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September 30, 2025

Abimbola Ojekanmi
Uranium Reclamation Coordinator
Mining Act Reclamation Program
New Mexico Energy, Minerals, and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, New Mexico 87502-5469

RE: 90% Closure Closeout Plan Submittal for the St. Anthony Mine Permit

Dear Dr. Ojekanmi:

I am writing on behalf of United Nuclear Corporation ("UNC") with regard to the former St. Anthony Mine located in Cibola County, New Mexico (St. Anthony Mine"). UNC is requesting a revision to the permit for the St. Anthony Mine, permit number MK006RE ("Permit"), to incorporate a closeout plan for the reclamation of the St. Anthony Mine and is submitting, with this letter, the 90% Closure Closeout Plan ("90% CCOP") to the Mining and Minerals Division of the New Mexico Energy, Minerals and Natural Resources Department ("MMD"). The 90% CCOP presents a final reclamation plan to support the revision of the Permit. The 90% CCOP may be accessed through the following BOX link: 90% CCOP for MMD Review. In addition, and consistent with UNC's prior discussions with MMD's request two copies of the 90% CCOP are also being sent by Federal Express.

On February 4 and April 4, 2025, UNC received MMD's "Technically Complete" Letters for the St. Anthony Mine Site 30% Closure-Closeout Plan ("30% CCOP") The February 4th letter included additional MMD comments on the 30% CCOP which UNC responded to on April 3rd. In the April 3rd letter, UNC confirmed that the key changes to the 30% CCOP that have been incorporated into the 90% CCOP include: a 500-year return event design for stormwater structures (Meyer Draw, diversion channels and erosion protection); the addition of a percentage of gravel mixed into the cover soils in strategic locations for Pile 3 and Pile 4 slopes to provide additional erosion protection; and, as noted in prior correspondence, a minimum 3-foot soil cover over waste materials exceeding the cleanup level. In addition, the April 3rd letter confirmed that the basis of design for hydraulic stabilization of Meyer Draw in the 90% CCOP is a series of drop structures rather than arroyo realignment.

In its April 4th letter, MMD indicated that: (1) it accepted the responses provided in UNC's April 3rd letter; (2) MMD has no further comments on the 30% CCOP; and (3) MMD supports UNC's advancement of the project to the 90% design. UNC understands that this 90% CCOP submittal will trigger MMD's drafting of the Permit.

MMD's February 4th letter requested an updated Financial Assurance ("FA") estimate for the 90% CCOP. As previously agreed, based on UNC's June 18th email and subsequent correspondence with MMD, and in light of the ~$98MM in FA instruments presently held by MMD and the parties' January, 2021 agreement, once MMD deems the 90% CCOP technically complete, UNC will submit an updated FA estimate based on the current design. If necessary, UNC will supplement the FA amount presently held by MMD, at which time MMD will sign and formalize the Permit.

Please contact the undersigned if you have any questions or would like to discuss the 90% CCOP or related issues.

Sincerely,

Lance M. Hauer, P.E.
Legacy Site Program Leader - Corporate Holdings
GE Aerospace

Cc: Amber Rheubottom, NMED
David Ennis, MMD
Cynthia Ardito, INTERA
Melanie Davis, Stantec
Monique Mooney, GE Aerospace
Chad Baker, Holland & Hart LLP

St. Anthony Mine Site Closure-Closeout Plan (CCOP)

90% Design Report

September 30, 2025

Prepared for:

United Nuclear Corporation

Prepared by:

Stantec Consulting Services, Inc. and

INTERA, Inc.

Disclaimer

The conclusions in the Report titled St. Anthony Mine Site Closure-Closeout Plan (CCOP) –90% Design Report (Report) are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has received information from United Nuclear Corporation (the "Client") and third parties to prepare the Report. This information has been used in accordance with, and is governed by, the terms set forth in the Alliance Partnership Agreement (APA), Amended and Restated, Version 3.0, between GE and Stantec (GE Contract No. 670107) dated March 25, 2025 (the "Contract").

This Report is intended solely for use by the Client in accordance with the Contract. Stantec's liability with respect to Client's distribution of the Report to third parties shall be governed by the terms outlined in the Contract.

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Executive Summary

This St. Anthony Mine Site Closure-Closeout Plan - 90% Design Report (90% CCOP) for the United Nuclear Corporation (UNC) St. Anthony Mine Site (Site) was prepared to fulfill the requirements pertaining to the reclamation of the former St. Anthony Mine (permit tracking No. MK006RE) in accordance with the New Mexico Mining Act Reclamation Program and the New Mexico Administrative Code (NMAC) 19.10.5. This 90% CCOP was prepared to comply with applicable regulations and conditions in the New Mexico Mining Act (NMMA), the Mining Act Rules for Existing Mining Operations (NMAC 19.10.5), and the New Mexico Water Quality Act (NMWQA).

The 90% CCOP is being submitted to support a revision incorporating a closeout plan into the permit for the St. Anthony Mine (MK006RE). The 90% CCOP is an update to the 30% CCOP submitted in October 2022, replaces the plan previously submitted to the New Mexico Mining and Minerals Division (MMD) in March 2019 (Stantec, 2019), and provides additional design details, as well as some design modifications, consistent with UNC's response to MMD comments on the 30% CCOP.

The Site is located in Cibola County, New Mexico, in a remote, sparsely populated area of the Cebolleta Land Grant approximately 40 miles west of Albuquerque and 4.6 miles southeast of Seboyeta. UNC operated the St. Anthony Mine, comprised of an open pit and underground shaft uranium mine, from 1975 to 1981. The Site includes underground workings for the St. Anthony Mine including one mine shaft and one vent shaft that are now sealed at the surface, underground workings for the Old St. Anthony Mine, two open pits (one containing water), seven piles of non-economic mine materials, numerous smaller piles of non-economical mine materials, and three topsoil and/or overburden piles.

Site Characterization

The reclamation plan for the Site includes excavation and consolidation of soil exceeding the radium 226 (Ra-226) Soil Action Level (SAL) of 6.6 picocuries per gram (pCi/g) for Ra-226. This standard is based on New Mexico Joint Guidance (MMD-NMED, 2016) targeting a final surface concentration of 5.0 pCi/g Ra-226 plus the 1.6 pCi/g Ra-226 Site background area concentration level as determined by the 2007 Materials Characterization (MWH, 2007b), which is included in Appendix B. The Materials Characterization included a radiological survey of non-economic materials at the Site, drilling and sampling of non-economic materials, and sampling of potential cover material borrow sources. The 2007 radiological characterization focused on the borrow and stockpile sources, non-economic materials piles, and mine facilities within the Western Shaft Area.

A Supplemental Radiological Characterization conducted in 2018 included areas within the approximate mine permit boundary that were excluded from the 2007 Materials Characterization. This supplemental Site characterization was also performed to estimate the outer boundary (lateral extent) of the mine waste or affected areas. Results of the Supplemental Radiological Characterization are presented in the *Summary of Supplemental Materials Characterization* memorandum (Stantec, 2018b) and in the *Supplemental Radiologic Characterization Report* (AVM, 2018), which are included in Appendix B.

A third radiological characterization was conducted on the Pit 1 infill piles in November 2019. This investigation was performed to estimate the Ra-226 concentrations of the piles in Pit 1 to evaluate

placement location for these materials. The characterization was performed by collecting soil samples from test pits and conducting onsite ex-situ gamma radiation soil screening and vendor laboratory analysis on the samples. Results of the test pit characterization are presented in the *Pit 1 Pile Investigation* report (AVM, 2020), which is included in Appendix B.

Stantec initiated a supplemental radiological characterization in May 2022 to estimate the lateral and vertical extent of mine waste in an approximate 22-acre area south of Pit 1 at the Site, where the Old St. Anthony Mine was located and operated from 1956 to 1960. The walkover radiological gamma survey conducted at the Site in 2018 indicated a small portion of this area, near the Old St. Anthony Mine underground workings, may exceed the SAL (6.6 pCi/g for Ra-226). The 2022 characterization included static gamma radiologic survey measurements, Global Positioning System (GPS)-based scan surveys, ex-situ gamma radiation soil screening, soil sampling and laboratory analysis. The supplemental characterization and laboratory testing were completed in November 2022. Results of the 2022 Supplemental Characterization, including an updated volume estimate of mine waste at the Site, are presented in *St. Anthony Mine – 2022 Supplemental Radiological Characterization South of Pit 1* (Stantec, 2022), which is also included in Appendix B.

Plan Summary

The design for reclamation of the site (Reclamation Design) includes regrading waste piles to stable slopes and covering the materials in place (Piles 1, 2, 3, 4, 5, and part of Topsoil/Overburden) for erosion protection and prevention of contact precipitation. Sodium tripolyphosphate (STPP) will be used to stabilize the existing sediments in the expressed water in Pit 1 and the Pit 1 infill piles will be moved to the bottom of Pit 1, graded, and covered during stabilization of Pit 1. The waste materials on the Site include: Ore Storage 1 and 2, Pile 7, Pile 6, the Shaft Area Access Road, the Mine Dump area, the Crusher Stockpile, the West Disturbance Area, and impacted surface soils throughout the Site; these will be hauled and placed into Pit 2 and covered with soil. The design also includes rockfall mitigation for safety in Pit 1; engineering controls and signage; revegetation; and stormwater controls within the Site.

Post mining land uses, depending on the specific area or feature, will include grazing and wildlife habitat, similar to current use of the land located outside the approximate mine permit boundary, and a vegetated water management structure within Pit 1. Restricted access areas may also exist post-closure. Engineering controls are planned to limit access to specific areas of the Site, namely Pit 1 and the future expressed water area on the Pit 1 cover.

Abbreviations

3D	three-dimensional
µR/hr	microroentgen per hour
AAS	Alternative Abatement Standard
AJD	Approved Jurisdictional Determination
bgs	below ground surface
CCOP	Closure-Closeout Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLG	Cebolleta Land Grant
cm	centimeter
COC	constituent of concern
COI	constituents of interest
cpm	counts per minute
CSWPPP	construction stormwater pollution prevention plan
cy	cubic yard(s)
EPA	US Environmental Protection Agency
ERA	Ecological Risk Assessment
FOS	factor of safety
GPS	Global Positioning System
HEC-HMS	Hydrologic Engineering Center's – Hydrologic Modeling System
HU	hydrologic unit
IFB	Issued for Bid
IL	investigation level
LOREL	lowest observed radionuclide effect level
MARP	Mining Act Reclamation Program

mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MMD	New Mexico Mining and Mineral Division
NM	New Mexico
NMAC	New Mexico Administrative Code
NMCRIS	New Mexico Cultural Resources Information System
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMMA	New Mexico Mining Act
NMOSE	New Mexico Office of the State Engineer
NMSA	New Mexico Statutes Annotated
NMWQA	New Mexico Water Quality Act
NOI	Notice of Intent
NOREL	no observed radionuclide effect level
NPDES	National Pollutant Discharge Elimination System
NRC	US Nuclear Regulatory Commission
pCi/g	picocuries per gram
pCi/L	picocuries per liter
$pCi/m^2/s$	picocuries per square meter per second
PMLU	post-mining land use
PPE	personal protective equipment
Ra-226	radium-226
RSO	Radiation Safety Officer
RUSLE	revised universal soil loss equation
SAL	Soil Action Level
SOP	Standard Operating Procedure
SPLP	synthetic precipitation leaching procedure

SRT	seismic refraction tomography
SSE	self-sustaining ecosystem
STPP	sodium tripolyphosphate
SWPPP	stormwater pollution prevention plan
U	uranium
UNC	United Nuclear Corporation
US	United States
USACE	US Army Corps of Engineers
USGS	US Geological Survey
WQCC	New Mexico Water Quality Control Commission
WTV	wildlife threshold values

1.0 INTRODUCTION

1.1 TERMS OF REFERENCE

This 90% CCOP was prepared to fulfill the requirements of mine site reclamation (permit tracking No. MK006RE) at the Site in accordance with the NMMA Reclamation Program, the NMWQA, and associated rules in the NMAC. The plan was prepared by a professional civil engineer registered in the State of New Mexico.

1.2 PLAN OBJECTIVES

The 90% CCOP is being submitted to support a revision incorporating a closeout plan into the permit for the St. Anthony Mine (MK006RE). The 90% CCOP is an update to the 30% CCOP submitted in October 2022, replaces the plan previously submitted to the MMD in March 2019 (Stantec, 2019), and provides additional design details, as well as some design modifications consistent with UNC's response to MMD's comments on the 2022 submittal. The 90% CCOP describes the work required to reclaim the Site to a condition that allows for establishing a self-sustaining ecosystem (SSE), appropriate for the life zone of the surrounding areas, and not in conflict with the post-mining land uses (PMLU) of grazing, wildlife habitat, and/or a vegetated water management structure. Engineering controls will be implemented to limit grazing and wildlife access to a specific area of the Site, including without limitation Pit 1, where the PMLU will be a vegetated water management structure. Figure 1-1 shows the PMLUs for the Site.

The objectives of the 90% CCOP are to prepare engineering plans for the reclamation of the permit area consistent with the requirements of the NMMA and to demonstrate compliance with applicable requirements of the NMWQA. The design described in this 90% CCOP is presented at a minimum 90% design level, meaning that it presents a completed design. For reference, the United States Army Corps of Engineers (USACE) (USACE, 2009) defines a 90% design as a Final Design, with the exception of any review comments on the deliverables to be addressed once reviewed. The 90% design includes the following:

- Complete design analyses with backup materials and explanatory materials supporting the design calculations, and
- 100% complete design drawings

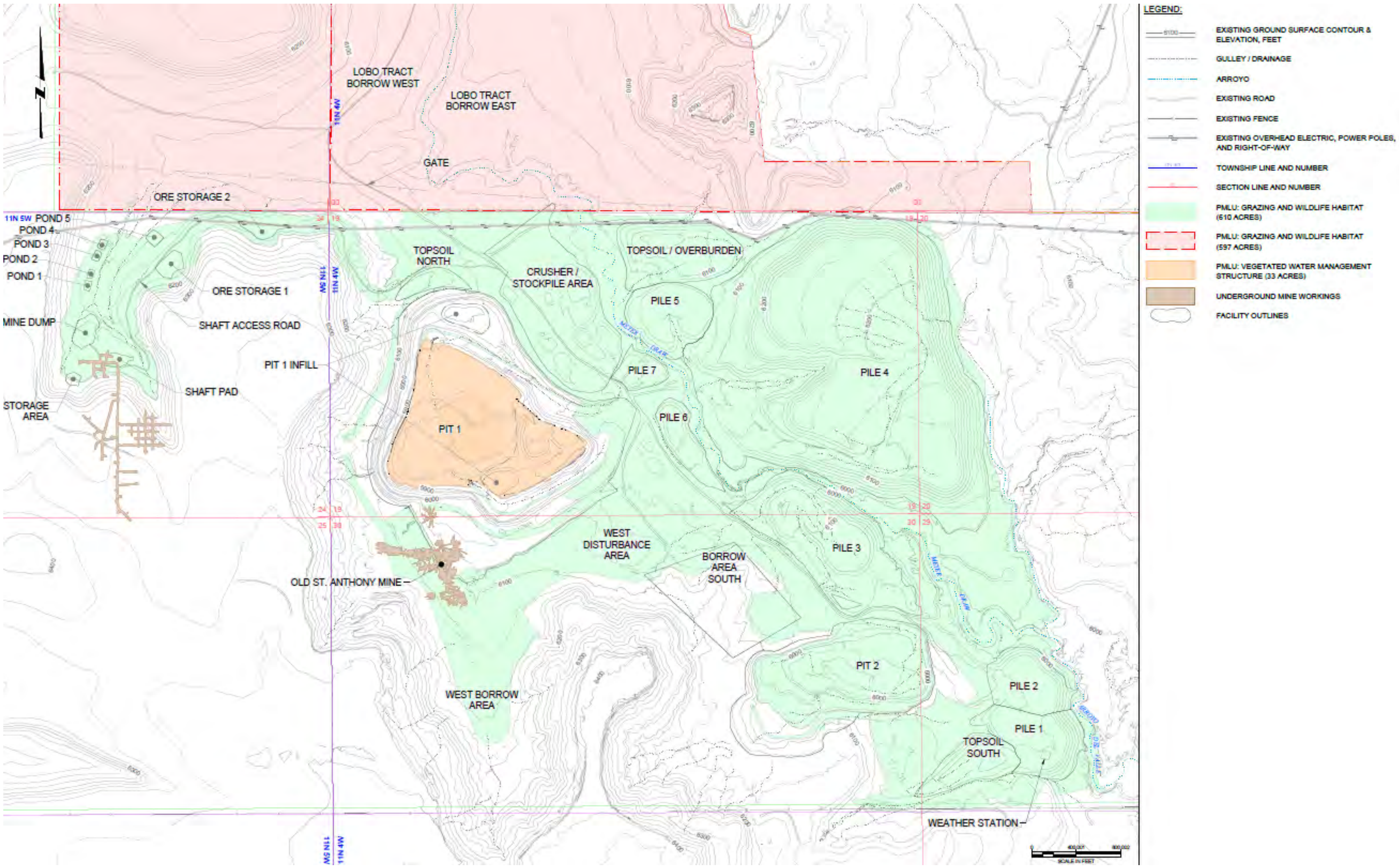


Figure 1-1. Post-Mining Land Uses (PMLU) for the St. Anthony Site

1.3 PLAN SUMMARY

Sections 1 through 3 of the 90% CCOP include a general overview of the project Site and Sections 4 through 6 describe the closure-closeout activities and the design details to support the plan. Section 7 provides an overview of the reclamation schedule and permitting. The Appendices to this 90% CCOP include the detailed data collection efforts for the Site as well as the design calculations that support the closeout design. The design drawings are listed in Table 1-1.

