material Placement				
		Zone U	Zone D1	Zone F	Zone D2	Other (Specify)
West Embankment						
East-West Embankment						
North-South Embankment						
North RDS						
HsB RDS						
West RDS						

2.0 DESCRIPTION AND NOTES

2.1 WEST EMBANKMENT

- Description of works

2.2 EAST-WEST EMBANKMENT

- Description of works

2.3 NORTH-SOUTH EMBANKMENT

- Description of works

2.4 NORTH RDS

- Description of works

2.5 HSB RDS

- Description of works

2.6 WEST RDS

- Description of works

3.0 PHOTOS

Photo 1 Description

APPENDIX A5

Request for Information Template

(Page A5-1)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date: Month DD, YYYY

File No.: VA101-126/24

RFI. No.: RFI-0X

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	

1.0 REQUEST FOR INFORMATION

Description of request

APPENDIX A6

Design Change Request Template

(Pages A6-1 to A6-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date: Month DD, YYYY **File No.:** VA101-126/24

DCR. No.: DCR-0X

Client:	Montana Resources, LLC
To:	
Copy To:	

1.0 GENERAL

1.1 AREA OF WORK

Description of Area

1.2 GENERAL AREA OF PROPOSED WORK:

Provide the following information (as a minimum) and add additional information as required depending upon change required:

- Purpose for Change Request
- Review of Change of Design
- Management of Changes

1.3 REFERENCES AND ATTACHEMENTS

No. of Sheets Attached: Number

Reference Drawings/Clauses:

Originator

Name, Designation, Title _____

Signature: _____

FOR DESIGN OFFICE USE

Date Received: _____

Proposed change substitution (*circle one*): Not Approved / Approved as Submitted / Approved as Amended:

No. of Sheets Attached: _____ (amendments only)

Engineer

Name: _____

Principal

Name: _____

Knight Piésold CONSULTING

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Title:	_____	Title:	_____
Signature:	_____	Signature:	_____

Date Returned: _____

NOTES:

1. Originator to keep a copy of all submissions and attachments.
2. Home office to keep a file copy of completed request form with attachments, marked up as described above.

APPENDIX A7

Non-Conformance Report Template

(Pages A7-1 to A7-2)

YANKEE DOODLE TAILINGS IMPOUNDMENT

CONSTRUCTION QUALITY DOCUMENTATION

Date: Month DD, YYYY

File No.: VA101-126/24

Ref. No.: NCR-00X

Client:	Montana Resources, LLC
To:	
Copy To:	
From:	XX

1.0 AREA OF WORK

2.0 DESCRIPTION OF NON-CONFORMANCE

3.0 PROPOSED REMEDIAL ACTIONS:

YANKEE DOODLE TAILINGS IMPOUNDMENT
CONSTRUCTION QUALITY DOCUMENTATION

4.0 CERTIFICATION

Originator

Name, Designation, Title _____

Signature: _____

FOR DESIGN OFFICE USE

Date Received: _____

Response to Non-Conformance (*circle one*): Not Approved / Approved as Submitted / Approved as Amended:

No. of Sheets Attached: _____ (amendments only)

Engineer		**Principal**	
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Signature:	_____	Signature:	_____

Date Returned: _____

NOTES:

1. Originator to keep a copy of all submissions and attachments.
2. Home office to keep a file copy of completed request form with attachments, marked up as described above.

APPENDIX A8

Monthly Quality Report Template

(Pages A8-1 to A8-14)

YANKEE DOODLE TAILINGS IMPOUNDMENT

MONTH 202X
MONTHLY QUALITY REPORT

PURPOSE:

Present monthly quality control results and to date records for material placed within YDTI Embankments, North RDS, West RDS and HsB RDS

Date Issued: X/X/2024

From: Name

To: Name

CC: Name, Name

TABLE 1

MONTHLY AND TOTAL MATERIAL SUMMARY
CONTROL TESTING (SOURCE AND STOCKPILE)

MATERIAL	MONTHLY VOLUME (yd^3)				CUMULATIVE VOLUME MONTH YEAR TO MONTH YEAR (yd^3)			
	N-S	E-W	W	TOTAL	N-S	E-W	W	TOTAL
Zone U – Embankment Crest Raise	-	-	-	0	-	-	-	0
Zone U - RDS	-		-	0	-		-	0
Zone U - HsB Area				0				0
Zone D1 - Embankment Crest Raise	-	-	-	0	-	-	-	0
Zone F - Upstream Earthfill	-	-	-	0	-	-	-	0
Zone D2 - Downstream Earthfill	-	-	-	0	-	-	-	0
Zone N - Instrumentation Bedding		-		0		-		0
Zone 3A - Drain Rock		-		0		-		0
Zone 2B - Transition Material		-		0		-		0
Zone 2A - Filter Material		-		0		-		0
Zone R1/R2 - Riprap Material		-		0		-		0

TABLE 2

MONTHLY AND TOTAL MATERIAL SUMMARY
RECORD TESTING (IN PLACE)