Table 1-1. List of Drawings

Drawing No.	Drawing Title
1	Cover Sheet
2	Site Location
3	Site Layout - Existing Conditions
4	Surface and Subsurface Characterization
5	Removal Excavation Plan (1 of 2)
6	Removal Excavation Plan (2 of 2)
7	Haul Road Plan (1 of 2)
8	Haul Road Plan (2 of 2)
9	Proposed Final Grading
10	Pit 1 Existing and Final Conditions
11	Pit Highwall Cross Section A
12	Pit Highwall Cross Section B
13	Pit Highwall Cross Section C
14	Pit 2 Cross Section D
15	Diversion Channel Index
16	Arroyo Excavation Plan and Profile (1 of 2)
17	Arroyo Excavation Plan and Profile (2 of 2)
18	Arroyo Stabilization Plan and Profile (1 of 2)
19	Arroyo Stabilization Plan and Profile (2 of 2)
20	Pit 1 Diversion Channel South Plan and Profile
21	Pit 1 Diversion Channel West Plan and Profile
22	North Pit 1 Diversion Channel Plan and Profile (1 of 2)
23	North Pit 1 Diversion Channel Plan and Profile (2 of 2)
24	Pit 2 Diversion Channel Plan and Profile
25	Pile 3 Diversion Channel Plan and Profile
26	Pile 4 Diversion Channel Plan and Profile
27	Proposed Excavation and Final Grading Plan – Lobo Tract Borrow
28	Proposed Excavation and Final Grading Plan – West Borrow
29	Proposed Excavation and Final Grading Plan – South Borrow
30	Temporary Stormwater Controls
31	Revegetation and Engineering Controls Plan
32	Pile 4 Stabilization Details (1 of 6)
33	Diversion Channel Details (2 of 6)
34	Arroyo Stabilization Details (3 of 6)
35	Cover System Details (4 of 6)
36	Temporary and Permanent Fence Details (5 of 6)
37	Monitoring Well Extension and Wildlife Pond Details (6 of 6)

1.4 HISTORY OF PLANNING EFFORT

The following presents a chronological list of closure planning activities conducted to date including submittals to MMD, New Mexico Environment Department (NMED) and other agencies:

- In January 2006, a Closeout Plan and a Materials Characterization Plan were submitted for the St. Anthony Mine Site.
- In April 2006, Lone Mountain prepared a Cultural Resource Survey for the Site.
- In May 2006 a report on Vegetation and Wildlife Evaluations/Recommendations was prepared by Cedar Creek Associates Inc. (Cedar Creek).
- The materials characterization field program was conducted in 2006 and 2007, and the Materials Characterization Report was submitted in October 2007.
- The St. Anthony Mine Closeout Plan was revised and resubmitted to MMD in July 2010.
- A Closeout Plan Cost Estimate was submitted in September 2010.
- In 2013, UNC provided Interim Financial Assurance for the 2010 Closeout Plan.
- On May 7, 2015, NMED conditionally approved the St. Anthony Mine Stage 2 Abatement Plan submitted on February 9, 2015.
- An anticipated schedule for the submittal of a Closeout Plan was submitted in January 2016.
- On December 16, 2016, UNC petitioned the New Mexico Water Quality Control Commission (WQCC) for alternative abatement standards (AASs) for the Jackpile sandstone.
- The WQCC approved the AAS Petition on September 29, 2017.
- In February 2018, a workplan for supplemental investigations was submitted. Technical comments were provided by MMD and NMED in April 2018, and responses to comments were provided in June 2018.
- In 2018, supplemental investigations were carried out that included supplemental materials characterization and a geotechnical investigation.
- A geotechnical investigation memorandum and a supplemental materials characterization memorandum summarizing the field work and results were submitted in August and September 2018, respectively.
- The Closeout Plan was revised, updated, and submitted in March 2019.
- A request for Agency comments on the Closeout Plan was submitted by MMD to NMED in April 2019, requesting additional NMED comments on the updated plan.
- NMED provided comments on the Closeout Plan in August 2019 and stated that it was inconsistent with NMED’s approval of the Stage 2 Abatement Plan.
- MMD provided comments on the Closeout Plan in September 2019 and concluded that the closeout plan was not approvable as submitted.
- In 2019, UNC informed MMD and NMED of technical and environmental challenges associated with the Reclamation Design in the 2019 Closeout Plan and met with MMD and NMED to discuss an alternative Reclamation Design to address these challenges.
- In January 2020, Stantec provided an updated opinion of construction cost estimates for the reclamation of the Site based on the alternative Reclamation Design.
- On February 14, 2020, UNC met with MMD and NMED via conference call to outline an approach for the alternative Reclamation Design.
- In February 2021, UNC increased the interim financial assurance based on the 2020 updated construction cost estimates.

- USACE issued an Approved Jurisdictional Determination (AJD) determining no Waters of the United States existed within the St. Anthony Mine Site in March 2021.
- UNC submitted technical memoranda on the technical and environmental infeasibility of backfilling Pit 1 above the elevation of the Jackpile – Dakota contact in November of 2021.
- UNC submitted the 2022 Supplemental Characterization Report prepared by Stantec and describing the supplemental radiological characterization of an area south of Pit 1 at the Site, where the Old St. Anthony Mine was located and operated on August 25, 2023.
- The St. Anthony Stage 2 Abatement Plan Modification with an appended 30% CCOP was submitted to MMD on October 11, 2022.
- UNC received comments on the 30% CCOP from MMD and NMED on February 22, 2023.
- UNC received comments from NMED on the Stage 2 Abatement Plan Modification, on August 3, 2023.
- UNC submitted responses to comments on the CCOP on August 30, 2023.
- UNC submitted responses to comments on the Stage 2 Abatement Plan Modification to NMED on October 17, 2023.
- UNC submitted an Updated Site Revegetation Plan for the site and an Ecological Risk Assessment (ERA) for Pit 1 to MMD and NMED on November 30, 2023.
- Stantec conducted a geophysics program onsite to evaluate subsurface conditions in the vicinity of the Old St. Anthony Underground Mine workings in December 2023.
- NMED provided a 2nd round of comments on the Stage 2 Abatement Plan Modification on December 21, 2023.
- UNC responded to the 2nd round of NMED comments on the Stage 2 Abatement Plan Modification on February 5, 2024.
- MMD provided a 2nd round of comments on the 30% Design CCOP on March 12, 2024.
- UNC submitted an addendum to the Stage 2 Abatement Plan Modification on April 2, 2024, a memorandum presenting an evaluation of iron and manganese concentrations in groundwater.
- NMED issued 3rd round of comments on the Stage 2 Abatement Plan Modification and comments on the UNC S2AM addendum on July 3, 2024
- UNC responded to the 2nd round of MMD comments on the 30% Design CCOP on July 30, 2024.
- UNC responded on August 27, 2024 to NMED's 3rd round of comments on the Stage 2 Abatement Plan Modification and the UNC April 2, 2024 submittal for the Stage 2 Abatement Plan Modification.
- UNC submitted an addendum to the Stage 2 Abatement Plan Modification on October 10, 2024, a memorandum proposing AASs for iron and manganese.
- UNC received a letter on October 30, 2024 from the NMED Surface Water Quality Bureau supporting the private exemption for St. Anthony.
- NMED issued 4th round of comments on the Stage 2 Abatement Plan Modification on December 19, 2024. The letter to UNC included NMED's response supporting AASs for iron and manganese as well as acknowledgement that the NMED Mining Environmental Compliance Section had received a determination from the NMED Surface Water Quality Bureau that the private exemption is supported for St. Anthony.
- MMD issued a Technically Complete Letter with comments on the 30% Design CCOP on February 4, 2025.
- UNC responded to the Technically Complete Letter and requested concurrence on several updates to be included in the 90% CCOP on April 3, 2025.

- MMD sent a letter accepting responses to the April 3, 2025 letter and confirmed that MMD had no additional comments on the 30% CCOP and reconfirmed that the 30% CCOP was technically complete on April 4, 2025.

2.0 REGULATORY FRAMEWORK

2.1 MMD REQUIREMENTS

This 90% CCOP was prepared to comply with applicable provisions of the NMMA, the Mining Act Rules for Existing Mining Operations (NMAC 19.10.5), the NMWQA, and associated regulations (NMAC 20.6.4).

The NMMA is administered by the MMD. The MMD's Mining Act Rules and Mining Act Reclamation Program (MARP) Closeout Plan Guidelines were used to develop this closeout plan. NMAC 19.10.5.506.A states that *"... closeout plans shall be based on site-specific characteristics and the anticipated life of the mining operation. Site-specific characteristics include, but are not limited to, disturbances from previous mining operations, past and current mining methods utilized, geology, hydrology and climatology of the area."*

NMAC 19.10.5.506.B states that *"[a] proposed closeout plan or a proposed closeout plan for a portion of the mine shall include a detailed description of how the permit area will be reclaimed to meet the requirements of Section 69-36-11B(3) of the [NMMA] and the performance and reclamation standards and requirements of 19.10.5 NMAC."*

The closeout must be designed to achieve an SSE compatible with the PMLU, unless this requirement is waived by the Director (19.10.5.506.C).

MMD requires a financial assurance proposal when the applicant receives notice from MMD that the closeout plan is approvable; however, a financial assurance estimate may be submitted with the CCOP. The financial assurance shall be provided in an amount adequate to complete the reclamation. The financial assurance estimate will reflect the probable difficulty of reclamation or closure and include, at a minimum, the following costs:

- Mobilization and demobilization
- Engineering redesign
- Profit and overhead
- Procurement costs
- Reclamation or closeout management
- Contingencies

As noted in Section 1.4, UNC provided interim financial assurance in 2013 and updated it in 2021. UNC will update and submit the financial assurance cost estimate based on the 90% CCOP after MMD deems the 90% CCOP technically complete.

2.2 NMED REQUIREMENTS

The NMMA requires that MMD receive a written determination from NMED that the activities under the CCOP "will be expected to achieve compliance with all applicable air and water quality and other environmental standards." In addition to the requirements of the NMMA and associated rules, this 90%

CCOP is also designed to meet closure requirements under the New Mexico Water Quality Control Commission Regulations for Ground and Surface Water Protection (20.6.2 NMAC).

2.3 ABATEMENT PLAN AND PERMITS

NMED conditionally approved a previous Stage 2 Abatement Plan for St. Anthony Mine on May 7, 2015, (the Stage 2 Plan) (INTERA, 2015) to address poor quality water in the Jackpile sandstone (Jackpile) and Pit 1 attributable to mining activities. The Stage 2 Plan contemplated compliance with AASs (discussed below). UNC submitted a Stage 2 Abatement Plan Modification to NMED in October 2022 that incorporates the maintenance of a hydraulic sink in Pit 1 rather than the creation of a flow-through system to address long-term groundwater containment. In April 2024, UNC submitted an addendum to the Stage 2 Abatement Plan Modification proposing AASs for iron and manganese which were not included in the original AAS request. In December 2024, UNC received NMED's response supporting AASs for iron and manganese. The Stage 2 Abatement Plan Modification does not contemplate any other changes to the existing AASs.

The USACE issued an AJD on March 2, 2021, that no Waters of the United States exist within the St Anthony Mine Site. The AJD expires on March 2, 2026. UNC will request a new AJD from the USACE prior to the expiration of the current AJD and will comply with any related requirements.

Unless a specific activity related to the construction will result in a stationary source with air emissions that exceed those outlined in NMAC 20.2.72.200, a permit will not be required for air emissions. No such stationary source is anticipated. The earthwork contractor will be required to develop, and submit to UNC for approval, a dust control and mitigation plan to manage fugitive dust on the Site haul roads while trafficking the Site, excavating, and grading.

2.4 ALTERNATIVE ABATEMENT STANDARDS OVERVIEW

The WQCC approved AASs for the Jackpile on September 29, 2017. These AASs apply within an approximately 1,072-acre area, as generally depicted on Figure 3-1 and defined by the following property corners: northwest corner 35.17 degrees north and -107.32 degrees west, northeast corner 35.17 degrees north and -107.29 degrees west, southeast corner 35.15 degrees north and 107.29 degrees west, and the southwest corner 35.15 degrees north and -107.32 degrees west. Within this area, the following standards in Table 2-1 apply:

Table 2-1. Alternative Abatement Standards for Constituents of Concern (COCs)

Constituent	Amount
Uranium	12.4 mg/L
Radium (combined radium 226 and radium 228)	2,913 pCi/L
Fluoride	10.7 mg/L
Sulfate	77,000 mg/L
Total Dissolved Solids	113,000 mg/L
Boron	5.05 mg/L
Chloride	908 mg/L

mg/L=milligrams per liter; pCi/L= picocuries per liter

As described in the Stage 2 Abatement Plan Modification, groundwater within the approximate mine permit boundary and within the AAS boundary will comply with these AASs.

As noted in Section 2.3, UNC has presented AASs for iron and manganese in the 2024 addendum to the Stage 2 Abatement Plan Modification. Consistent with NMED's response to comments dated December 19, 2024, UNC anticipates that NMED will conditionally approve the Stage 2 Abatement Plan Modification and support the WQCC approval of the AAS for iron and manganese during a future proceeding before the WQCC.

3.0 SITE BACKGROUND AND DESCRIPTION

3.1 LOCATION AND LAND STATUS

The Site is located in Cibola County, New Mexico, in a remote, sparsely populated area, on the Cebolleta Land Grant approximately 40 miles west of Albuquerque and 4.6 miles southeast of Seboyeta. UNC operated the St. Anthony Mine, comprised of an open pit and underground shaft uranium mine, from 1975 to 1981, pursuant to a mineral lease with the Cebolleta Land Grant, the current owner of the surface and mineral rights. The original lease covered approximately 2,560 acres. This lease was obtained on February 10, 1964, and was surrendered by a Release of Mineral Lease dated October 24, 1988. UNC has access to the Site with the permission of the Cebolleta Land Grant and Lubo Land (formerly Lobo Partners), LLC through a 2008 access agreement.

The St. Anthony Mine includes a pair of underground workings mined during different periods of operations by different operators based on anecdotal evidence. The Site workings comprise one mine shaft and one vent shaft that are sealed at the surface; two open pits (one containing expressed groundwater); seven piles of non-economic mine materials; numerous smaller piles of non-economic mine materials; and three topsoil and/or overburden piles. The two open pits and the Old St. Anthony underground workings at the Site are located in Sections 19 and 30, Township 11 North, Range 4 West, and the entrance to the newer St. Anthony underground mine is located in Section 24, Township 11 North, Range 5 West. The land area disturbed during mining encompasses approximately 430 acres and includes roads, building and shaft pads, and former settling ponds along with the open pits and non-economic mine material piles. The majority of mine-related perturbations were confined to the permit area. Other than access roads (typical of rangeland two-tracks), there was little evidence of mining activity external to the permit area. The Site layout showing these features is shown on Drawing 3.

UNC owns the property to the north of the mine area which consists of approximately 292 acres, and soils on this parcel have been characterized for use as a source of borrow soil for Site reclamation. The land tract is located outside of the approximate mine permit boundary and is not included within the Site. The UNC property is used only for cattle grazing.

3.2 CLIMATE

The climate of the region, as summarized by measurements taken between 1905 and 2006 at the nearby Laguna, NM weather monitoring station (WRCC, 2019), has an average annual precipitation of 9.89 inches, with the heaviest precipitation falling as thunderstorms during July, August, and September. Pan evaporation rates obtained at the Los Lunas Station between 1962 and 1975 show an average annual evaporation approaching 52 inches (NOAA, 1982), or approximately five times the average annual precipitation.

The Site climate is arid to semi-arid with variable precipitation that is consistently exceeded by evaporation and transpiration demands (INTERA, 2015). Based on climatic records for Laguna, New Mexico (Station No. 294719), average annual precipitation is 9.9 inches, with the majority falling between

July and September (SWCA, 2020), whereas mean pan evaporation equals 63 inches per year and potential evaporation is estimated to be about 52 inches per year (INTERA, 2015).

3.3 GEOLOGY AND SEISMICITY

The Site is on the Colorado Plateau physiographic province, broadly characterized by plateaus of stratified sedimentary rock overlying tectonically stable Precambrian basement. The relatively high relief and dramatic topography of the Colorado Plateau formed as canyons were incised within thick sedimentary sequences. Within the southeastern portion of the Colorado Plateau lies the San Juan Basin, a structural depression encompassing most of northwestern New Mexico and adjoining parts of Colorado and Utah. The strata of the San Juan Basin dip gently to the north (approximately 2 degrees), although small faults and folds alter the dip of the strata locally. The San Juan Basin is truncated on its southeastern margin by the Jemez lineament, a northeasterly trending structural boundary between the Colorado Plateau to the northwest and the Rio Grande Rift to the south and east. The Site is within the Grants uranium district that lies on this transitional margin amidst many prominent Late Cenozoic volcanic fields that demarcate the Jemez lineament and the southeast margin of the San Juan Basin.

The contemporary seismicity of the Colorado Plateau physiographic province has been investigated by seismic monitoring (Wong and Humphrey, 1989). The Wong and Humphrey study characterized the seismicity of the plateau as small to moderate magnitude with a low to moderate rate of widely distributed earthquakes. The United States Geological Survey unified hazard tool yields a peak ground acceleration of 0.14 g for the 2,475-year return period earthquake at the Site coordinates. This assessment is based on a shear-wave velocity in the upper 100 ft of the subsurface of 760 m/s for the Site Class B/C boundary condition. Site- specific shear wave velocity data has not been collected.

Sediments in the Grants area were deposited in various continental environments. During late Permian time, the area now defined by the San Juan basin was an active seaway connecting the central New Mexico Sea with the Paradox basin in Utah. During this time, the Glorieta sandstone and San Andreas limestone were deposited. The region was subsequently uplifted in Laramide time and fluvial, lacustrine, and aeolian sediments of the respective Chinle Formation, San Rafael Group, and Morrison Formation were deposited. Upper Cretaceous strata consist of marine shore zone sandstones, marine shales, and various continental deposits. In ascending order, these are represented by the Dakota Sandstone, Mancos Shale, and the Mesaverde Group.

Stratigraphy of interest at the Site includes the Mancos Formation (Late Cretaceous), the Dakota Formation (Early and Late Cretaceous) and the Morrison Formation (Late Jurassic). The surficial geologic unit at the Site is the Mancos Formation consisting of three sandstone units and interbedded shale units with a maximum thickness of 465 feet. The upper sandstone caps Gavilan Mesa to the south of the pits. The Dakota Formation sandstone is 6 to 20 feet thick in the Site area. The Morrison Formation is approximately 600 feet thick and is comprised of the Jackpile Member (sandstone), the Brushy Basin Member (interlayered mudstone and sandstone), the Westwater Canyon Member (sandstone), and the Recapture member (interbedded claystone and sandstone).

Uranium production at the Site was from the Jackpile Member with each pit penetrating approximately 75 feet into this unit. The thickness of the Jackpile sandstone in the Site vicinity varies from 80 to 120 feet and is representative of deposition in a braided stream environment.

3.4 SURFACE WATER HYDROLOGY

The surface topography at the Site and the surrounding area is a combination of steep-sided mesas separated by broad, gently sloping valleys. The drainage channels incised into these valleys were infilled with alluvial and colluvial deposits. Most if not all drainage channels at the Site are ephemeral and only flow during, and shortly after, a precipitation event.

The greatest stormwater runoff rates result from thunderstorms that occur between the summer and early fall months. As described by Sabol et al. (1982), typical New Mexico thunderstorms have three phases: (1) a short-duration, low-intensity phase, (2) a higher intensity period, and (3) a longer, low-intensity period. The initial, low-intensity period fills potential rainfall loss reservoirs such as interception, depression storage in soils, and reducing the water storage capacity of soils. In extreme rainfall events, the short-duration, high-intensity rainfall often exceeds the infiltration capacity of the soil.

The St. Anthony underground workings, waste piles, the larger Pit 1, and smaller Pit 2 are located within the Arroyo del Valle Subwatershed of the Arroyo Conchas Watershed (Figure 3-1). As defined by the US Geological Survey (USGS) National Watershed Boundary Dataset, the Arroyo Conchas Watershed has a 10-digit hydrologic unit (HU) code of 1302020708 and the Arroyo del Valle Subwatershed has a 12-digit HU code of 130202070802. The Subwatershed contains the ephemeral Meyer Draw, which separates the overburden piles from the two open pits, and its Arroyo del Valle ephemeral tributary, which joins Meyer Draw downgradient of Pit 1 (Figure 3-1). Arroyo del Valle Subwatershed empties to the Rio San Jose, which empties to the Rio Puerco, which empties to the Rio Grande. The channel length between the Meyer Draw Arroyo at the downstream end of the Site and the confluence of the Rio Puerco with the Rio Grande is 93 miles. Nearly all the area within the St. Anthony AAS boundary is contained within the Arroyo del Valle Subwatershed except the southwest corner that falls within the Rio Moquino Subwatershed (Figure 3-1).

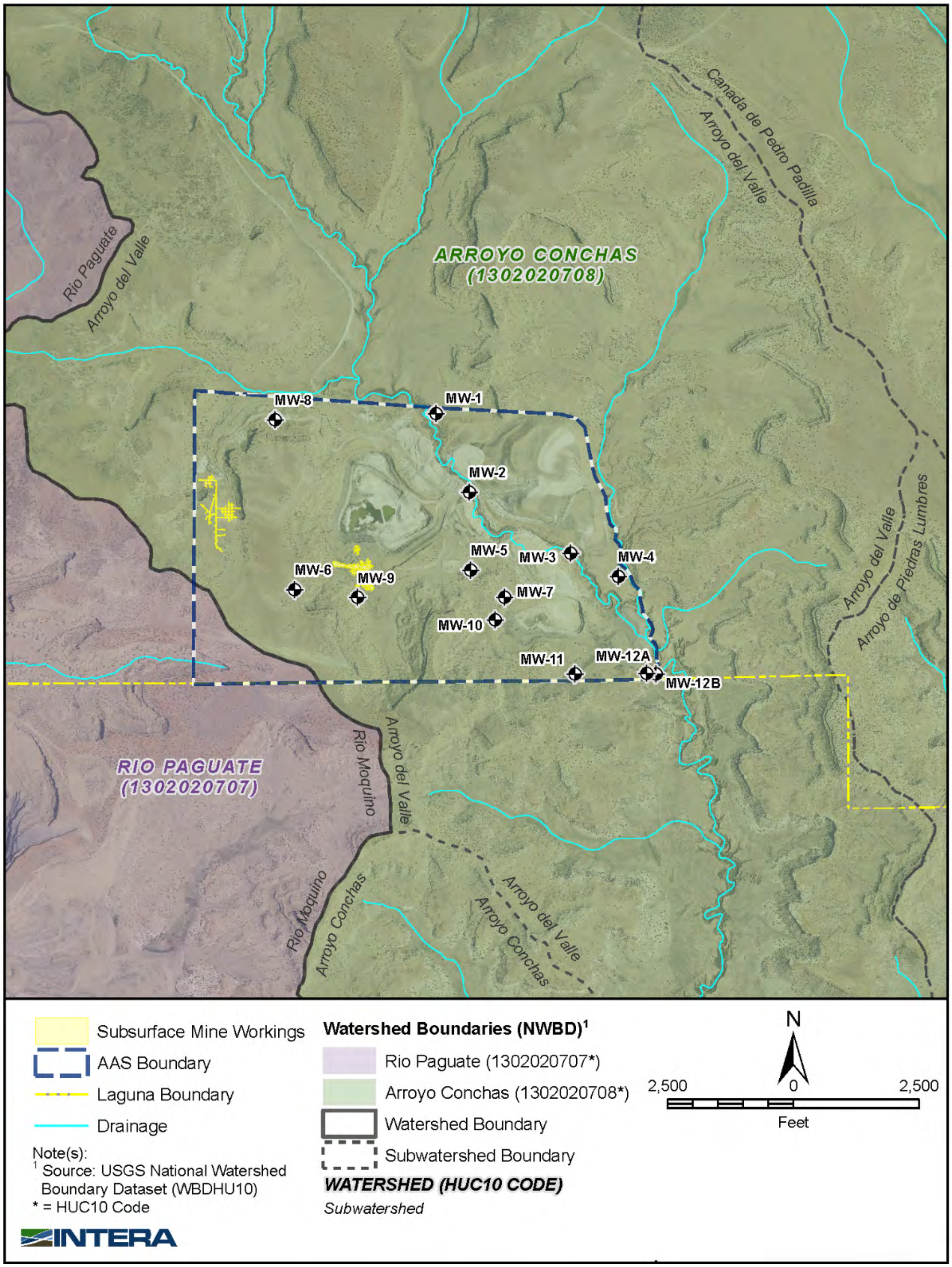


Figure 3-1. Watersheds and Subwatersheds Surrounding St. Anthony

At the Site scale, water in Meyer Draw, and its Arroyo del Valle tributary, typically only flows or pools in direct response to a significant precipitation event. Water from precipitation rarely appears in either Meyer Draw or the Arroyo del Valle tributary (INTERA, 2015). In recent years, unpredictable, non-continuous upstream water discharges, attributable to pumped groundwater used for agricultural and stock watering, have been observed in Meyer Draw (SWCA, 2020). Expressed water ponds within Pit 1 and is completely contained within the pit (INTERA, 2015). Ponded water in Pit 1 is considered exempt from water quality standards as a private water per the letter to UNC from the NMED Surface Water Quality Bureau dated October 30, 2024. The NMED letter dated December 19, 2024 containing the 4th round of comments on the Stage 2 Abatement Plan Modification included the NMED Mining Environmental Compliance Section acknowledgement of receipt of the determination from the NMED Surface Water Quality Bureau that the private exemption is supported for St. Anthony.

3.5 HYDROGEOLOGY AND WATER SUPPLY

The Site is located in the southeastern part of the San Juan Basin, a large structural basin that encompasses roughly 21,000 square miles within New Mexico, Colorado, Arizona, and Utah (Kelley, 1963; Craigg, 2001). Like other areas in the San Juan Basin, the groundwater for the Site and the surrounding region derives primarily from recharge in the topographically high areas and flows toward discharge areas at lower elevations (Stone et al., 1983). Locally, recharge likely occurs to the northwest of the Site in the San Mateo Mountains, which comprise Mt. Taylor and the Mesa Chivato volcanic field. At a regional scale, groundwater in the Dakota Sandstone and sandstone units of the Morrison Formation, including the Jackpile sandstone, flows from the north across the Site to the south/southeast. Regional groundwater contours, developed by the New Mexico Office of the State Engineer (NMOSE) (NMOSE, 2002) highlight groundwater recharge in the San Mateo mountains and flow to the southeast in the vicinity of the Site (INTERA, 2015).

Groundwater in extractable quantities has been observed in the Cretaceous Dakota Sandstone and the Jackpile Sandstone and Westwater Canyon Member (Westwater) of the Jurassic Morrison Formation. At the Site, both the Dakota Sandstone and the Jackpile unit are exposed but not the Westwater, which lies roughly 200 feet below the Jackpile. Given its greater depth, the Westwater contains groundwater within the Site and its vicinity. Groundwater is found in the Jackpile across nearly all the Site apart from the southern areas where the Jackpile is essentially unsaturated (INTERA, 2015). The Dakota Sandstone is unsaturated where it surrounds Pit 1 and to the south (INTERA, 2015). However, field notes and bore log record observations of groundwater in the Dakota at St. Anthony monitoring well MW-8, located about 1,900 feet north of Pit 1, and at three monitoring wells for the JJ mine site, located between 4,500- and 7,600-feet northwest of the Site (INTERA, 2021). Other studies in the St. Anthony area indicate that there are discontinuous water-bearing zones in the Cretaceous Mancos Shale’s sandstone intervals commonly referred to as “Tres Hermanos” (INTERA, 2006).

The Jackpile Sandstone is the hydrostratigraphic unit of primary interest to the CCOP because it contains naturally mineralized, poor-quality groundwater, some of which flows into Pit 1. Consisting of a 70 to 200-foot-thick lens of relatively well-lithified, medium- to coarse-grained, arkosic sandstone, the Jackpile sandstone has a relatively low hydraulic conductivity (0.005 to 0.9 foot/day) and, where saturated, generally has low yields of groundwater (Owen, et al., 1984; Zehner, 1985; INTERA, 2015).

The Jackpile Sandstone is bounded by adjacent layers with much lower hydraulic conductivity that act as confining layers. Confining layers can impede vertical flow out from the confined groundwater unit. The Brushy Basin mudstone that underlies the Jackpile acts as the lower confining layer because the mudstone has a much lower hydraulic conductivity than the Jackpile (INTERA, 2015). The upper confining layer comprises the kaolinitic cements in the upper Jackpile and, where present, a mudstone or clay interval at the bottom of the Dakota Sandstone (INTERA 2015). The upper part of the Jackpile has kaolinitic cements that fill the pore space, and as discussed below, appear to create a confining interval within the Jackpile itself (Schlee and Moench, 1961; Kittel, 1963; Sections 3.3.4 and 5.1.1 in INTERA, 2015).

On a regional scale, groundwater in the Jackpile flows from the north and northwest, where groundwater heads are highest, toward the south and southeast, where groundwater heads are lowest (Figure 3-2). Evaporation of the expressed water present in Pit 1 acts like a well pumping from the Jackpile and continues to decrease groundwater heads around the pit, creating a groundwater cone of depression (INTERA, 2006, 2015, 2017, 2019; see Figure 3-2 groundwater head contours in and around Pit 1). Jackpile groundwater flows into Pit 1 because evaporation removes inflowing groundwater at a rate sufficient to keep the elevation of the expressed water very close to the pit floor’s lowest elevation of about 5,850 feet above mean sea level (ft amsl). Groundwater flows out from the Jackpile sandstone into the subsurface alluvial sediments of Meyer Draw, where it is lost to transpiration by tamarisk trees (INTERA, 2015). The alluvial sediments have an estimated thickness of 15 to 25 ft and were deposited into a channel incised into the Jackpile by erosion (INTERA, 2015). Based on data for the Jackpile top elevation and 2011-2013 groundwater heads (INTERA, 2015, 2017, 2019), confined conditions extend across the JJ mine area (green overlay color in Figure 3-3) whereas unconfined conditions extend across most of the Jackpile-Paguate and St. Anthony mines (purple overlay color in Figure 3-3). Unconfined conditions in the Jackpile at St. Anthony Mine are caused mainly by the gradual rise in the Jackpile’s bottom elevation and, locally, by the Pit 1 hydraulic sink. The Jackpile is unsaturated southeast of the unconfined conditions (Figure 3-3), including at the St. Anthony MW-12a and MW-12b monitoring wells (Figure 3-2), because the bottom elevation of the Jackpile is higher than groundwater heads to the north and northwest (Figure 3-3). Given the observed, confined conditions for Jackpile groundwater at some monitoring wells, the Jackpile’s kaolinitic cements and the mudstone at the base of the Dakota Sandstone, where present, have a lower vertical and horizontal hydraulic conductivity than that in the rest of the Jackpile (INTERA, 2015, 2017, 2019, 2021).

The Dakota Sandstone is the second hydrostratigraphic unit of interest to the 90% CCOP because it overlies the Jackpile Sandstone and is used as a drinking water supply outside the Site. Although the Dakota Sandstone is relatively thin locally - ranging in thickness from 6 to 20 ft, its representative thickness is about 50 ft at the regional scale. The Dakota Sandstone is a white and light gray, fine- to medium-grained, sugary-textured, well-cemented sandstone. However, examination of its exposures in Pit 1 reveals that the Dakota Sandstone tends to be highly fractured.

As noted above, the Dakota is completely unsaturated around the two St. Anthony pits and the southern part of the Site, but it is saturated farther to the north.

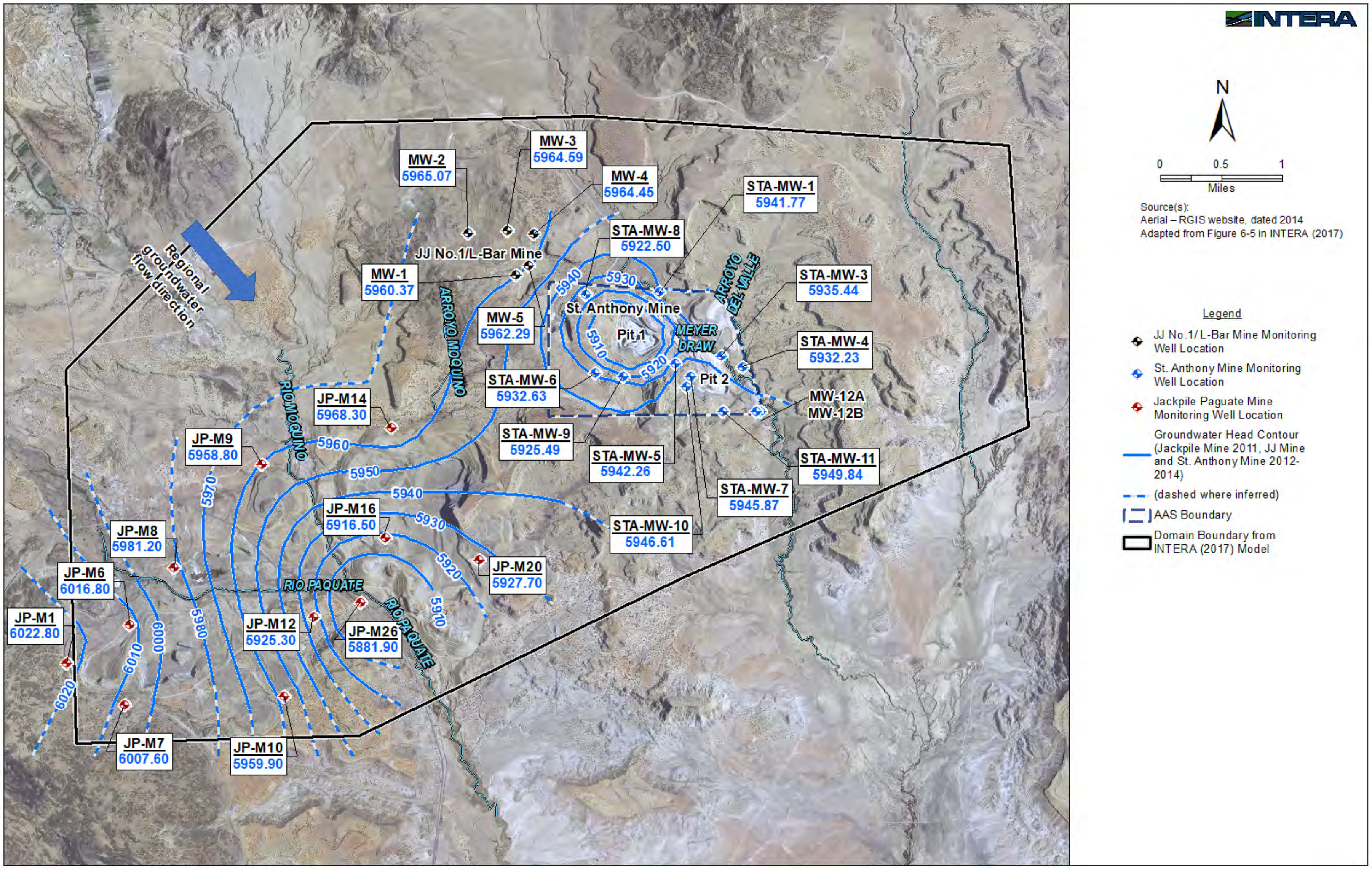


Figure 3-2. Estimated Contours for Groundwater Heads under 2011-2013 Conditions (adapted from Figure 6-5 in INTERA, 2017)

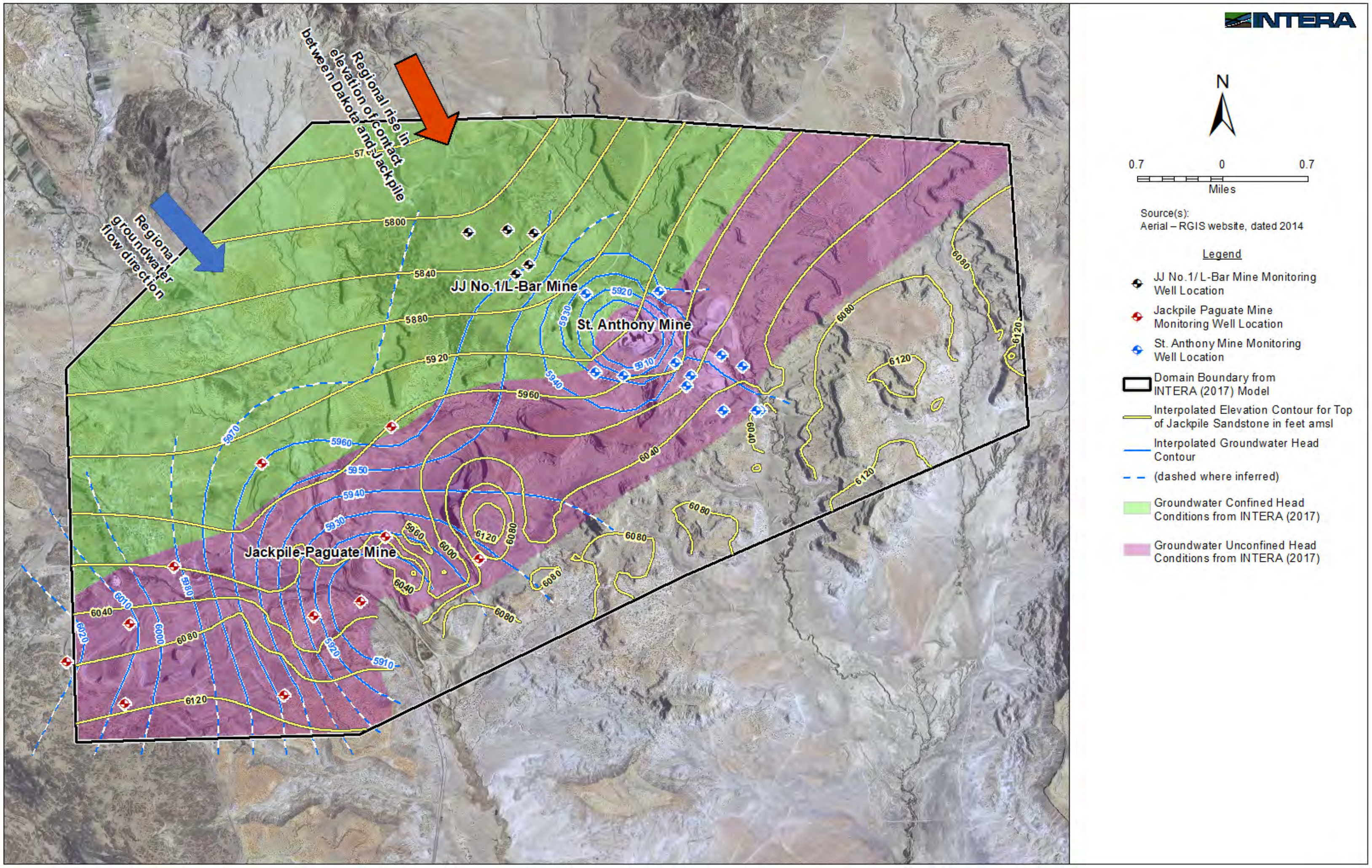


Figure 3-3. Top Elevation of Jackpile Sandstone, Estimated Groundwater Head Contours, and Estimated Areas with Confined and Unconfined Groundwater Conditions (adapted from Figure 6-7 in INTERA, 2017)

3.5.1 Water Supply

Supply wells in the area typically extract water from one or more of the sandstone units, including the Tres Hermanos in the Mancos Shale, the Dakota Sandstone, the Jackpile, a sandstone lens in the Brushy Basin mudstone, and the Westwater. Wells with multiple open intervals indicate that the shallower sandstone units, e.g., Tres Hermanos, Dakota Sandstone, and Jackpile, do not yield sufficient amounts of water, thus necessitating extraction from the deeper and more productive Westwater.