MATERIAL	MONTHLY VOLUME (yd^3)				CUMULATIVE VOLUME MONTH YEAR TO MONTH YEAR (yd^3)			
	N-S	E-W	W	TOTAL	N-S	E-W	W	TOTAL
Zone U – Embankment Crest Raise	-	-	-	0	-	-	-	0
Zone U - RDS	-		-	0	-		-	0
Zone U - HsB Area				0				0
Zone D1 - Embankment Crest Raise	-	-	-	0	-	-	-	0
Zone F - Upstream Earthfill	-	-	-	0	-	-	-	0
Zone D2 - Downstream Earthfill	-	-	-	0	-	-	-	0
Zone N - Instrumentation Bedding		-		0		-		0
Zone 3A - Drain Rock		-		0		-		0
Zone 2B - Transition Material		-		0		-		0
Zone 2A - Filter Material		-		0		-		0
Zone R1/R2 - Riprap Material		-		0		-		0

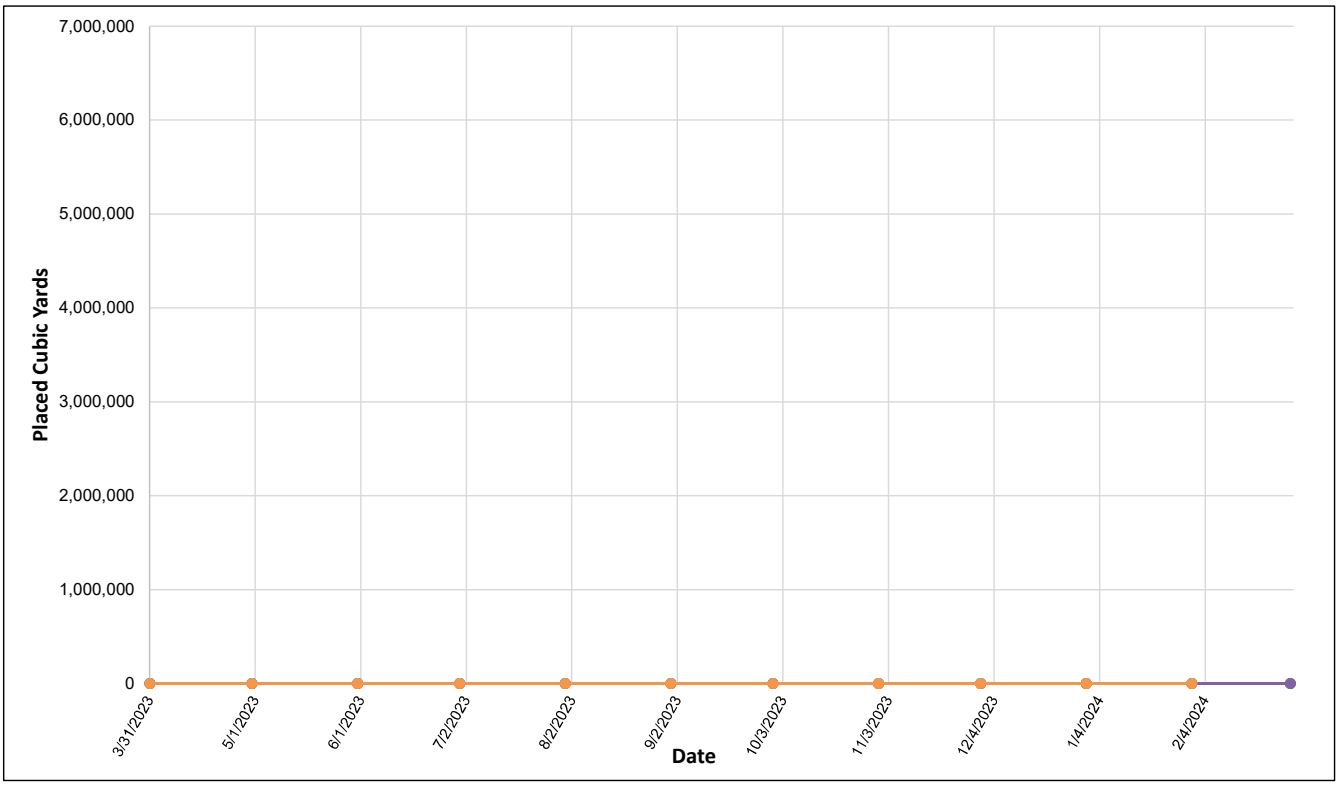
NOTES:

1. NOTES

X/X/2024	
DATE	PREPARED

FIGURE 1

CUMULATIVE CUBIC YARDS PLACED BY DATE
MONTH 202X TO MONTH 202X



X/X/2024	
DATE	PREPARED

TABLE 3

MONTHLY CONTROL TESTING SUMMARY
C1 PARTICLE SIZE DISTRIBUTION TESTING

Material	Control Test Frequency	Monthly Volume	Testing Summary		
	C1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				
Zone F - Upstream Earthfill	20,000				
Zone D2 - Downstream Earthfill	40,000				
Zone N - Instrumentation Bedding	2,000				
Zone 3A - Drain Rock	4,000				
Zone 2B - Transition Material	2,000				
Zone 2A - Filter Material	2,000				
Zone R1/R2 - Riprap Material	4,000				

TABLE 4

MONTH 202X TO MONTH 202X CONTROL TESTING SUMMARY
C1 PARTICLE SIZE DISTRIBUTION TESTING

Material	Control Test Frequency	Cumulative Volume	Testing Summary		
	C1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				
Zone F - Upstream Earthfill	20,000				
Zone D2 - Downstream Earthfill	40,000				
Zone N - Instrumentation Bedding	2,000				
Zone 3A - Drain Rock	4,000				
Zone 2B - Transition Material	2,000				
Zone 2A - Filter Material	2,000				
Zone R1/R2 - Riprap Material	4,000				