Information compiled from a recent query of the NMOSE's Waters Database revealed there are sixteen water supply wells that are screened in the Jackpile Sandstone and may withdraw Jackpile groundwater within a 5-mile radius of the Site (Figure 3-4). Evidence of pumping is available for ten of the sixteen wells. Where available, the reported screened intervals were compared to INTERA's geologic model to interpret the targeted stratigraphic units. At least five of these wells intercept three to four sandstone units including sandstone intervals found in the Dakota, Jackpile, Brushy Basin, and Westwater stratigraphic units (Table 3-1). Other wells may intercept fewer stratigraphic units. NMED and NMOSE have restricted the construction of new supply wells or changes to the point of diversion of existing supply wells within the site AAS boundary (NMOSE, 2018).

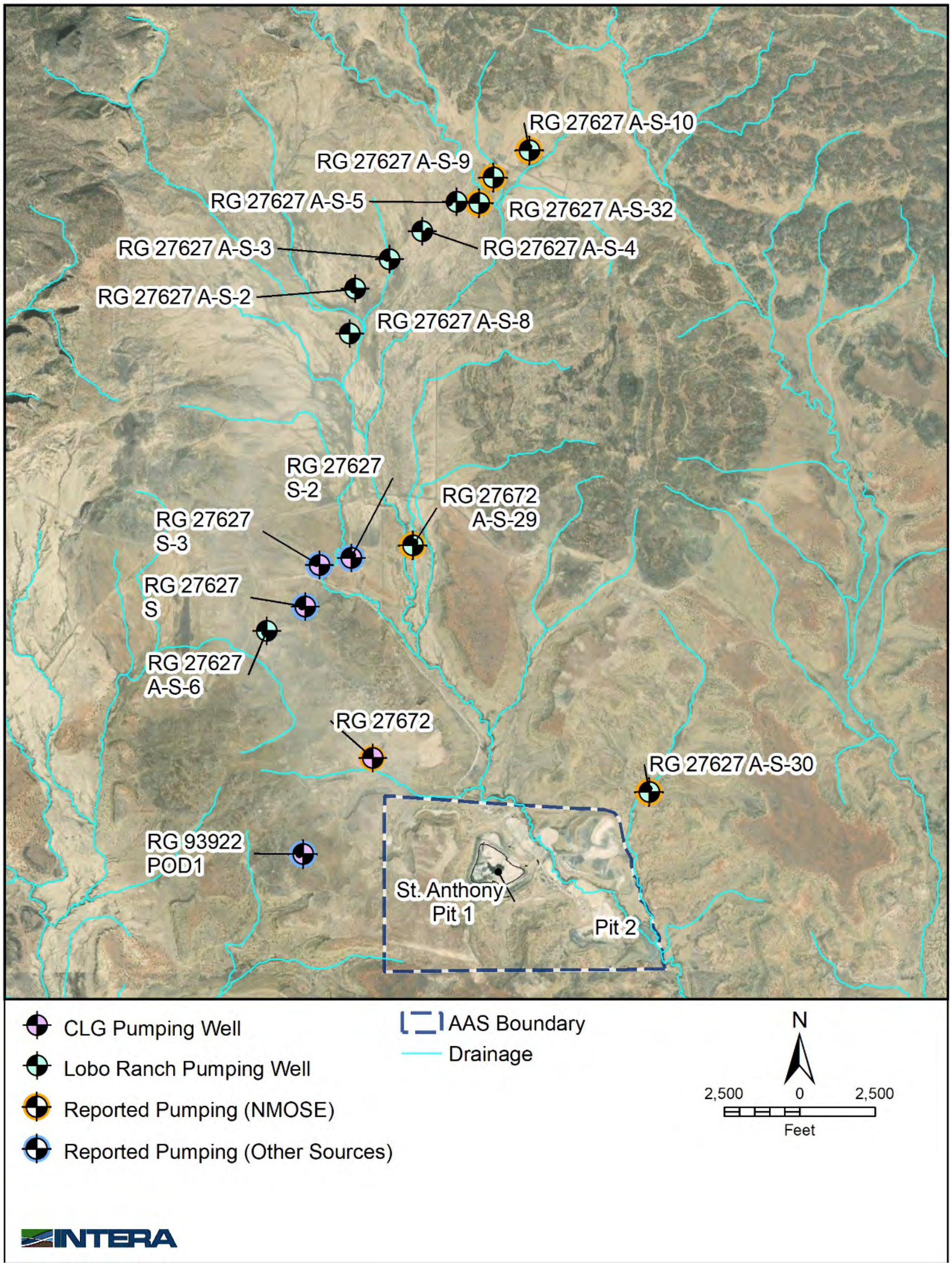


Figure 3-4. Active or Potentially Active Water Supply Wells near St. Anthony

The query revealed records for sixteen wells, owned by either the Cebolleta Land Grant (CLG) or the former Lobo Ranch Partners, LLC (Lobo Ranch) within five miles of the Site. The new owners of the Lobo Ranch are reported to be Lupo Land LLC. Of the sixteen well records, eight water supply wells are found within a 2.5-mile radius of the Site, and nine others are found three to five miles from the Site (Table 3-1 and Figure 3-4). All wells in the Waters Database within five miles of the Site are located upgradient of the Site, relative to the direction of groundwater flow, under current conditions in which Pit 1 acts as a hydraulic sink. Wells RG 93922 and RG 27672 A-S-30 are within 2.5 miles of the Site and are used for stock watering (Table 3-1), whereas RG 27672 A-S-29 is within 2.5 miles of the Site and is used for irrigation. Well RG 27672 has NMOSE production records and is also within 2.5 miles of the Site, but neither the water usage nor construction information are listed within the NMOSE Waters Database. Well RG 27627 A-S-6 is within 2.5 miles of the Site but has no production, or construction information, and is therefore considered a water supply well with potential withdrawal from the Jackpile Sandstone. The remaining three wells within 2.5 miles of the Site are RG 27672 S, RG 27672 S-2, and RG 27672 S-3. These wells do not have production or screen interval information, but personal communication with the CLG personnel indicates that these wells have been pumped over the past decade.

The query revealed limited information regarding well construction and production rates for the CLG wells near the Site. CLG well RG 93922 is listed as having its entire length (0 to 745 ft) perforated. Totalizer data obtained from RG 93922 suggests pumping from at least 2019 through 2020. The query result of another CLG water well, RG 27672, has NMOSE pumping records that span 2011 through 2013, but no well construction information is available. Personal communication with CLG staff about RG 27672 pumping indicates that its reported pumped volume more likely came from CLG wells RG 27672 S, RG 27672 S-2, and/or RG 27672 S-3 as opposed to RG 27672.

Well construction and production information is available for several Lobo Ranch supply wells near the Site. Well RG 27627 A-S-30, located less than one mile east of the Site, is listed as having a 20-foot-long screen interval with intermittent pumping spanning 2015 through 2020. Comparison of the well's reported screen interval depth to INTERA's Jackpile geologic model (see Section 5.1.5 in INTERA, 2015) suggests that this well is likely screened in the Jackpile Sandstone. Well RG 27627 A-S-29, located just under two miles from the Site, has reported pumping from 2017 through 2020 and its shallowest screen interval intercepts the Jackpile Sandstone. Four Lobo Ranch wells with pumping and/or construction information are located within a three-to-five-mile radius of the Site and include RG 27627 A-S-8, A-S-9, A-S-10, and A-S-32. The Jackpile Sandstone, based on modeled top and bottom elevations, is located just below the shallowest screened interval for wells A-S-8, A-S-9, and A-S-10. Intermittent pumping from 2010 through 2020 is reported for A-S-9 and A-S-10, and there are no pumping records at well A-S-8. RG 27627 A-S-32 has production (2015 through 2020) but no construction information, although it is expected that the well is constructed similarly to nearby wells RG 27627 A-S-9 and RG 27627 A-S-10. The five remaining Lobo Ranch wells have neither construction nor production information but are considered potential water supply wells because their production within Jackpile Sandstone cannot be ruled out. These wells include RG 27627 A-S-2, A-S-3, A-S-4, A-S-5, and A-S-6.

The well construction information in Table 3-1 is consistent with the characterization of the Jackpile Sandstone as a low-permeability unit that yields low flows to wells. The two wells nearest the Site are used only for stock watering, one of which, RG 93922, has a 745-foot-long perforated interval. Although many of the RG 27627 wells intercept the Jackpile Sandstone, they were drilled an additional 300 to 400 ft below the bottom of the Jackpile Sandstone and constructed with two or three screened intervals below the Jackpile Sandstone to intercept higher yields of groundwater.

As explained above, water supply wells also extract water from the Dakota Sandstone. The Village of Moquino used a Dakota Sandstone supply well at a depth of about 300 to 350 ft, approximately 3.7 miles west-northwest and upgradient of the Site. The Moquino well was supplemented in approximately 1990 by a deeper well into the Westwater Canyon sandstone.

Table 3-1. Jackpile Sandstone Water Wells Within 5 Miles of the St. Anthony Mine

Well ID	Approximate Distance and Orientation from Pit 1	Total Depth (ft)	Depth to Screened Intervals (ft)	Reported Source Unit	Interpreted Stratigraphic Source Unit[1]	Water Usage	Owner	Source of Reported Pumping
RG 93922	6,200 feet west	745	0-745	--	Tres Hermanos, Dakota, Jackpile, & Brushy Basin or Westwater	Stock	CLG	Field Totalizer
RG 27672	5,400 feet northwest	--	--	--	--	--	CLG	NMOSE
RG 27672 S	10,600 feet north/northwest	510	--	--	--	--	CLG	CLG personal comm
RG 27672 S-2	11,300 feet north/northwest	535	--	--	--	--	CLG	CLG personal comm
RG 27672 S-3	11,500 feet north/northwest	353	--	--	--	--	CLG	CLG personal comm
RG 27672 A-S-2	19,600 feet north/northwest	1,050	--	--	--	Irrigation	Lobo Partners	--
RG 27672 A-S-3	20,400 feet north/northwest	1,085	--	--	--	Irrigation	Lobo Partners	--
RG 27672 A-S-4	21,100 feet north/northwest	1,150	--	--	--	Irrigation	Lobo Partners	--
RG 27672 A-S-5	22,000 feet north/northwest	1,120	--	--	--	Irrigation	Lobo Partners	--
RG 27672 A-S-6	11,000 feet west/northwest	1,660	--	--	--	Irrigation--	Lobo Partners	--
RG 27627 A-S-8	18,170 feet north	1,215	595-725 845-910 1,050-1,072	Sandstone/ Gravel/ Conglomerate	Jackpile Sandstone, Brushy Basin, & Westwater	Irrigation	Lobo Partners	--
RG 27627 A-S-9	22,800 feet north	1,110	640-720	Jackpile Sandstone	Dakota & Jackpile Sandstone	Irrigation	Lobo Partners	NMOSE
			852-885	Sandstone	Brushy Basin			
			970-1097	Westwater Sandstone	Westwater Sandstone			
RG 27627 A-S-10	23,740 feet north	1,140	640-730	Jackpile Sandstone	Dakota & Jackpile Sandstone	Irrigation	Lobo Partners	NMOSE
			820-880	Sandstone	Brushy Basin			
			980-1100	Westwater Sandstone	Westwater Sandstone			
RG 27627 A-S-29	11,000 feet north	800	400-475	Jackpile Sandstone	Dakota & Jackpile Sandstone	Irrigation	Lobo Partners	NMOSE
			650-675	Brushy Basin Sandstone	Westwater Sandstone			
			710-800	Westwater Sandstone				
RG 27627 A-S-30	5,680 feet northeast	400	160-180	Other/Unknown	Jackpile Sandstone	Stock	Lobo Partners	NMOSE
RG 27627 A-S-32	21,900 feet north	--	--	--	--	--	Lobo Partners	NMOSE

[1] Based on INTERA Geologic Model

3.6 VEGETATION

Three vegetation ecotypes dominate the area surrounding the Site: 1) grassland ecotypes, 2) juniper scrub ecotype, and 3) bottomland ecotype. A sub-ecotype, riparian drainage bottom (Tamarisk), is also present in drainage bottoms within the bottomland ecotype. Several Site-specific evaluations have been completed by Cedar Creek, including the most recent in 2023, (Cedar Creek, 2023b) which describes the vegetation ecotypes at the Site as consisting of grassland, Juniper scrub, and bottomland. Aside from occasional road crossings, the riparian drainage bottom ecotype was largely avoided by past mining activities.

Grasslands are herbaceous communities dominated by grasses and occasional forbs that can sometimes be seasonally dominant. Trees and larger shrubs are largely absent from this type except for the occasional invader of local sites. Grasslands in this part of New Mexico may be dominated by annual grasses, perennial bunchgrasses, or perennial sod-forming grasses and typically of the warm-season group. In the area of the Site the grasslands are of this latter warm-season perennial sod-forming group. Soils tend to be deep (greater than 6 feet). Typical geomorphic features are floodplains, alluvial fans, and fan remnants.

The Juniper scrub ranges between a “savanna” of scattered trees within the benched high-plains grassland, to dense, woody-dominated areas with very poor herbaceous understories. The Juniper scrub ecotype is usually associated with rock outcroppings and thin and skeletal soils, often with a sandy texture. Occasional Piñon are found throughout the ecotype.

The bottomland ecotype is primarily characterized as having higher available water within the soil profile (more loamy, less sandy). Also, the higher available water is due to the ecotype being physically located in the arroyo bottoms that tend to collect surface runoff and fine-textured erodible materials. The increased soil moisture and loamy texture lead to increased vegetative cover from herbaceous taxa. Visible salt crusts were noted within the drainage bottom and along the cut banks. The arroyo is deeply incised, and the upland grasslands immediately adjacent to the arroyo are not subject to flooding from typical precipitation events. On occasion, the bottomland community can exhibit areas of shrub domination by four-wing saltbush in areas exhibiting moderately elevated salt accumulations but can also exhibit areas of dominance by winterfat or Bigelow’s sagebrush. Other areas may be nearly absent of shrubs, and grasses (and rarely forbs) are dominant. Tamarisk and other noxious weeds were also noted in the drainage bottoms as part of the riparian drainage bottom ecotype. This ecotype was observed to be in a deteriorated condition due to natural disturbances (e.g., frequent flooding and dominance of Tamarisk and other weedy taxa) unrelated to past mining activity. Physical effects associated with frequent, severe flooding along the riparian drainage bottom were readily evident and included features such as deeply incised channels, large deposits of sediment, flood debris at elevated locations, and poorly consolidated soils.

3.7 WILDLIFE AND CULTURAL RESOURCES

3.7.1 Wildlife

A wildlife survey was completed as part of the original closeout plan (Cedar Creek, 2006). The survey findings are summarized here. Wildlife habitats observed on the Site included Rim Rock & Cliff Faces (rim rock), seasonal water sources (stock tanks and remnant ponded water of pits), and the four vegetation ecotypes including grassland, bottomland, juniper scrub, and a sub-ecotype tamarisk dominated riparian drainage bottom. Habitats not within the former mine disturbance footprint were observed to be of good quality, except for the riparian drainage bottom. The rim rock habitat offered opportunities for cliff nesting raptors and smaller avifauna, though no nests were observed along transects through this habitat. The boulder and cobble fields below the cliff escarpments provide escape cover to small mammals and herpetofauna. Grasslands and juniper scrub habitats exhibited light to moderate utilization by domestic livestock. In contrast, the riparian drainage bottom offered poor quality wildlife habitat due to the significant stands of tamarisk and other invasive vegetation species that degrade the quality of habitat for wildlife foraging and nesting.

Big game species observed onsite included elk, mule deer, and black bear. Smaller mammals and their signs observed onsite included prairie dogs, rabbits, and mice. Small raptors were observed flying through, or foraging on, the Site, including sharp-shinned hawks, prairie falcons, and red-tailed hawks. Other indigenous fauna observed throughout most habitats included common migratory bird species, lizards, and snakes.

Only three seasonal water sources (livestock watering facilities or stock tanks) were observed within the study area aside from the ponded water remnant in the bottom of Pit 1. Shorebird and mule deer tracks were observed along the mudflats of a livestock watering facility located outside of the Site.

During a Site visit in January 2023, two large stick nests were observed onsite near Pit 1 by personnel from New Mexico Department of Game and Fish (NMDGF), MMD, and members of UNC's closure team. UNC will conduct a comprehensive nest survey in February/March prior to, and in the same year, ground disturbance activities onsite will begin, so that appropriate spatial and temporal buffers during construction activities can be applied. UNC will provide a report summarizing the findings of the raptor nest survey following the field survey.

3.7.2 Cultural Resources

Lone Mountain Archaeological Services performed cultural resources surveys of the Site and borrow areas in 2006 (LMA, 2006). The reports are included as Appendix A. The cultural resource surveys included record searches of known historic sites in the vicinity of the St. Anthony Mine and a complete pedestrian survey of disturbance areas. The surveys were performed under the NM Cultural Resources Information System (NMCRIS) No. 98419, State Permit No. NM 06-073 and NMCRIS No. 108738, State Permit No. 08-073. Sixteen archaeological sites, one previously reported archaeological site, and numerous isolated occurrences were recorded during the survey. Six of these identified sites and isolated occurrences are in proximity to soil excavation areas and one occurrence is within a proposed soil borrow area. Because the sites are near the perimeters of the work areas, Stantec proposes establishing a minimum 50-foot buffer around the locations prior to initiating earthwork. A qualified archaeologist will review sites located within soil reclamation areas once the buffers have been established. The locations of the identified sites and isolated occurrences are not shown in this document and have been redacted from the report in Appendix A.

3.8 MINING HISTORY AND CURRENT STATUS

The St. Anthony Mine was operated by UNC from 1975 to 1981 (NMED, 1995). The Site property was leased by UNC from the Cebolleta Land Grant during mine operations and the lease was terminated in 1988. Excavation of Pit 2 was initiated in November 1975 and excavation of Pit 1 was initiated during the summer of 1976. Both pits extended approximately 75 feet into the Jackpile Sandstone (Baird et al., 1980). An aerial photo from 1962 indicates that the Old St. Anthony underground mine was operating prior to development of the pits.

UNC also operated an underground mine, approximately 2,500 feet west of Pit 1. The shaft for the underground mine was in a short canyon that is separated from the rest of the Site by a portion of the Gavilan Mesa. The shaft construction for the underground workings began in January 1977 and was completed to a depth of approximately 357 feet, deep enough to extend below the Jackpile sandstone to the top of the Brushy Basin Member of the Morrison Formation. A second underground mine known as the Old St. Anthony Mine, not operated by UNC, was present onsite and located south of Pit 1. Limited historical details are available for this mine and its operation pre-dates the underground workings west of Pit 1 and the development of the open pits.

The UNC underground operation was suspended in June 1980 and the open pit operation ceased in August 1980. Stockpiled ore was hauled from the Site to area mills until 1981. The St. Anthony mine produced approximately 280 tons of triuranium octaoxide (U_3O_8) in 1979 and approximately 288 tons U_3O_8 in 1980 (NMED, 1995).

Closure activities at the mine were completed in 1984 and 1985, and the mineral lease was surrendered in 1988. Closure consisted of capping the St. Anthony mine shaft and vent hole at the surface and removing equipment and buildings, trash cleanup and fence repair. Closure of the shaft and vent were documented in a letter to MMD in December 2006 (UNC, 2006).

A preliminary Site Assessment was performed in 1995 by the NMED in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations (NMED, 1995). The results were submitted to the US Environmental Protection Agency (EPA), which concluded that further investigation was not warranted under the Superfund regulations. In 2000, water samples obtained from Pit 1 by the MMD and NMED during two Site visits revealed elevated levels of several constituents. Elevated levels were attributed primarily to the concentration of naturally-occurring groundwater constituents occasioned by evaporation of water in the pit bottom.

UNC has no plans for future mining activities at the Site.

4.0 SITE CHARACTERIZATION

4.1 RADIOLOGICAL DATA SUMMARY (2007, 2018-2019, AND 2022)

4.1.1 2007 Site Characterization

A surface and subsurface Materials Characterization was conducted at the Site between April 2006 and July 2007, as described in the Materials Characterization Report (MWH, 2007b) which is included in Appendix B. The 2007 Materials Characterization included investigation of surface and subsurface materials at various areas within, and near, the Site in accordance with the approved Materials Characterization Work Plan (MWH, 2007a). The purpose of the 2007 Materials Characterization was to evaluate soil suitability as a growth media and radiological risk. The Materials Characterization included a radiological survey of non-economic materials at the Site; drilling and sampling of non-economic materials; and sampling of potential cover material borrow sources. The radiological characterization focused on the borrow and stockpile sources, non-economic materials piles, and mine facilities within the Western Shaft Area.

Several methods were employed in the 2007 Materials Characterization. A gamma exposure rate survey was conducted in each area on a regular grid and judgmental gamma measurements were collected in Pits 1 and 2 to characterize small non-economic piles located within the pits, using a Ludlum Model 19 µR meter. Following the gamma survey, surface and subsurface soil samples were collected from the ground surface, test pits and drill hole samples and analyzed for:

- Radiochemical parameters (uranium, gross alpha, Ra-226, thorium 230)
- Metals in leachate (13 metals, gross alpha, Ra-226, Ra-228)
- Agronomic properties

Over 300 gamma measurements were collected at the Site, including the main mine area (where the open pits are located) and the Western Shaft Area. Gamma measurements ranged from 5 to 800 microroentgen per hour (µR/hr) with a mean of 55 to 100 µR/hr, depending on the measurement method (i.e., shielded, or unshielded). The highest gamma measurements (145 to 600 µR/hr) came from the following areas:

- Pile 7 (east of Pit 1)
- Crusher Stockpile Area (northeast of Pit 1)
- West Disturbance Area (southeast of Pit 1)
- Mine Dump (underground area)
- Ore Storage Areas 1 and 2 (underground area)
- Ponds 1 and 4 (underground area)
- Shaft Access Road (underground area)

Gamma measurement (contact shielded) from the background area ranged from 5 to 13 µR/hr (mean 8 µR/hr). Gamma measurements from the borrow areas and the topsoil piles ranged from 4 to 13 µR/hr (mean 7 µR/hr). The Materials Characterization Report (MWH, 2007b) presents measurements from the background reference area and the borrow areas.

Approximately 100 surface and subsurface soil samples were collected for analysis. The results were as follows:

- Ra-226 – ranged from non-detect to 611 pCi/g (mean 59.9 pCi/g)
- Uranium – ranged from non-detect to 1,660 milligrams per kilogram (mg/kg) (mean 164.2 mg/kg)
- Thorium – ranged from non-detect to 602 pCi/g (mean 45.3 pCi/g)
- Gross alpha – ranged from 4.6 to 2,490 pCi/g (mean 248.4 pCi/g)

Background concentrations for Ra-226 and uranium ranged from non-detect to 3.4 pCi/g (mean 1.6 pCi/g) and from non-detect to 9.2 mg/kg (mean 3.8 mg/kg), respectively. The highest Ra-226 concentrations (52.2 to 611 pCi/g) came from the following areas:

- Piles 5, 6 and 7 (east of Pit 1)
- Mine Dump (underground area)
- Ore Storage Area 2 (underground area)
- Ponds 1 through 4 (underground area)
- Shaft Access Road (underground area)

The synthetic precipitation leaching procedure (SPLP) method was used to evaluate the relative potential for leaching of metals from the samples. The results of the analyses for the SPLP samples are included in the Materials Characterization Report (MWH, 2007b). Further description and interpretation of SPLP results is included in the Stage 1 Abatement plan (INTERA, 2006).

4.1.2 2018 Site Characterization

A Supplemental Radiological Characterization conducted in 2018 included areas within the approximate permit boundary that were excluded from the 2007 Materials Characterization. During the 2007 Materials Characterization, soils in the areas between the main mine Site features (e.g., waste piles) were not characterized and a defined perimeter of the mine impacted soils was not determined. This 2018 supplemental Site characterization was performed to characterize surface materials between the waste piles and estimate the outer boundary (lateral extent) of the mine waste or affected areas.

The Supplemental Radiological Characterization was conducted in accordance with the Supplemental Investigations Work Plan (Stantec, 2018a). Results of the Supplemental Radiological Characterization are presented in the *Summary of Supplemental Materials Characterization* memorandum (Stantec, 2018b) and in the *Supplemental Radiologic Characterization Report* (AVM, 2018), which is included in Appendix B. The *Supplemental Radiologic Characterization Report* describes the field investigation methods and detailed results of the investigation (gamma survey measurements, subsurface sampling and analytical results, and a correlation between gamma radiation and Ra-226 concentrations).

The field investigation included static gamma radiologic survey measurements, ex-situ and in-situ gamma radiation soil screening, soil sampling and laboratory analysis. Direct gamma radiation level measurements were conducted using 2x2 NaI scintillation detectors (Eberline SPA-3 and Ludlum 44-10), paired with a Ludlum 2221 or 2241 scale/rate meter. Gamma measurements were collected along transects spaced 30 feet apart, with the detector held one foot above the ground surface. In addition, gamma measurements were collected in step-out areas (e.g., areas outside the approximate mine permit boundary) where gamma measurements exceeded the investigation level (IL) for Ra-226.

Based on gamma survey results, 24 locations with the highest Ra-226 levels were selected for subsurface sampling and analysis from test pits. Field personnel conducted ex-situ gamma radiation soil screening from the test pits and collected 44 soil samples for laboratory analysis of Ra-226 concentrations.

A Site-specific correlation was developed using regression analysis for the collimated and bare 2x2 NaI detectors to convert the detector gamma radiation levels (in counts per minute [cpm]) to surface soil Ra-226 concentration (in pCi/g). Fourteen correlation samples were sent to the laboratory for Ra-226 analysis.

The gamma radiation measurements in cpm were converted to Ra-226 concentrations (activity) in pCi/g using the Site-specific correlation. The 2007 Materials Characterization was conducted using exposure rate measurements, which were also converted to Ra-226 concentrations using the Site-specific correlation.

Results of the gamma survey indicated that surface soils with Ra-226 concentrations greater than the IL were generally located within the approximate mine permit boundary (see Figure 5 in Appendix B.2, Attachment A), except for the access road and other relatively small areas (less than 10 acres total) as described below. The access road extending to the north of the approximate mine permit boundary had consistently high gamma measurements (generally between 10 and 100 pCi/g) as far as approximately 2.2 miles along the road from the approximate mine permit boundary (see Figure 6 in Appendix B.2, Attachment A). The remaining areas where IL exceedances were measured outside the approximate mine permit boundary, as well as the approximate sizes of the affected areas, included:

- South of Shale Pile 1 (<0.1 acre)
- South of Pit 1 (0.5 acre)
- Around the Western Shaft Area and north of the Shaft Area Access Road (2 acres)
- North of Pit 1 near the Site entrance (7 acres)

The highest Ra-226 concentrations within the Site were measured in the central portion of the Site adjacent to the west side of Pile 6, within the Crusher/Stockpile area, and within Pile 7. Gamma radiation was measured above 100 pCi/g at numerous small waste piles in an area adjacent to Pile 6. The gamma radiation levels tended to decrease with increased distance from the piles and towards the permit boundaries. Ponds 1 through 4 in the Western Shaft Area had similarly elevated readings that were generally contained within the pond boundaries. Additionally, the arroyo (Meyer Draw) had readings of approximately 10 to 100 pCi/g in the deepest parts of the channel and readings of 6.6 to 10 pCi/g on the banks and adjacent areas.

4.1.3 2019 Pit 1 Piles Characterization

Following initial discussions around engineering design to stabilize the piles located within Pit 1, a radiological characterization was conducted on the Pit 1 infill piles in November 2019. The purpose of this investigation was to estimate the Ra-226 concentrations of the piles in Pit 1 to evaluate placement location for these materials. The characterization was performed by collecting soil samples from test pits and conducting onsite ex-situ gamma radiation soil screening and vendor laboratory analysis on the samples. The ex-situ gamma radiation field soil screening results for Ra-226 conformed with the vendor laboratory Ra-226 results. Ra-226 concentrations in the individual soil samples from the piles ranged from 7.5 pCi/g to 125.5 pCi/g. The average Ra-226 concentration in individual test pits ranged from 13.7 pCi/g to 103.5 pCi/g, and the average Ra-226 concentration in the piles ranged from 25.0 pCi/g to 77.2 pCi/g. Uranium concentrations in the individual samples sent to the vendor laboratory from the test pits ranged from 19 mg/kg to 130 mg/kg. The report for this investigation is in Appendix B.

4.1.4 2022 Surface Characterization

A Supplemental Surface Radiological Characterization was initiated in May 2022 in the area south of Pit 1 and extending into the proposed West Borrow Area (Stantec, 2023b). This characterization was performed to characterize the surficial materials and some observed mine materials located in an area beyond the approximate mine permit boundary to the south, near the location of the Old St. Anthony Mine underground workings. The work area is the area south of the Mine Permit Boundary on Figure 4-1. The supplemental characterization and laboratory testing was completed in November 2022.

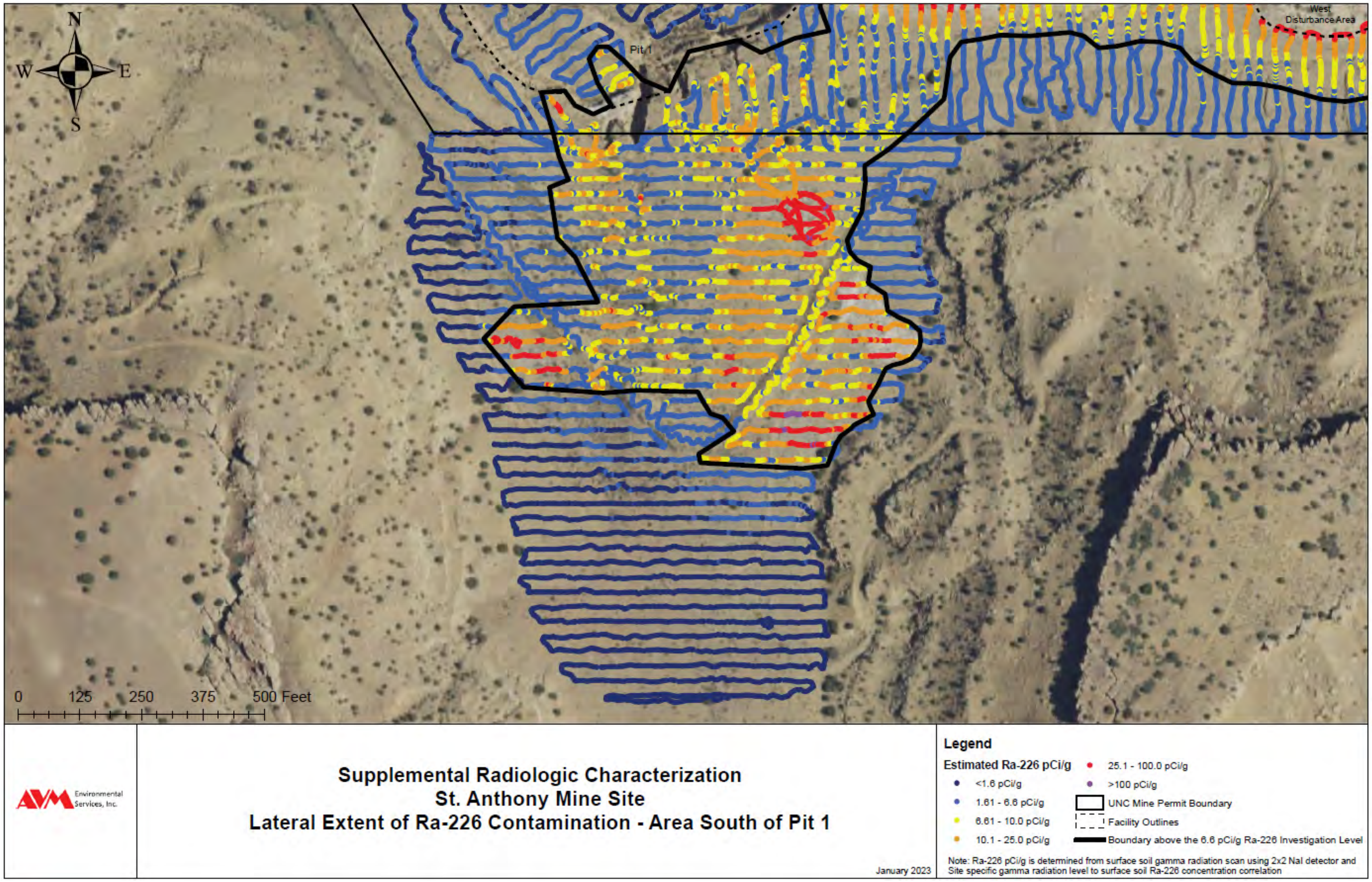


Figure 4-1. 2022 Characterization Area

The 2022 Supplemental Surface Radiological Characterization was conducted in accordance with the Supplemental Investigations Work Plan (Stantec, 2018a). The field investigation included gamma radiologic survey measurements, ex-situ and in-situ gamma radiation soil screening, soil sampling and laboratory analysis. Direct gamma radiation level measurements were conducted using 2x2 NaI scintillation detectors (Eberline SPA-3 and Ludlum 44-10), paired with a Ludlum 2221 or 2241 scale/rate meter. Gamma measurements were collected along transects spaced 30 feet apart, with the detector held one foot above the ground surface. The gamma radiation measurements in cpm were converted to Ra-226 concentrations (activity) in pCi/g using the Site-specific correlation.

Based on the results of the gamma survey, field personnel selected locations for subsurface sampling and analysis from test pits. Additional test pit locations were advanced in the southern portion of the investigation area to assess Ra-226 concentrations for a potential borrow source.

During the investigation, the greatest Ra-226 concentrations were measured in waste piles where estimated Ra-226 concentrations ranged from 6.61 pCi/g to greater than 100 pCi/g. The area and estimated depth of mine waste exceeding the investigation level was incorporated into the estimated volume of mine waste at the Site. Gamma measurements in the southern portion of the 2022 Supplemental Characterization area were less than the investigation level and were generally near or below background; this material will be used for cover borrow material post-removal, in the area. The report for this investigation is included in Appendix B.

4.2 GEOTECHNICAL INVESTIGATIONS

Geotechnical data was collected in 2018 to supplement the data set of material properties collected in 2007 from the waste piles. The 2018 boreholes were primarily focused on the existing piles and areas where data was not previously collected. In 2021 and early 2022, additional geotechnical drilling was completed around the Pit 1 highwall to collect soil and rock data to evaluate highwall stability. The drawings show the borehole and test pit locations from all three investigations.

4.2.1 2007 Investigation

From April 2006 to July 2007, MWH (now Stantec) conducted a geotechnical investigation as part of the materials characterization work to determine soil suitability for use as growth media, potential borrow and cover material, and radiological risk. Areas of focus for the investigation included borrow and stockpile sources, non-economic materials piles, and mine facilities in the western shaft area. A radiological survey was conducted prior to excavating test pits and drilling boreholes in the investigation areas. Geotechnical laboratory data collected included gradations and moisture contents of the soil samples. The *Materials Characterization Report Saint Anthony Mine Site* describes the methods and findings of the investigation and is included in Appendix C.

Radiological Survey Results

Gamma exposure rate measurements were collected by a certified Radiation Safety Officer (RSO) using a Ludlum Model 19 µR Meter. Survey measurements were taken in a grid pattern at each location. The survey procedure and results are included in the *Materials Characterization Report Saint Anthony Mine Site* (MWH, 2007b) document.

Analytical Testing Results - Soils

Lab testing for the field program focused on radiochemical properties, metals in leachate, and agronomic properties. A minimum of 2 samples were selected from each borehole and sent to Energy Laboratories, Inc. in Casper, Wyoming. Details and results of the laboratory testing are included in the *Materials Characterization Report Saint Anthony Mine Site* (MWH, 2007b) document.

4.2.2 2018 Investigation

Stantec conducted a geotechnical investigation at the Site during March and April 2018 to collect subsurface information to characterize soil and rock in the piles and evaluate the suitability of potential borrow sources as cover materials. Field activities comprised drilling and soil sampling of select non-economic waste rock piles and potential borrow areas around the Site and included 51 boreholes advanced using the hollow-stem auger drilling technique. The *St. Anthony Mine Geotechnical Investigation 2018* memo (Appendix C) describes the methods and findings of the investigation.

Geotechnical Testing Results

Daniel B. Stephens & Associates (DB Stephens), a geotechnical testing laboratory in Albuquerque, NM, performed laboratory testing on samples collected during the geotechnical investigation. Tests included sieve analyses, hydrometer, Atterberg limits, moisture and density, standard Proctor compaction, and consolidated undrained triaxial shear. A summary of the sampling program, testing procedures, and results, as well as DB Stephens' complete laboratory testing report, are included with the memo in Appendix C.

Analytical Testing Results - Soils

ALS Environmental performed analytical testing on 17 bulk soil samples collected from boreholes in Shale Piles 1 and 2, Pile 4, and the Borrow West area during the geotechnical investigation. Samples were tested for Ra-226, Uranium, Thorium-230, and Gross-Alpha concentrations. Sample results were used in conjunction with analytical testing results from the 2007 field investigation (MWH, 2007b) to evaluate Ra-226 activity levels throughout the Site, including areas that were not sampled for analytical testing during the 2018 investigation. These results are also included with the geotechnical memo in Appendix C.

4.2.3 2020 Geotechnical Laboratory Testing

Stantec selected additional samples from those previously collected in the proposed borrow areas to be tested for evaluation of cover design parameters. DB Stephens performed laboratory testing on samples collected during the 2018 geotechnical investigation. Tests included gravimetric and volumetric water content, saturated hydraulic conductivity, soil water characteristic curves, and particle-size distribution with hydrometer.