X/X/2024	
DATE	PREPARED

TABLE 5

MONTHLY CONTROL TESTING SUMMARY
C2 ABA TESTING

Material	Control Test Frequency	Monthly Volume	Testing Summary		
	C1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				

TABLE 6

MONTH 202X TO MONTH 202X CONTROL TESTING SUMMARY
C2 ABA TESTING

Material	Control Test Frequency	Cumulative Volume	Testing Summary		
	C1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				

X/X/2024	
DATE	PREPARED

FIGURE 2
ALL ZONE U CONTROL (SOURCE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X

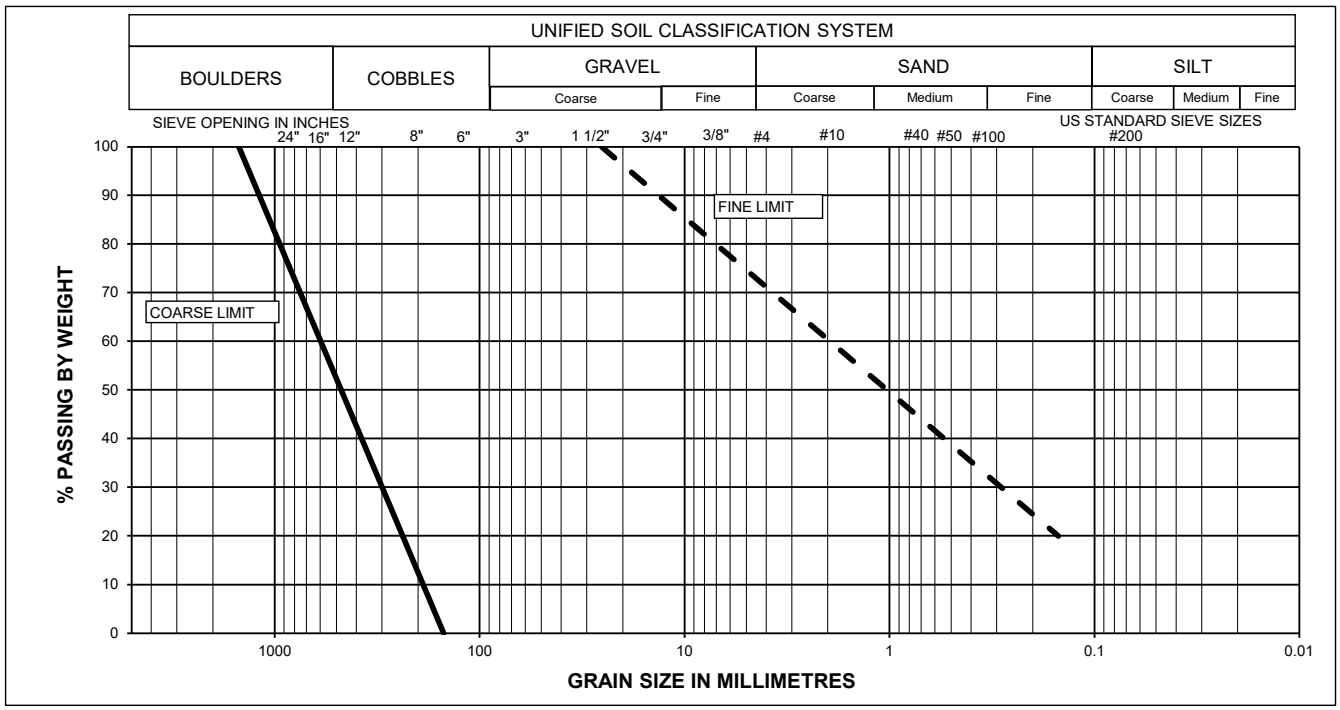
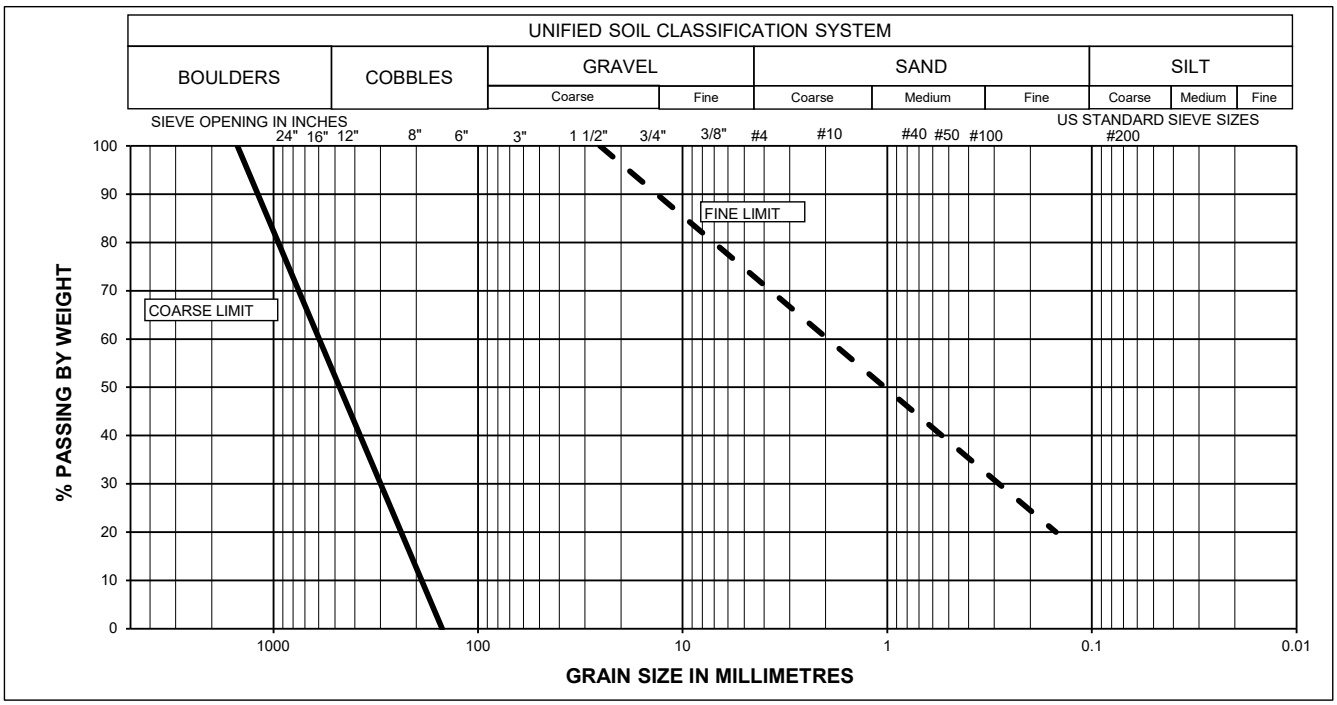