4.2.4 2021-22 Highwall Investigation

In 2020 and 2021 Stantec completed a desktop study and field reconnaissance, followed by data processing and analysis in support of a future geotechnical design for the mine pit highwalls. The desktop study included review of available geotechnical information to identify site specific and regional drivers of instability. The field study included a Site visit by a Stantec geologist and a geotechnical engineer to complete a geological field map of the slopes along with high-resolution survey, digital photogrammetry, and LiDAR of the highwall. The geotechnical mapping and photogrammetry survey data were processed and analyzed using ShapeMetrixUAV software to generate a three-dimensional image of the rock slopes. Stantec used the structural data to assess the rock mass and complete a kinematic analysis to identify potential failure modes and perform a preliminary slope stability analysis (Stantec, 2021a).

Based on the preliminary findings, a geomechanical/geotechnical drilling program was developed to collect samples of the rock profile for visual classification and to test samples in the laboratory for mechanical strength properties. This program was conducted November 2021 through January 2022 and included five boreholes, two angled and three vertical, along Pit 1 to depths of between 250 and 300 feet. Borehole locations are shown on Drawing 4. Downhole geophysics were also performed including dilatometer strength testing of the weak Mancos shales and televiewer to evaluate fractures. The details of the highwall investigation conducted in two phases are summarized in St. Anthony Mine; Pit 1 Highwall Stability – Phase 2 Report (Stantec, 2023a) and the report was submitted to MMD under separate cover.

Slope stability was evaluated using the data collected from the 2021-22 Geotechnical Investigation. Results indicated current slopes had adequate stability (Stantec, 2023a). Although the walls appear stable, significant erosion debris, loose rocks columns, and rock overhangs were observed during the visual field inspection conducted in September 2020 (Stantec, 2021a).

Geotechnical Testing Results

Nine samples were collected from the overburden soils and used for classification and index property testing. Overburden soils largely consisted of silt underlain by a sandy or silty clay above the bedrock. In addition, 110 rock cores samples were selected for laboratory testing consisting of point load index testing, unconfined compressive strength, triaxial compressive strength, direct shear, and durability testing. The upper 20-30 ft of the Mancos shale was determined to be weak to very weak and did not qualify for point load testing. Overall, point load tests indicated higher unconfined compressive strengths of the rock samples than unconfined compressive strength testing at almost two to one for the Jackpile and Mancos shale. Strength for these units was determined from only the unconfined compression tests.

Analytical Testing Results

Samples from the highwall drilling were not tested for analytical parameters, however core samples were screened for radioactivity in the field during sampling. In general, samples in the Mancos shale and

Dakota formations were at, or near, background levels (60 to 80 cpm) with limited areas showing increased activity of 90 to 120 cpm. Screening in the ore-bearing Jackpile formation indicated activity generally above background levels with measurements between 100 and 5000 cpm.

4.3 GEOPHYSICAL INVESTIGATION

A geophysical investigation was completed in December 2023 in the vicinity of the Old St. Anthony underground workings to identify the potential presence of near surface void spaces that may present a hazard during construction activities south of Pit 1. Review of the geophysical data indicated stratigraphy of the Mancos Formation and did not indicate the presence of near-surface void spaces. The results of the geophysical survey are summarized below and included in the Geophysical Letter Report (Collier Geophysics, 2024) included in Appendix C.2.

A vertical shaft was identified south of Pit 1 in 2012; the shaft extended approximately 50 feet below ground surface (bgs) and had a concrete collar that extended approximately 8 feet bgs. UNC backfilled the shaft in 2013 and placed a concrete slab over the backfilled shaft. The shaft location aligned with workings of the Old St. Anthony Underground mine. It is unknown if the shaft was the primary shaft that was used to access the Old St. Anthony Mine workings or if there were other vents or shafts in the area that now may contain void spaces near ground surface. Surface mapping in the area of the Old St. Anthony Mine, photographs, and maps of the location of the backfilled shaft are included in Appendix B.4 Attachment 3.

Construction activities planned in the general area of the Old St. Anthony workings include the development of stormwater diversion channels. In December 2023, Collier Geophysics (Collier) completed a geophysical survey in the general area of the planned stormwater diversion channels to evaluate the presence of near-surface void spaces that may present a hazard during construction. Collier tested the use of two techniques, ground penetrating radar (GPR) and three-dimensional seismic refraction tomography (3D SRT).

GPR test grids were evaluated on the lower bench and in the area of the backfilled shaft. Review of the GPR data collected in two areas indicated the signal penetration was severely limited in both test areas, with maximum depths of penetration limited to approximately 10-15 feet bgs due to the high clay content and residual moisture in the soil. Though limited in depth, the GPR data indicated near surface stratigraphy of soils in the Mancos formation and did not indicate the presence of near surface void spaces.

SRT data were collected in individual grids using 3D geometry. The 3D SRT grid locations were on the upper bench and included the location of the backfilled shaft. Review of the 3D SRT data indicated the general stratigraphy present in the Mancos Formation and did not indicate the presence of near surface void spaces. An anomaly was observed in the area of the backfilled mine shaft that coincided with the concrete collar and concrete slab covering the shaft.

4.4 GROUNDWATER QUALITY CHARACTERIZATION

Groundwater quality monitoring was performed as part of the Stage I and Stage 2 Abatement investigations at the St. Anthony Mine and has continued to the present. The most recent site-specific groundwater quality monitoring data (2018-2025) for the Site has been collected as part of the ongoing groundwater monitoring associated with the abatement process.

5.0 POST-MINING LAND USE

5.1 AVAILABLE REGULATORY OPTIONS

Per the definitions in NMAC 19.10.1.7 (A), land use at the majority of the Site following closure is intended to be grazing and/or wildlife habitat, similar to the land currently located around the approximate mine permit boundary area. A vegetation survey has been conducted in nearby areas by Cedar Creek of Fort Collins, Colorado to determine the existing native species scribe plant communities and corresponding vegetation characteristics for undisturbed areas. The goal at closeout for grazing is to reclaim to a range condition of "good or better" by comparison to a vegetation reference area, by the time of bond release sampling, based on the definitions in the Revegetation Sections of the MARP (MMD, 1996). The post-mining land use design criteria are summarized in Table 5-1.

Table 5-1. Post-Mining Land Use Design Criteria

Design Element	Design Criteria	Design Guidance
Post-Mining Land Use	Post-mining land use is grazing and wildlife habitat outside of Pit 1. PMLU within Pit 1 is a vegetated water management structure.	SSE Guidelines (MMD 2022) and NMAC 19.10.1.7

5.2 GRAZING AREAS

Following reclamation of the piles and pits, and the period of reestablishing native vegetation, the reclaimed Site excluding Pit 1 will be open to grazing of livestock. Following earthwork, the mine permit area will be fenced to exclude livestock for 12 years while the native plant communities reestablish. Due to the highwalls, limited access, and potential for future expressed water in Pit 1, grazing will not be permitted in Pit 1 and livestock will be excluded from the pit bottom.

5.3 WILDLIFE HABITAT

As described in Section 3.7.1, post-reclamation habitat is expected to consist of a variety of wildlife typical of the Arizona/New Mexico Plateau tablelands ecoregion. Signs of big game including mule deer, elk, and black bear were observed on the Site. Small mammals and herptiles were observed to be using rock piles associated with rim rock habitat. Small raptors (red-tailed hawks, sharp-shinned hawks, and prairie falcons) were observed flying over or foraging onsite, but no raptor nests were observed during the wildlife survey.

5.4 VEGETATED WATER MANAGEMENT STRUCTURE

Following reclamation, water is predicted to seasonally express within Pit 1 after several years. Avoiding water expression is not economically or technically feasible, and it would be environmentally unsound to attempt to do so (Stantec 2021b and INTERA 2021). The reclaimed surface within Pit 1 is anticipated to support an SSE for a vegetated water management structure. Engineering controls are included in the design to restrict access to the Pit 1 seasonal water.

5.5 ECOLOGICAL RISK ASSESSMENT

To assess the potential risk to wildlife and livestock from the Pit 1 reclamation, Cedar Creek conducted an ecological risk assessment (ERA) which was submitted to MMD on November 30, 2023 (Cedar Creek, 2023b). After the reclamation, sections of bedrock stratigraphy along the highwall that surrounds Pit 1 will remain exposed and groundwater at the base of Pit 1 will express in the future.

Any water that expresses in Pit 1 is classified as a “private water” under New Mexico Statutes Annotated, 1978 Compilation as amended in 2025 (NMSA, 2025), § 74-6-2(Y) and, as such, is not subject to New Mexico surface water quality standards. Therefore, an ERA was completed to address the potential for ecological risks associated with the Pit 1 reclamation approach.

The ERA involved the following steps: (1) identifying sources and concentrations of Constituents of Interest (COIs); (2) identifying plausible wildlife receptors and exposure pathways; and (3) quantifying and characterizing ecological risk. These steps are consistent with risk assessment guidance employed by applicable federal and state entities, including the EPA (EPA 1998a, 1998b) and the NMED (NMED 2017, 2000). The ERA adopted conservative estimates of exposure where uncertainties exist. Accordingly, it assumed that the duration of future surface water expression in Pit 1 will be of sufficient duration for rooted aquatic plants and sediment-dwelling invertebrates to inhabit the pit and for a relatively complex trophic food web to develop. Additionally, although engineering controls are intended to prevent large mammal access to Pit1, the ERA calculated surface water exposure to these animals.

5.5.1 Results

The results of the ERA indicate that wildlife and livestock would not be at risk if exposed to the Pit 1 environment. No risk was predicted from exposure to radiological and non-radiological constituents to livestock or wildlife that may eat or drink in the Pit 1 environment, or nest or roost along Mancos shale or Dakota sandstone areas in the Pit 1 highwall or otherwise use the Pit 1 environment. The NMDGF, in a letter to MMD dated February 5, 2024, disagreed with the non-exposure risk for livestock due to uncertainties regarding the long-term quality of future expressed water in Pit 1 and recommended installation of fencing to restrict access to the future expressed water. The 90% CCOP includes fencing to restrict livestock and large mammal access to vegetated water management structure.

A supplemental evaluation for the Pit 1 highwall indicates a very slight potential for risk to nesting birds or roosting bats if they nest or roost directly on exposed Jackpile formation in Pit 1. Because conservatively-estimated concentrations of radiological COIs on the Jackpile sandstone were slightly greater than No Observed Radionuclide Effect Level (NOREL)-based Wildlife Threshold Values (WTVs), the potential for risk could not be completely ruled out. However, the Low Observed Radionuclide Effect Level (LOREL)-based risk estimates to birds and bats from Jackpile sandstone exposures indicate risk is not certain and, given the physical position of the formation relative to the ground and its lack of deep crevices, it is unlikely that birds or bats would use the Jackpile sandstone for nesting or roosting. The NMDGF agreed with this conclusion in the February 5, 2024, letter to MMD.

5.5.2 Future Monitoring

Past sampling results indicate that concentrations of COIs in future expressed water in Pit 1 will likely increase due to evaporation. This could pose future risk to wildlife receptors. To assess future risk, WTVs were calculated by first setting a target wildlife dose and then back-calculating to the expressed water concentration necessary to produce the applicable dose from radionuclides in the organism (internal dose), plus the external dose components from radionuclides in the environment. The WTVs are summarized in Table 5-2 below.

Table 5-2. Wildlife Threshold Values (WTVs) for Pit 1 Expressed Water

COI	Minimum WTV, Livestock excluded (pCi/L)
Ra-226	99
Ra-228	133
U-234	232,737
U-235	252,975
U-238	258,596

Notes:
1. No Observed Radionuclide Effect Level (NOREL) -based WTVs from Table 4-2 in the ERA are shown here. These are the lowest thresholds for wildlife and corresponds to the highest estimated level where no effect is anticipated in animals.
2. Livestock has been excluded as receptor because the ramps to Pit 1 and the area of expressed water will be fenced to prevent livestock access.

As stated in UNC's July 26, 2024 response to agency comments, UNC proposes to monitor the quality of any post-reclamation expressed water in Pit 1 to ensure that concentrations of COIs do not exceed minimum WTVs. The lowest WTVs for radium isotopes correspond to the mallard duck at 99 pCi/L (Ra-226) and 133 pCi/L (Ra-228), respectively. The ratio of Ra-226 to total uranium measured in pit water shows a consistent ratio of approximately 2.4:1 (Ra-226 to total Uranium). Therefore, measuring Ra-226 and Ra-228 levels alone will provide an efficient way to monitor potential risk to wildlife. Based on the historical maximum concentrations of Ra-226 (49 pCi/L) and Ra—228 (24 pCi/L), it is unlikely that radium concentrations in future expressed water will exceed the WTVs. However, if UNC's post-reclamation monitoring indicates that concentrations do exceed the WTVs, UNC will conduct additional STPP treatments or take other action to ensure ongoing protectiveness to potential receptors.

The future expression of groundwater at the base of Pit 1 after reclamation completion cannot be predicted with certainty. Accordingly, UNC plans to begin sampling for Ra-226 and Ra-228 one year after the initial, post-reclamation expression of groundwater in Pit 1 and to conduct annual sampling for five years, assuming expressed water is present in the pit. UNC will then evaluate the concentration trends to develop a frequency for future sampling events and revise the sampling frequency to align with other future sampling obligations.

6.0 CLOSURE/CLOSEOUT PLAN OBJECTIVES AND TASKS

6.1 PLAN SUMMARY

The Reclamation Design includes regrading and covering several waste piles in place (Piles 1, 2, 3, 4, and 5). The Pit 1 infill piles will be moved to the bottom of Pit 1 and covered. The Topsoil/Overburden (T/O) pile will be partially excavated, with a portion placed in Pit 1 as part of the cover system and another portion used as fill material for the Meyer Draw reclamation. Stantec designed the regraded and covered Piles 1 through 4 with maximum slope lengths of 350 feet (either total pile slope length or inter-bench length) and maximum slope grades of 3.5H:1V. The Pit 1 and Pit 2 cover slopes were designed with grades between approximately 0.5 and 2.0 percent.

The remaining waste piles and excavated areas outside of Pit 1 will be hauled and placed into Pit 2 and covered with soil. The Reclamation Design also includes STPP stabilization of existing sediments in Pit 1; Pit 1 highwall stabilization; fencing and signage; revegetation; and stormwater controls. Drawings 9 through 14 show the grading plans for the piles and pits.

6.2 EXCAVATION AND PLACEMENT

The objective of excavation and placement of the mine materials is to combine select waste piles and other mine-impacted materials within the two open pits and stabilize materials that are to remain in-place. Higher activity mine materials have been prioritized for placement in Pit 2. The materials will then be covered with an earthen cover. The Pit 2 final cover elevation will be graded to the southeast and sloped toward the arroyo so that surface water is shed for drainage. The cover surface elevation near the southeast side of Pit 2 has been selected to establish a gentle cover slope and minimize potential for erosion without mounding materials. Appendix E includes a material balance summary and calculations that describe sources of the existing material volumes onsite and links these volumes to the placement locations in one of the two open pits. Earthwork activities will avoid the existing power lines in operation along the approximate northern mine permit boundary.

Due to the presence of potentially harmful gases, localized to some boreholes on the waste piles, encountered during drilling in 2018 (see Appendix C for details), Stantec recommends appropriate safety precautions during future earthwork at the Site. Prior to the start of construction, the Site Health and Safety Plans will be revised to include a personnel air monitoring plan in the immediate work areas, where earthwork is in progress. The Contractor will also be required to develop a Hot Work Plan to ensure safe construction operations in the presence of accumulated gases, and an Emergency Plan detailing actions to be taken if air monitoring indicates hazardous conditions exist. Furthermore, before work begins, construction workers will receive awareness training on the types of gases that may be encountered during excavation activities. Special considerations during construction may include the use of personal H_2S detectors by personnel near the earthwork, as well as the use of a 4-gas meter to routinely monitor the work areas for elevated gas concentrations, and to determine whether implementation of the Emergency Plan is needed. Additional personal protective equipment (PPE) and/or engineering controls may be required under certain circumstances and conditions should be reevaluated prior to the start of earthwork.

6.2.1 Surface Soil Action Level (SAL)

The reclamation approach for the Site includes excavation and consolidation of soil exceeding the Ra-226 Soil Action Level (SAL). The SAL for excavation and consolidation of soil at the Site is 6.6 pCi/g for Ra-226 which is based on 5.0 pCi/g Ra-226 plus the 1.6 pCi/g Ra-226 Site background area concentration level as determined by the 2007 Materials Characterization (MWH, 2007b), as described in Section 4.2 and Appendix B. The soil excavation and Reclamation Design Criteria are summarized in Table 6-1.

Table 6-1. Excavation and Soil Action Level Design Criteria

Design Element	Design Criteria	Design Guidance
Soil Action Criteria	The concentration of Ra-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than • 5 pCi/g, averaged over the first 15 centimeter (cm) of soil below the surface, and • 15 pCi/g, average over 15 cm thick layers of soil more than 15 cm below the surface	Joint Guidance for the Cleanup and Reclamation of Existing Uranium Mining Operations in NM

6.2.2 Verification

Soil exceeding the 6.6 pCi/g SAL (including the areas discussed in Section 4.1) will be excavated, hauled, and placed onsite in Pit 2 or regraded in-place and covered. Excavation control will be performed to support mine-impacted soil excavation. The Site characterization identified an approximate area of 440 acres where soils exceeding the SAL are present, including mine features such as waste ore piles and roads are shown on Drawings 5 and 6. The assessed lateral and vertical extent of soil excavation exceeding the SAL includes an area of approximately 272 acres with approximately 32 acres in Pit 1 that will remain in Pit 1. There is an additional estimated 168 acres of area with soil exceeding the SAL within Pile 3, Pile 4, and Pile 5 combined. These piles will be regraded, stabilized, and covered in place.

An Excavation Control Plan is provided as Appendix D.1 to support the excavation and consolidation of soils that exceed the SAL. Upon completion of the soil excavation and placement, a Verification Survey will be performed in the excavated areas to confirm the SAL has been met. A Verification Plan is provided as Appendix D.2. Standard Operating Procedures (SOPs) for implementing the Excavation Control and Verification Plans are provided in Appendix D.3.

6.2.3 Excavation Volumes

Material will be excavated from the waste storage piles and other mine-impacted facilities, excluding Pit 1, at the Site prior to placement in Pit 2. Material transport from the excavation areas to the pits is expected to occur along the haul routes using trucks. Loose rock and soils on the Pit 1 benches will be scraped from the Pit 1 walls and benches in select areas to provide a safe work zone for earthwork in the pit bottom. This material will be temporarily stockpiled in the pit bottom for use in the cover system. The Pit 1 infill waste piles, on the north, south, and east sides, and within Pit 1, will be excavated and placed in the bottom of Pit 1 in compacted lifts. Loose material removed from the Pit 1 highwalls and benches, which is not expected to exceed the SAL as discussed in Section 4.2.4, will be placed as engineered fill above the Pit 1 waste in the pit bottom. Subsequently, a layer of material excavated from the T/O Pile will be placed on top of the highwall excavation material, prior to placement of additional borrow soil cover. The highwall excavation and T/O Pile materials are considered part of the cover system since they do not exceed the SAL and will contribute to attenuation of radon emanation from the underlying Pit 1 Infill material. No material will be transported from Pit 1 to other Site facilities.