FIGURE 3
ALL ZONE U RECORD (IN PLACE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X



X/X/2024	
DATE	PREPARED

FIGURE 4
ZONE UA CONTROL (SOURCE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X

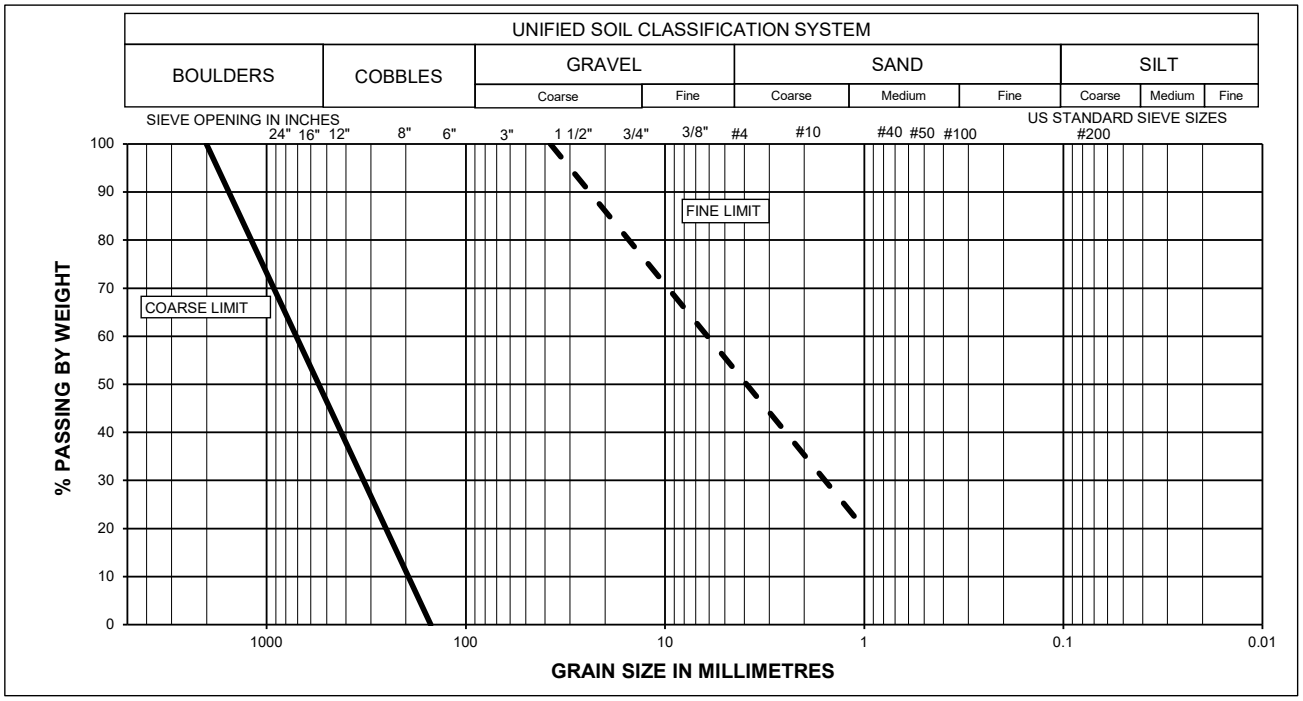
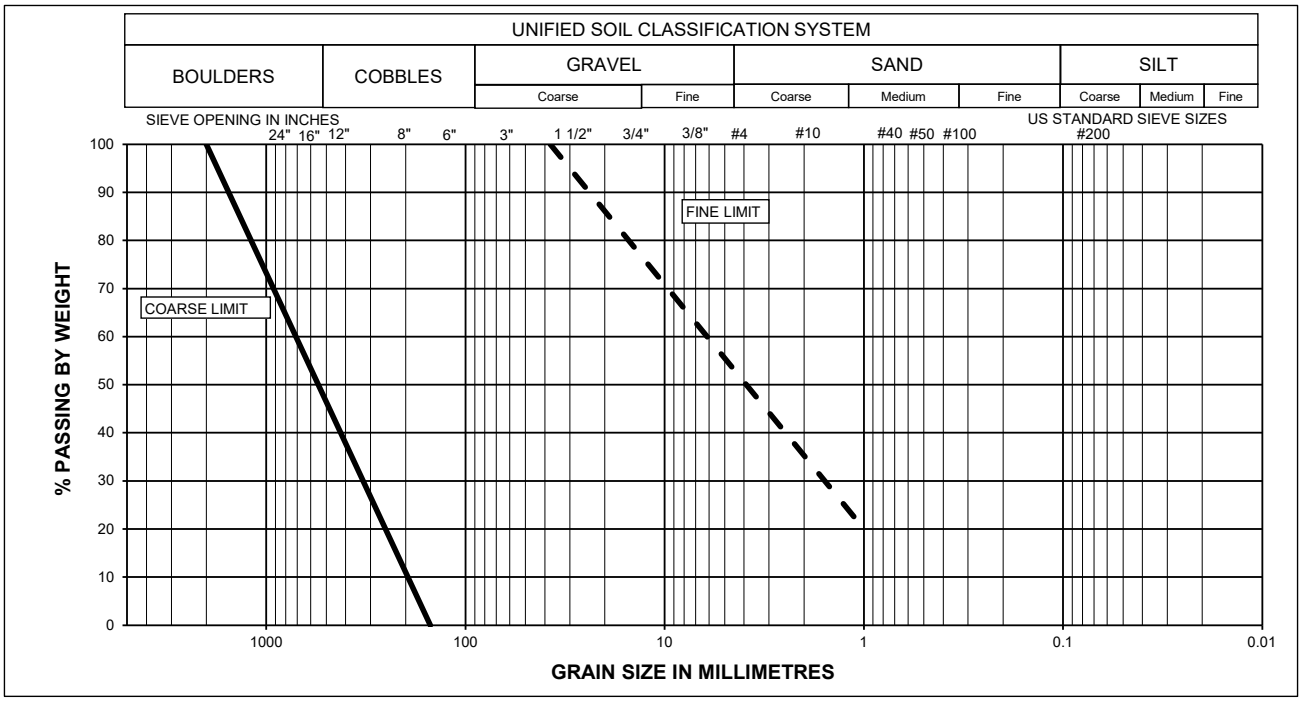


FIGURE 5
ZONE UA RECORD (IN PLACE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X



X/X/2024	
DATE	PREPARED

FIGURE 6
ZONE D1 CONTROL (SOURCE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X

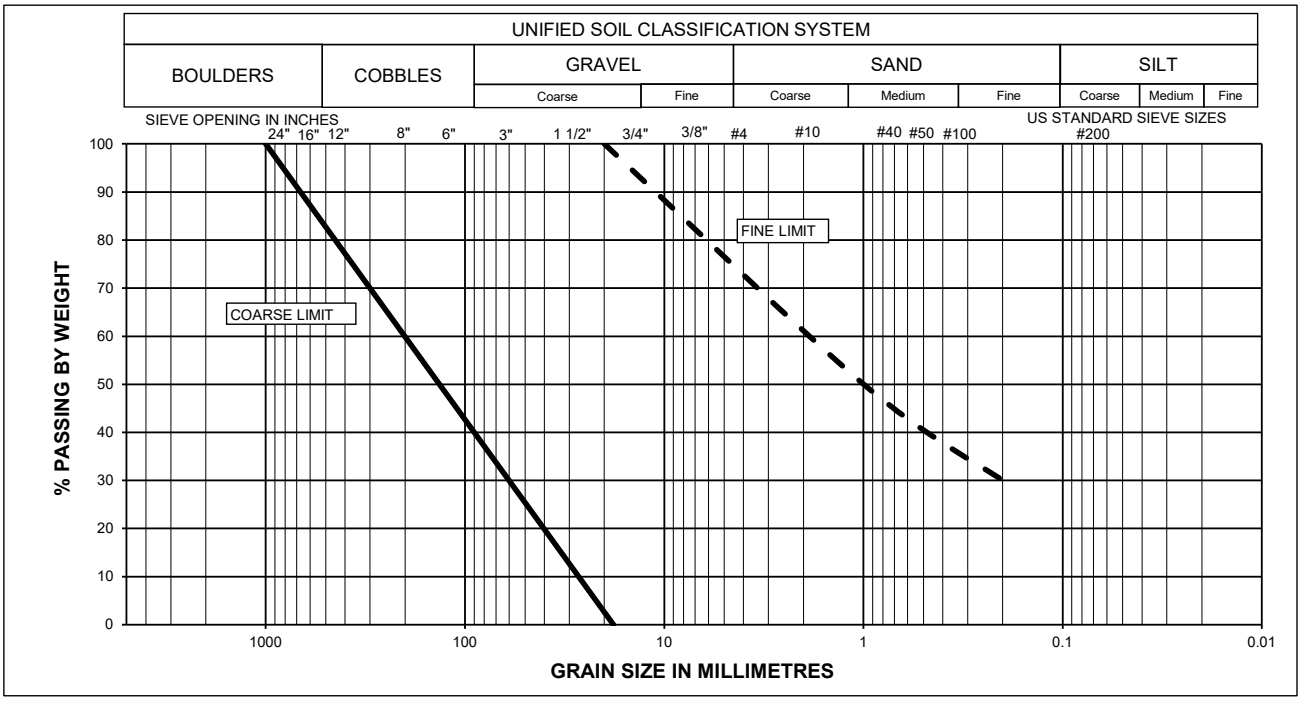
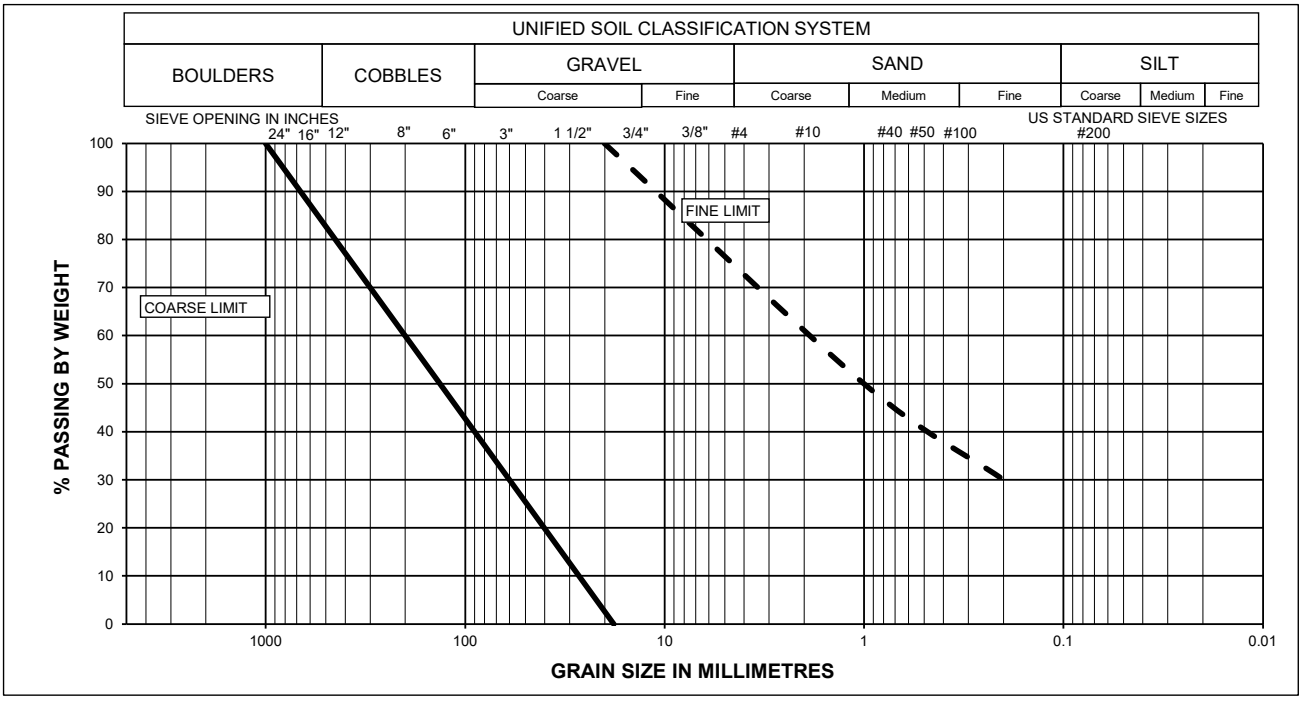


FIGURE 7
ZONE D1 RECORD (IN PLACE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X



X/X/2024	
DATE	PREPARED

FIGURE 8
ZONE F CONTROL (SOURCE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X