The onsite, ex-situ soil screening results, laboratory analytical results, and observations made in the 2018 test pits (see Section 4.1.2), were used to estimate the depths of SAL exceedances. These depth estimates were used to interpolate the depth of SAL exceedances for the remainder of the Site. The maximum depths of SAL exceedances were 5.0 ft to greater than 6.5 ft (the maximum excavation depth of the test pits) bgs in the following areas (see Figure 3 of Appendix B.2, Attachment A):

- Greater than 6.5 ft bgs between Pile 3 and Pit 2 at Test Pit 24 (note: this test pit was excavated to a final depth of 6.5 ft without encountering the maximum depth of SAL exceedance)
- 6 ft bgs near Borrow Area South at Test Pit 23
- 5 ft bgs west of the Crusher/Stockpile Area at Test Pits 4 and 5
- 5 to 6 ft bgs between Pit 1 and Pile 6 at Test Pits 11 and 13

The lateral extent (limits of excavation) and depths of SAL exceedances (excavation depths) are shown on Drawings 5 and 6. The Site excavation surface was interpolated from these depths and the estimated lateral extents.

Stantec used the ground surface elevations, the lateral extent (outer boundary) of Ra-226 above the SAL, the depths of SAL exceedances (including the mine features characterized in 2007) and the interpolated depths in other areas of the Site to estimate the volume of mine waste with Ra-226 concentrations above the SAL (6.6 pCi/g). There is a total estimated volume of 2.1 million cubic yards (cy) of mine-impacted material (including approximately 666,000 cy of surface excavation material from intermediate areas between the mine features) to be moved to Pit 2, and approximately 21.3 million cy within piles to be regraded in place.

Material within Meyer Draw and along Pile 4 that exceeds the SAL will be addressed as shown on Drawing 5. Impacted material in, and along, the arroyo will be excavated, moved to, placed and compacted in Pit 2 with other excavated impacted surface materials prior to conducting pile regrading and channel stabilization measures. After the removal of impacted material, grading of the arroyo will require 1.5M cy of cut which will be regraded into Pile 4, and a compacted fill volume of approximately 206,000 cy of non-impacted fill) will be required to achieve the design grade of Meyer Draw. The fill will be placed in segments where the design arroyo corridor passes through the current footprints of Piles 1, 2, and 3. In these segments, where the design grade is at a higher elevation than the estimated base of the waste pile, impacted pile material within the arroyo corridor will be excavated to the maximum depth of SAL exceedance (to be verified during construction), incorporated into the adjacent waste pile regrades, and replaced with non-impacted fill to the design grade. The pile regrades are discussed in greater detail in Section 6.4.

Waste pile volumes were estimated by comparing the existing (Cooper, 2011) and pre-mining (Archuleta et al., 2017) ground surface topographies, with the exception of the surface excavation volume which was estimated using the methods described above. Excavations for all facilities will extend to non-impacted ground (i.e., soil less than the SAL) such that the existing material at the facilities that exceeds the SAL is removed and stabilized, and the new, exposed ground surface may be directly revegetated.

Approximately 2.1 million cy of mine-impacted waste material from the piles and intermediate areas will be excavated and transported to Pit 2. Approximately 368,500 cy of additional non-impacted material currently in the South Topsoil pile also will be placed in Pit 2 as part of the cover system. Table 6-2 lists individual volumes for each facility. The material to be placed in the bottom of Pit 1 includes approximately 528,000 cy of Pit 1 Infill material (mine-impacted waste) currently located within Pit 1, plus approximately 50,000 cy of material from the highwall excavation and approximately 122,000 cy of material from the T/O Pile to be placed as part of the cover system. Stantec performed volume reduction calculations to account for the compaction of excavated material within the pits (see Appendix E).

A negligible amount (less than 500 cy) of concrete debris, mainly from the remains of structural foundations, is present in the Shaft Pad area. This material will be disposed in Pit 2 and buried with the soil and rock being placed there. There are some additional concrete building slabs located near Pile 3 to be removed.

6.2.1 Pit Backfill Volumes

Pits 1 and 2 will be partially backfilled using the materials and fill sequencing described in the following sections. Pit 1 will be partially backfilled with the infill waste piles currently located within Pit 1. These piles are the only source of SAL exceedance material for the Pit 1 backfill, with the remaining backfill volume comprising the cover system.

The materials to backfill Pit 2 will come from the soil excavation and site excavation as well as existing materials in the waste piles. The sum volume (compacted) of the materials listed in Table 6-2 as destined for Pit 2 is less than the total backfill volume required to reach the design grading surface shown in the drawings. There is an available contingency volume of approximately 43,530 cy for additional waste backfill, if needed, in Pit 2. Table 6-3 lists the estimated backfill volumes for the two pits. These volumes comprise compacted waste materials only (i.e., materials exceeding the SAL) and do not include the cover systems to be placed atop each pit backfill. Note that the Pit 2 volume represents the full waste backfill volume required to attain the design waste elevation to facilitate cover construction for surface water management and thus includes the contingency volume. Cover design is described in Section 6.6.

Table 6-2. Earthwork Volumes

Facility	Estimated Pile Volumes to Remain (cy)	Estimated Excavation (cy)	Placement Destination
Pile 1	925,912	-523,298 (cut) +501, 803 (fill)	Regrade in-place
Pile 2	761,907		Regrade in-place
Pile 3	2,080,033		Regrade in-place
		57,600 (cut)	Pile 4 Regrade
Pile 4	16,559,884	-4,369,362 (cut) +5,374,616 (fill)	Regrade in-place (Pile 4)
Pile 5	633,082		
Pile 6	-	254,375	Pit 2
Pile 7	-	87,086	Pit 2
Surface Excavation	-	666,356	Pit 2
West Disturbance Area	-	83,575	Pit 2
Crusher Stockpile	-	573,847	Pit 2
Shaft Area Access Road	-	26,401	Pit 2
Mine Dump	-	37,658	Pit 2
Ore Storage 1	--	16,087	Pit 2
Ore Storage 2	-	12,943	Pit 2
2022 Area - South of Pit 1	-	21,360	Pit 2
South Topsoil Pile	-	368,502	Pit 2 Cover System
Highwall Loose Materials	-	50,000 (estimated)	Pit 1
Pit 1 Infill Piles	-	527,680	Pit 1
Topsoil/Overburden	534,122	124,594	Pit 1 Cover System
Arroyo Excavation	-	1,517,685	Pile 4 and Meyer Draw

Table 6-3. Pit Backfill Volumes

Facility	Estimated Waste Compacted Backfill Volume (cy)
Pit 1	485,376
Pit 2	1,636,470

6.2.1 Pit 2 Backfill Design

Pit 2 will be backfilled to a minimum elevation of approximately 6038 ft for surface water drainage to the southeast into the Pit 2 Diversion Channel and back to Meyer Draw. The regraded waste surface will slope to the south and east at approximately 1.5 percent. The material to be backfilled in Pit 2 includes, listed in “bottom up” order: material from Ore Storage 1 and 2; Pile 7; Pile 6; Shaft Area Access Road; Mine Dump area: Crusher Stockpile; West Disturbance Area; 2022 Area (south of Pit 1), and excavated impacted surface soil throughout the Site. The waste profile for the backfilled Pit 2 is shown in Figure 6-1. Final sequencing may differ from the above and will be determined in the field at the time of construction.

The cover materials will consist of material from the South Topsoil pile and West Borrow area and the soil cover (described in Section 6.6) will be graded to a slope of approximately 1.5 percent across the full area of Pit 2 to mitigate erosion due to surface runoff. The western highwall and southwestern corner of Pit 2 will be left undisturbed, as these areas were found to contain no mine-impacted materials (see Appendix B) and are not expected to be areas of concern with regard to slope stability once the pit is backfilled. Because the design includes contingency space for additional waste, the final slope of the Pit 2 cover can be adjusted for final volumes.

An area of approximately 30 feet (vertically) on the northwestern Pit 2 highwall will remain exposed after the pit is backfilled. The area west of the northwest highwall generally slopes to the north, carrying surface runoff away from the open pit and toward the northeast. The Pit 2 diversion channel is designed to reduce flow back to the final cover by diverting run-on (which would otherwise flow into the pit) along the southwestern and southern edges of the pit. Erosion protection for the cover below the remaining highwall will be added as part of the final design. Protection measures will prevent erosion of the Pit 2 cover associated with concentrated run on from the limited catchment area.

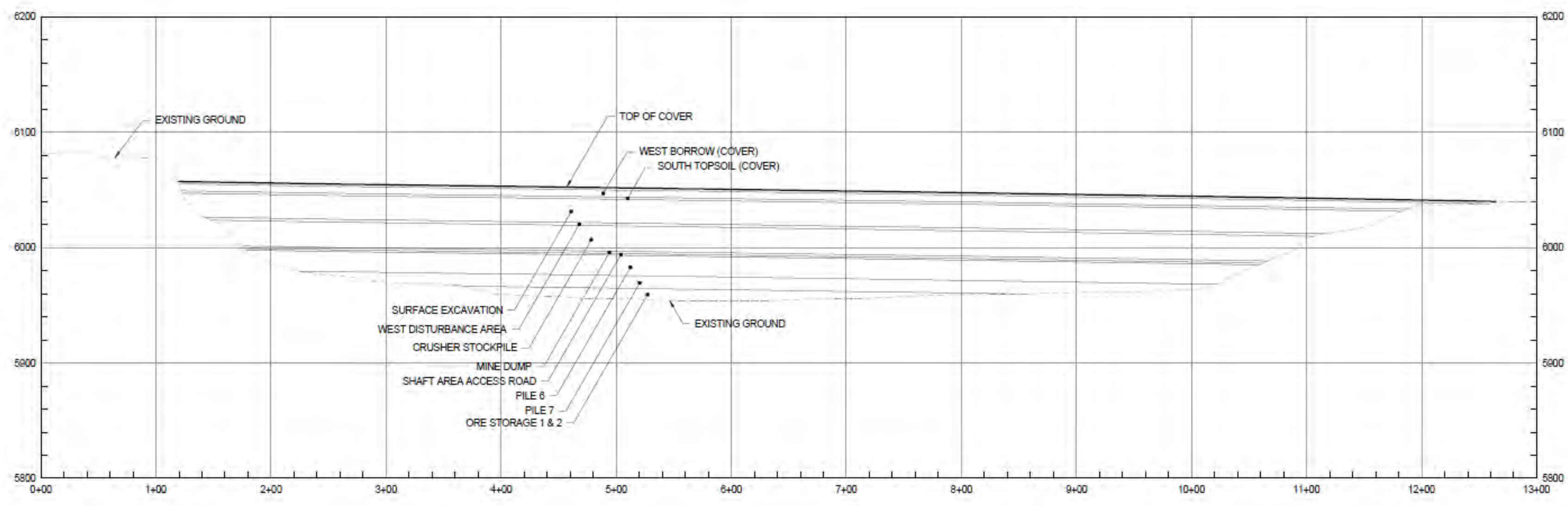


Figure 6-1. Pit 2 Backfill Profile

6.3 PIT 1 DESIGN

The design for long-term stabilization of Pit 1 includes components to maintain the hydraulic sink in the pit and prevent migration of poor quality groundwater from the Site. These include: (1) grading the existing waste piles in the pit; (2) removing loose materials from the highwall and benches for safety and stability; (3) covering the waste and highwall material with a revegetated cover that will enhance evapotranspiration; and (4) managing surface water in, and around, the pit to prevent erosion.

Engineering controls, consisting of barriers or fencing and signage, are included to restrict ungulate and human access to the pit bottom. The Pit 1 engineering controls include: the installation of permanent range fencing that will limit access to the Pit 1 highwall area, gates at the top of each access ramp into the pit, that will prevent/restrict cattle and vehicle access down the ramps, and permanent fencing in the pit bottom to prevent wildlife access to the vegetated water management structure. The specific locations, dimensions, and materials to be used as part of the Pit 1 engineering controls are described in greater detail in Section 6.10 and are shown on Drawings 31 and 36.

6.3.1 Performance Objectives and Design Criteria

The closure design for Pit 1 is intended to achieve the following hydrologic and geotechnical objectives:

1. Maintain the pit's long-term capture of local groundwater (act as a hydraulic sink) through strategic design of the pit backfill so that if groundwater daylights into the pit, it does not flow out of the area of expression.
2. Increase evapotranspiration of surface water from the pit bottom, through re-vegetation on a cover system that is erosionally stable long-term.
3. Reduce surface water run-on to the pit from the watershed surrounding the pit.
4. Modify the Pit 1 highwall to an erosionally and structurally stable configuration.
5. Address potential rockfall hazard for workers in the pit.

The closure design will maintain the Pit 1's long-term behavior as a hydraulic sink, which prevents groundwater and solutes from leaving the pit. Pit 1 will continue to act as a hydraulic sink for groundwater by maintaining a backfill elevation below the Dakota-Jackpile interface, while still addressing applicable waste and stability needs for the pit. The existing waste piles within the pit are currently exposed to meteoric water and wind and subject to erosion. In addition, erosion and rockfall from the highwalls occurs.

After implementation of the closure design, the existing Pit 1 waste piles will be consolidated beneath an earthen cover and the seasonal expression of pit water is expected to be significantly reduced in both extent and duration compared with current conditions. Establishing the vegetation communities on the pit cover material will increase transpiration from the cover surface. Surface water run-on into the pit will be significantly reduced by the construction of diversion channels that will intercept and divert rainfall-driven flows from the catchment area surrounding the pit. Further, runoff from the two access ramps into the pit will be directed through armored drainage channels over the cover to the center of the pit, to prevent cover erosion due to concentrated flows. Seasonal variations in the expression of pit water and associated extents are expected to occur; however, under the design, the pit is anticipated to be dry during certain periods such as during fall and summer months. Table 6-4 is a summary of the Pit 1 Highwall design criteria.

Table 6-4. Pit 1 Highwall Design Criteria

Design Element	Design Criteria	Design Guidance
Highwall - Global Stability	• Seismic annual exceedance probability (AEP) of 1×10^{-4} • Factor of safety (FOS) of 1.3 for long-term static conditions • FOS of 1.1 for pseudo-static conditions	Selection based on similar mine closure projects throughout the Western US
Highwall - Rockfall	• Minimize rockfall hazards for safety during remediation work • Minimize rockfall impacts on slope erosion for long-term stability	N/A

6.3.2 Design

The current condition of the Pit 1 highwalls includes loose rock and eroded soils and rock that have accumulated on the benches. To protect workers during reclamation, initial work will be required to remove boulders, clear select areas on the existing benches, and create a rockfall zone below the highwalls in the bottom of the pit. Material excavated during this stabilization process from the highwall will be stockpiled for placement as a bridging lift over the ponded water areas in the bottom.

Following removal of loose materials from the Pit 1 highwalls, STPP stabilization of the existing pond water and sediments will be initiated. Based on the success of the St. Anthony field pilot test using STPP to sequester uranium and radium, UNC and its consultants will perform a full-scale application of STPP to the pit water area prior to backfilling the pit bottom. Following STPP application, materials removed from the highwalls will be placed to bridge the remaining wet areas in the pit bottom to establish a working surface for the equipment. This material is expected to serve as a bridging layer for the Contractor to be able to place additional fill material over the STPP treated water areas. In some areas, the thickness of the initial lift will be increased to establish a stable working platform for additional fill. Any remaining volume of material from the highwall, after establishment of the working surface, will be placed on top of the waste from the infill piles.

The material in the Pit 1 infill piles, currently within Pit 1, will then be excavated and placed at the bottom. These piles consist of about 528,000 cy of mine waste in three separate piles on benches above the pit bottom. Ra-226 concentrations of test pit soil samples collected from the piles during the 2019 characterization ranged from 7.5 pCi/g to 125.5 pCi/g. Once moved, placed, and compacted in the pit, the layer of mine waste from these piles is expected to be approximately 18 feet thick.

About 50,000 cy of material excavated from the highwalls, if placed in a single lift, will be compacted to about a one-foot-thick layer over the infill waste material. This cover layer is expected to contribute to attenuation of radon from the underlying waste. Additionally, soil cover with a minimum thickness of 4.5 feet will be placed on top of the infill and highwall materials for added radon attenuation and revegetation. The first 2.5 feet, placed directly over the highwall materials, will consist of material from the T/O pile and will act as a radon barrier. The final (upper) two-foot layer of the cover system, providing growth media and additional radon attenuation, will comprise soil excavated from the Topsoil North pile and the West Borrow area. The grading plan for the Pit 1 cover will optimize evaporation and transpiration with a shallow stormwater basin located in the center of the cover to collect surface water flow and facilitate evaporation.

6.3.3 Pit 1 Highwall Stabilization

The top of the highwall in Pit 1 ranges in elevation from 6050 to 6140 feet. The existing slope of the highwall ranges from approximately 1/3:1 to 2/3:1 for the area above the elevation of 6000 feet. There is an existing bench in the wall at an approximate 5980 feet elevation. The pit wall materials show high susceptibility to weathering and erosion over the long term. Long term erosion of the highwall is expected to be reduced by the diversion channels around the top of the highwall. However, wetting and drying and freezing and thawing of the exposed rock could still result in surficial weathering of the highwall over time. Long-term weathering would not be expected to cause large-scale instability of the highwall but could increase rockfall hazards over the long-term.

Based on visual observations of pit wall conditions, Stantec recommends surficial scaling of the highwall and clearing of eroded materials on existing benches, to mitigate rockfall and potential surficial failures at a smaller scale than captured in the models. The design includes mechanical removal of loose rock and eroded materials from the walls and benches from within the upper Mancos and Dakota formations from the top of the walls and working downward. Removal of loose rocks and erosion debris from the highwall face and benches will help to alleviate the potential safety risks to workers during earthwork in the pit bottom and allow additional catchment for future potential rockfall. The removed materials will be stockpiled in the pit bottom and then spread and compacted in the pit bottom. Additional mitigation of rockfall hazards, during closure construction, and long-term is discussed in Section 6.3.5.

6.3.4 Slope Stability

The Pit 1 highwall, was evaluated for slope stability against a static long-term FOS equal to or greater than 1.3, a pseudo-static FOS equal to or greater than 1.1, and a static shallow bench failure FOS equal to or greater than 1.0. The selected minimum FOS values for comparison used for these analyses are 1.3 for static, 1.0 for pseudo-static conditions, and 1.1 for shallow bench-scale failure. These FOS were used as general guidance for the analyses and comparison with the calculated values (Read, 2019 [Table 9.9]). Pit 1 was assigned a low consequence of failure because it is a closed pit located on remote private land that will have restricted access upon completion of reclamation.

Strength and fracture data obtained for the highwall rock mass from site geotechnical investigations and laboratory testing were used to model stability of the existing walls along a series of cross-sections to estimate factors of safety for the current and design configurations. Limit equilibrium models were developed to calculate factors of safety for stability of the highwall cross-sections. The stability models met the target FOS criteria for long-term static, pseudo-static, and static shallow bench failure modes (Stantec, 2023a). The existing slopes meet the design stability criteria and do not require additional stabilization.