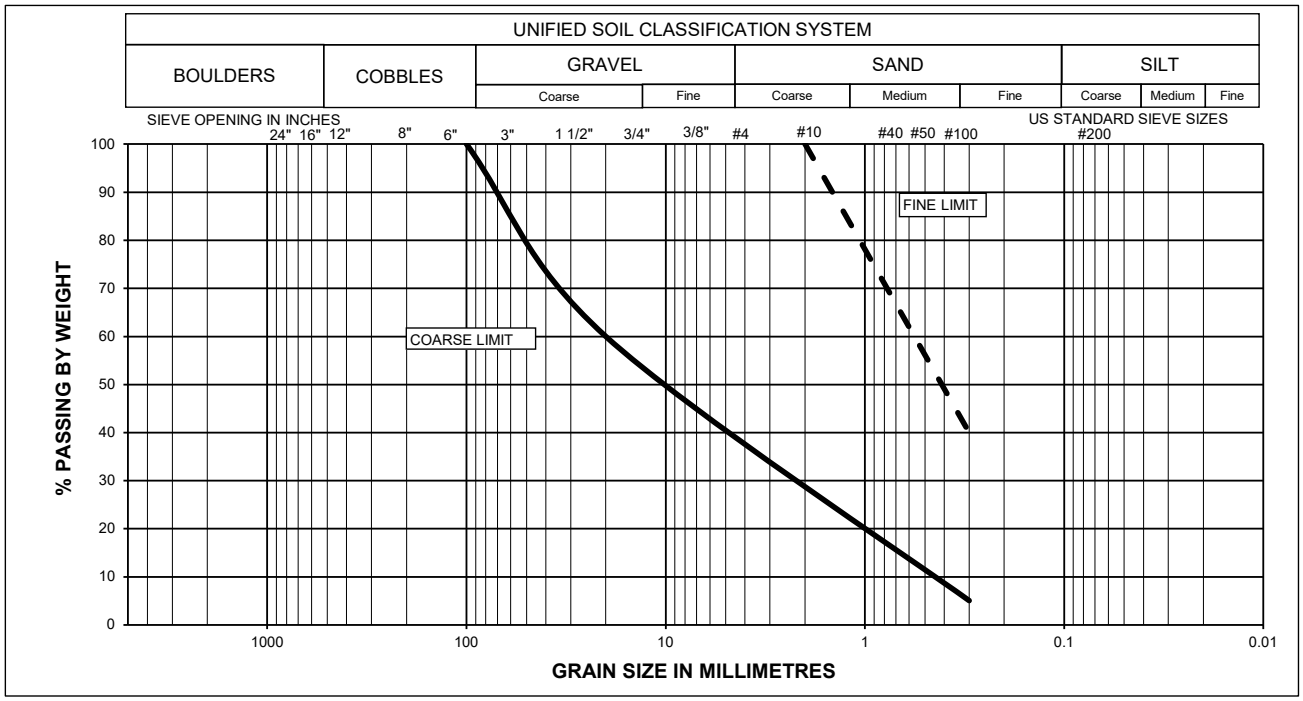
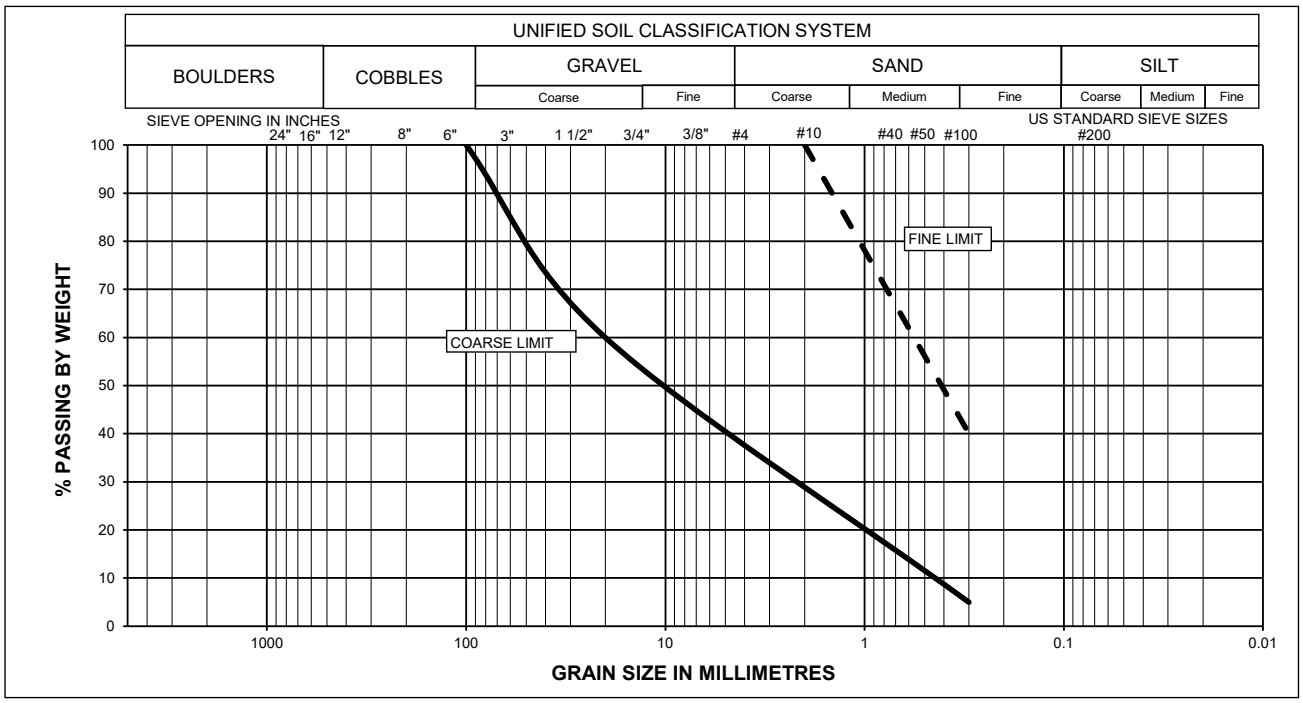


FIGURE 9
ZONE F RECORD (IN PLACE) PARTICLE SIZE DISTRIBUTION TESTS
MONTH 202X TO MONTH 202X



X/X/2024	
DATE	PREPARED

TABLE 7

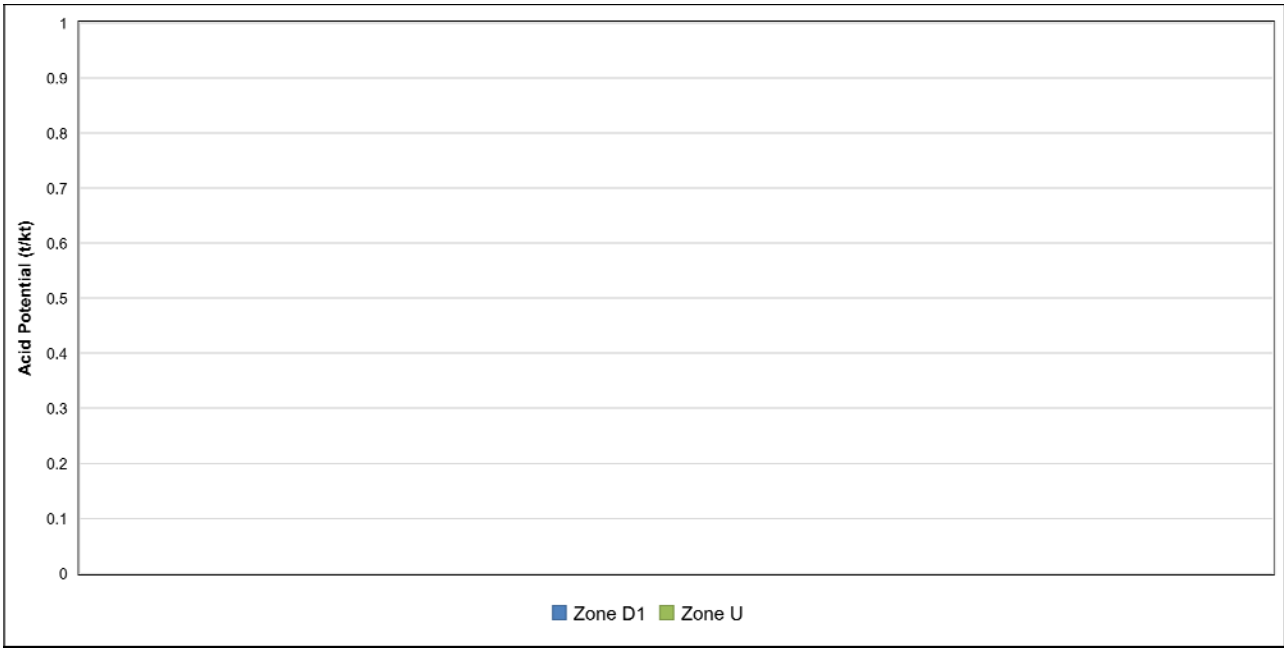
ABA TESTING RESULTS SUMMARY
MONTH 202X TO MONTH 202X

Print Apr/25/24 11:31:16

Sample ID	Neutralization Potential	Acid Potential	Acid/Base Potential	Total S	H2O Extr. S	HCl Extr. S	HNO3 Extr. S	Residual S	NPR
	t/kt	t/kt	t/kt	%	%	%	%	%	

X/X/2024	
DATE	PREPARED

FIGURE 10
ACID POTENTIAL BY ZONE (t/tk)
SAMPLES RETURNED MONTH 202X TO DATE



X/X/2024	
DATE	PREPARED

TABLE 8

MONTHLY RECORD TESTING SUMMARY
R1 MOISTURE CONTENT TESTING

Material	Control Test Frequency	Monthly Volume	Testing Summary		
	R1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone D1	40,000	-	-	-	-

TABLE 9

MONTH 202X TO MONTH 202X RECORD TESTING SUMMARY
R1 MOISTURE CONTENT TESTING

Material	Control Test Frequency	Cumulative Volume	Testing Summary		
	R1	(yd^3)	Required	Collected	Returned
	1 PER				
Zone D1	40,000	0	-	-	-

X/X/2024	
DATE	PREPARED

TABLE 10

MONTHLY RECORD TESTING SUMMARY
R2 PARTICLE SIZE DISTRIBUTION TESTING

Material	Control Test Frequency	Monthly Volume	Testing Summary		
	R2	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				
Zone F - Upstream Earthfill	20,000				
Zone D2 - Downstream Earthfill	40,000				
Zone N - Instrumentation Bedding	2,000				
Zone 3A - Drain Rock	4,000				
Zone 2B - Transition Material	2,000				
Zone 2A - Filter Material	2,000				
Zone R1/R2 - Riprap Material	4,000				

TABLE 11

MONTH 202X TO MONTH 202X RECORD TESTING SUMMARY
R2 PARTICLE SIZE DISTRIBUTION TESTING

Material	Control Test Frequency	Cumulative Volume	Testing Summary		
	R2	(yd^3)	Required	Collected	Returned
	1 PER				
Zone U – Embankment Crest Raise	400,000				
Zone U - RDS	400,000				
Zone U - HsB Area	400,000				
Zone D1 - Embankment Crest Raise	40,000				
Zone F - Upstream Earthfill	20,000				
Zone D2 - Downstream Earthfill	40,000				
Zone N - Instrumentation Bedding	2,000				
Zone 3A - Drain Rock	4,000				
Zone 2B - Transition Material	2,000				
Zone 2A - Filter Material	2,000				
Zone R1/R2 - Riprap Material	4,000				

X/X/2024	
DATE	PREPARED

TABLE 12

D1 MOISTURE CONTENT TESTING RESULTS
SAMPLES RETURNED TO DATE

Sample ID	Moisture Content %

X/X/2024	
DATE	PREPARED