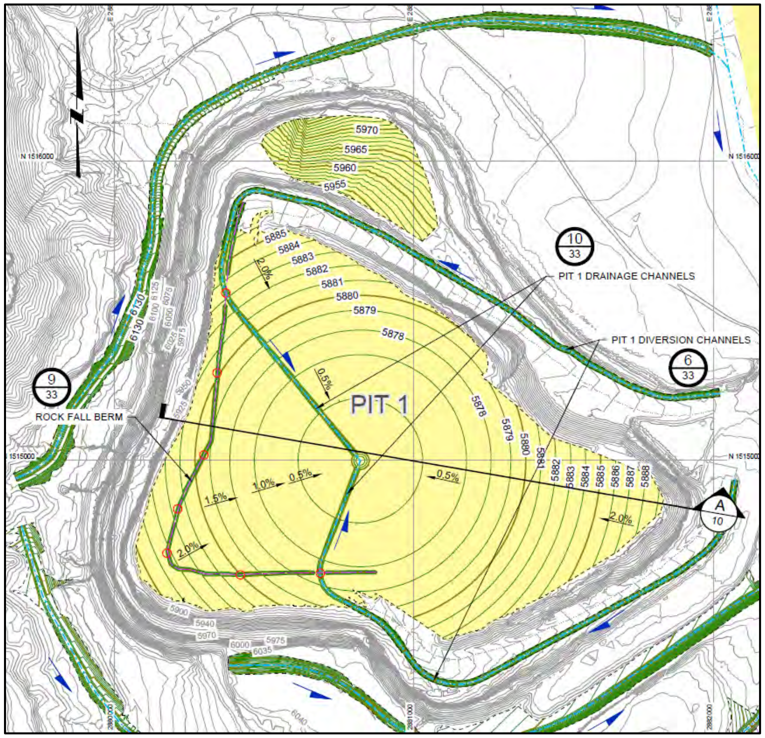
Stantec completed slope stability analysis for both circular and non-circular failure types along the Pit 1 walls. Slopes were analyzed for both shallow failures along the surface, or failure of a single bench, and global failures along planes deeper into the highwall through multiple benches. Static and pseudo-static loading conditions were analyzed. The stability model scenarios met the minimum comparison factors of safety. The 45 ft blast damage zone at the face of the wall generally controlled failure surfaces. Small scale, surficial failures generally had the lowest factors of safety. In general, stability results indicate global and surficial stability of the highwall. For these conditions, large scale slope cuts are not recommended. Surficial scaling of the pit walls and placement of materials in the pit is not expected to impact global stability results.

6.3.5 Rockfall Mitigation

Rockfall modeling was completed using the results of the 2021-22 geotechnical investigation. The model results showed rockfall runouts could be hazardous for workers in Pit 1. Rockfall results also showed that erosion debris on the highwall surfaces contributed to greater run-out distances (Stantec, 2023a). Based on this assessment, scaling of loose rocks and removal of erosion debris on the highwall will be performed to reduce potential rockfalls and runout distances. A fall zone will be delineated and a rockfall berm will be constructed to limit rockfall hazard. Figure 6-2 shows a portion of the planned design for the Pit 1 highwall and the planned location of the rockfall berm along the base of the west and southwest areas of the highwall.

Stantec used a rockfall modeling program to delineate hazard zones in the pit bottom to evaluate hazard protection solutions and effectively design hazard avoidance measures for the pit. The model simulated rock falls from various locations and heights along the highwall and calculated the trajectories and impact forces expected. The results of the rockfall analysis for Pit 1 indicate significant variability in rockfall retention, runouts, and potential bounce heights for all seeder (rock) locations considered per the sections evaluated. Rockfall retention varied from as little as 35% up to 99.9%, runouts beyond the toe-of-slope ranged from 18-feet to 105-feet, and bounce heights at strategic locations from the highwall toe range from 2-feet to over 20-feet.

Stantec designed the location of the rockfall berm based on maximum rockfall run-out distances estimated from the rockfall modeling. The distance of the berm from the highwall varies from approximately 40 ft to 105 ft depending on the expected maximum runout (for existing conditions) at various rockfall analysis locations along the highwall. The berm will have gaps approximately every 100-150 feet to allow surface water drainage towards the center of the pit. As shown on Drawing 10, the berm will be approximately three feet in height with 2H:1V side slopes and will consist of compacted fill material excavated from the West Borrow Area. Following earthwork activities, the berm will remain in place and be revegetated along with the surrounding Pit 1 cover soils.



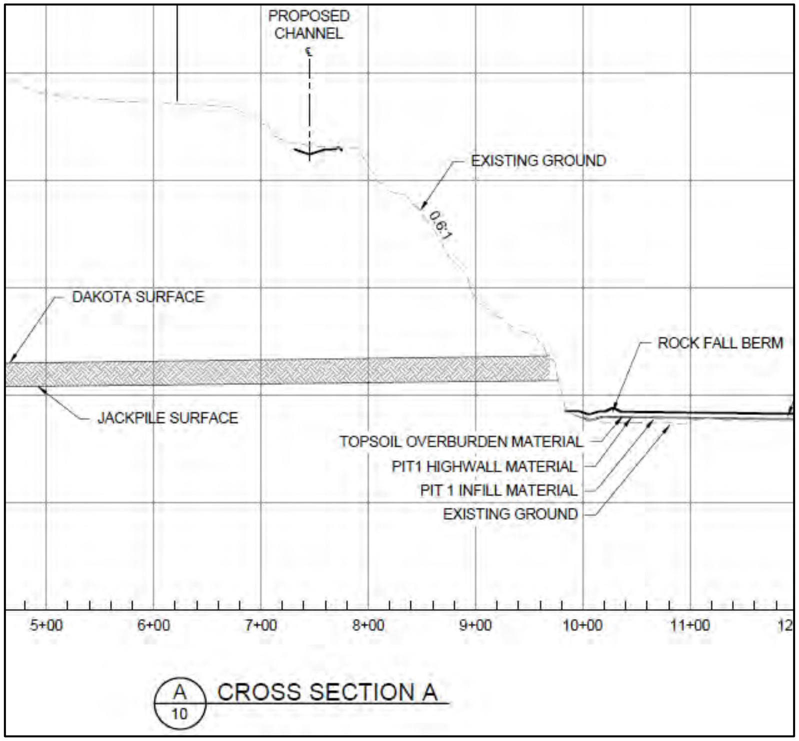


Figure 6-2. Pit 1 Highwall Excavation and Stabilization

6.3.6 STPP Application for COC Stabilization

Prior to backfilling and grading of the area of expressed water in Pit 1, sodium tripolyphosphate (STPP) will be mixed with the expressed water and shallow sediments to immobilize uranium and radium. The approach will be implemented consistent with the pilot test conducted onsite in 2019 and documented in the St. Anthony Mine Pit 1 Sodium Tripolyphosphate Pilot Test Results (INTERA, 2020) (STPP Report).

6.3.6.1 STPP Background

The application of STPP ($Na_5P_3O_{10}$) is advantageous for immobilization of uranium (U) and radium (Ra) because it reacts to form low-solubility phosphate solids that contain alkaline earth metals or other compounds that can be accommodated in its structure (e.g. UO_2^{2+}). In contrast to other sources of phosphate, like trisodium phosphate (Na_3PO_4), STPP reacts slowly with water to release phosphate that can in turn react with calcium and U already in the water to form autunite ($Ca(UO_2)_2(PO_4)_2 \bullet nH_2O$), ningyoite ($(U,Ca,Ce)_2(PO_4)_2 \bullet 1\text{-}2(H_2O)$) or other similar low-solubility solids (Zhenqing et al., 2009). Similar reactions occur to form a low-solubility solid with Ra substituted for calcium in the structure. Since it reacts slowly, STPP can diffuse into solid materials and react with sediment porewater where dissolved U and Ra are elevated. These apatite-like minerals incorporate U and Ra and will also coat the sediment with additional apatite-like minerals in a process taking months to years. This slow reaction provides a more thorough coating of apatite minerals on sediment surfaces that can act as a long-term sink for U and Ra (DOE, 2012).

As presented in the STPP Report, bench and drum scale testing and an onsite pilot test were conducted to evaluate the effectiveness of using STPP to immobilize U and Ra in water and sediment. Four months after application of STPP, the U concentration decreased by 83% and Ra concentration decreased by 77% in the treated region when compared to expressed water concentrations prior to the pilot tests. The results were below the WTVs discussed in Section 5.5.2.

6.3.6.2 STPP Application

Within 2 months prior to Contractor mobilization, the Engineer will complete a bathymetric survey of the expressed water in Pit 1 and collect samples for a water quality evaluation. Laboratory analytical results will be generated from 5-point composite samples of expressed water for the compounds listed above. This estimated volume of water and set of water quality parameters will be used to inform the Contractor as to the specific volumes of STPP to incorporate.

Based on the pilot test, the rate of STPP application will be approximately 89,000 gallons of solution per 3,130,000 gallons of expressed water. The final rate of application will be determined by the Engineer based on the advance analytical results.

The Engineer will use the Contractor's provided STPP material data, the expressed water sample results, and volume calculations to determine the overall quantity of STPP to add to the expressed water. If the sample results are consistent with the pre-pilot expressed water results, then a prescribed quantity of STPP will be added during full-scale application to achieve 2.5 grams of STPP per liter of expressed water.

Prior to mobilization for the full-scale STPP application, the Contractor will be required to submit an STPP application plan to the Engineer, to include the following:

a) Contractor's preferred vendor and manufacturer's data to demonstrate the STPP material will be provided in a powder form and is readily dissolved in water.
b) Analytical results for the proposed STPP material for arsenic, uranium, and radium 226 and 228 to ensure arsenic concentrations are below 1 microgram per gram (µg/g).
- A proposed mixing water source with analytical results to demonstrate that the proposed mixing water meets WQCC Standards.
c) Proposed mixing equipment and description of proposed mixing method(s).
d) Proposed approach to determine that adequate STPP material has been added to the mix water to achieve the required concentration of the solution, including application rate, and mixing time.
e) Proposed approach for mixing the STPP solution into both the expressed water and the top 12 inches of sediments in the expressed water area across a 100-foot square grid. This will include extent of area to be mixed, depths of mixing, and duration of mixing to achieve the desired application rate for STPP into the expressed water and sediment.

After the Engineer has approved the Contractor's proposed approach and the Contractor has mobilized to the Site, STPP application will begin. The Contractor will:

- Measure the temperature of mix water and expressed water and provide this data to the Engineer to confirm the previously calculated quantity of STPP to achieve a concentration up to 80% of the solubility at the water temperatures, is correct for the time of application.
- Initially, mix the STPP material with water that meets WQCC Standards in frac tanks (or similar) onsite until the STPP has dissolved in the water based on visual observations.
- Apply and mix the STPP solution into the expressed water and record mixing depth to demonstrate each 100 square foot area with the extent of the expressed water has been mixed to 12-inches below the top of the sediment surface. This application process will be documented for construction completion (QA) purposes.
- After completing mixing, collect and submit for analysis a 5-point composite sample of STPP-modified expressed water for Ra-226 and Ra-228 levels for comparison against the Wildlife Threshold Values (WTVs). Concentrations above these WTVs would indicate future treatment may be necessary to protect wildlife. Water samples will be collected 24 hours, and 3 days after completion of mixing. The results will be reviewed by the Engineer for acceptance prior to demobilizing the STPP equipment and beginning placement of fill in the pit bottom.
- If initial sample values are not below WTVs, after consultation with the Engineer, conduct additional mixing and recollect a 5-point composite for analysis for WTVs at the same time intervals as the previous step. Repeat until compound concentrations are below WTVs.

6.4 REGRADED WASTE PILES

Several of the existing waste piles will be recontoured in place. The existing volume of material in Pile 4, the largest pile onsite, will be combined with Pile 5 and the remaining volume of the T/O Pile (leftover after the material to be used as fill in Pit 1 removed), also located along the east side of the Meyer Draw.

Piles 1 and 2 (shale piles) and Pile 3, located near Pit 2, will be regraded and stabilized in place prior to being covered. Due to limited available space for the Pile 3 regrade on the west side of Meyer Draw, approximately 58,000 cy from the existing Pile 3 volume will be incorporated into the Pile 4 regrade on the opposite side of the arroyo, as discussed below.

6.4.1 Performance Objectives and Design Criteria

Table 6-5 summarizes the design criteria being applied to regrading of Site waste piles in place. The primary objective is to achieve erosionally stable slope grades and lengths; further design criteria for the completed waste piles with covers are in Section 6.6. The surface regarding design criteria are included in Table 6-5.

Table 6-5. Surface Regrading Design Criteria

Design Element	Design Criteria	Design Guidance
Surface Re-grading	• Stable configuration that minimizes ponding and promotes conveyance of surface water • Slopes to be revegetated should be graded to no steeper than 3H:1V • Erosional stability for design slope lengths • Slope stability for design slope grades and lengths. • Designed for a long-term static factor of safety of 1.3 or greater and designed for a factor of safety of 1.1 or greater under pseudostatic analysis.	• MARP Closeout Plan Guidelines • NMAC 19.10.5.C: (1) "…compatible with a self-sustaining ecosystem or approved post-mining land use." And (2) "…designed constructed and maintained to minimize mass movement."

6.4.2 Grading

The Reclamation Design includes regrading and covering several piles in place. The largest pile onsite (Pile 4) will be regraded into a new, covered pile that also comprises regraded material from Pile 3, Pile 5, and the T/O Pile within a merged footprint. The regraded Pile 4 (with Pile 3, Pile 5, and T/O Pile material) will be contoured to stable slopes in between Meyer Draw and Arroyo del Valle. The design for Pile 4 is to push the material to the borders of Meyer Draw and Arroyo del Valle and grade the side slopes to a nominal design grade of 30 percent (3.5H:1V) with a 2 percent top slope. The pile slopes will be broken by benches to capture and convey rainfall runoff from the interbench slopes to minimize erosion potential. The maximum slope length between the benches on Pile 4 will be approximately 250 feet.

The existing powerlines on the northern edge of the approximate mine boundary of the Site create a restriction for regrading Pile 4 to the north. Continental Divide Electric Cooperative (CDEC) requests a 20-foot circumferential buffer area around each power pole (i.e., 10-feet in each direction). The grading limits of Pile 4 were kept to 10 feet south of the powerlines to avoid the power poles.

Piles 1, 2, and 3 will also be regraded in place. Since the Meyer Draw design corridor will partially pass through the existing locations of the piles, waste pile material will be removed from the corridor and incorporated into the adjacent pile regrades to make way for the arroyo corridor. As previously discussed, the full depth of mine-impacted waste pile material currently located below the bottom elevation of the arroyo will be excavated and replaced with compacted, non-impacted fill. At Piles 1 and 2, the excavated material will be placed outside of the arroyo corridor and included in the regrade of the shale piles. At Pile 3, some excavated material will be moved to the northeast side of the arroyo corridor and incorporated into the Pile +4 regrade, due to capacity limitations in the Pile 3 regrade area. For the Pile 3 configuration shown on Drawing 9, which Stantec designed to meet the grading criteria in Table 6-5, to meet the maximum slope criteria, a mine waste volume of about 58,000 cy will be moved from Pile 3 to Pile 4. Therefore, in addition to the Pile 3 material within and northeast of the arroyo corridor, some of the Pile 3 material currently located southwest of the arroyo corridor will also need to be relocated into the Pile 4 regrade.

The side slopes of Piles 1, 2, and 3 will be graded to a maximum design grade of 30 percent (3.5H:1V). Pile slopes adjacent to Meyer Draw will be approximately 4H:1V, whereas slopes on the opposite sides of the piles (i.e., facing Pit 2 and away from Meyer Draw) will be graded to slopes ranging from 3.5:1 to 4:1. The maximum design length of the slopes for the regraded configuration of Piles 1, 2 and 3 is 350 feet. The Pit 2 diversion channel runs between Piles 1 and 2 and drains directly into Meyer Draw. A summary of the maximum design slope grades and lengths is included in Table 6-6. Following completion of grading, the waste piles will be covered for long-term stabilization as described in Section 6.6.

Table 6-6. Summary of Regraded Waste Pile Slopes

Pile	Maximum Slope Angles	Maximum Corresponding Slope Lengths (feet)
1 and 2	4H:1V	300
3	4H:1V	350
4	3.5H:1V	250

6.4.3 Pile Slope Stability

Stantec conducted slope stability analyses as part of cover design evaluations for Piles 1 through 4. The factors of safety for static and pseudo-static slope stability were calculated by Stantec using limit equilibrium slope stability analyses via the computer software SLOPE/W version (Geo-Slope International, 2024). Appendix G.3 describes methods used to develop the model input parameters and summarizes the results.

Stantec evaluated slope stability of the grading for the regraded waste piles. Standard penetration test (SPT) blow count data from the piles was used to estimate strength parameters for the waste rock materials. Due to safety concerns, drilling on the waste rock piles did not reach the foundation soils but Stantec assumed that the foundation beneath the waste rock piles would have the same strength parameters as nearby locations for which lab data is available. These strength parameters were therefore applied to the foundation regions of the models based on the location’s proximity to the respective pile. Laboratory strength testing has been performed on samples collected from the borrow soils to obtain shear strength parameters for the potential cover materials. The geotechnical data was primarily collected during the 2018 site geotechnical investigation (Appendix C).

Factors of safety values were evaluated against acceptable published values that align with standard mining practice for slopes. The selected minimum FOS values for comparison used for these analyses are 1.3 for static, 1.0 for pseudo-static conditions, and 1.1 for shallow bench-scale failure. These FOS were used as general guidance for the analyses and comparison with the calculated values. Limit equilibrium models were developed to calculate factors of safety for stability of the Pile 1 through Pile 4 cross-sections. The stability models analyzed met the target factor of safety criteria for long-term static, pseudo-static, and static shallow bench failure modes (See Appendix G.3).

The slopes of the waste rock piles meet the design stability criteria and do not require additional stabilization. Stantec completed slope stability analysis for both circular and non-circular failure types along critical sections containing the tallest and steepest slopes of Piles 1 through 4. The location and orientation of the cross sections modeled for Piles 1 through Pile 4 are detailed in Figure 1 of Appendix G.3.

Stantec used entry-exit, grid-and-radius, and block-specified search methods to locate critical failure surfaces for each cross-section. Slopes were analyzed for both shallow failures along the surface, or failure of a single bench, and global failures along planes deeper into the piles through multiple benches. Static and pseudo-static loading conditions were analyzed. Table 6-7 presents the results of the static and pseudo-static slope stability analyses for the regraded waste rock piles. The static modeling results indicate that all cross sections evaluated for Piles 1 through 4 exceed the comparative minimum FOS requirement of 1.3 for static conditions. Additionally, all cross sections exceeded the minimum recommended FOS of 1.1 for pseudo-static modeling.

Table 6-7. Calculated Factors of Safety Pile Slope Stability Models

Structure	Cross-Section ID	Base-Case Drained Static FOS	Minimum Recommended FOS	Pseudo-static FOS	Minimum Recommended FOS
Pile 1	Section 1-1	2.8	1.3	1.9	1.1
Pile 2	Section 2-1	2.9		1.9	
Pile 3	Section 3-1 (southwestern slope)	2.8		1.9	
	Section 3-1 (northeastern slope)	3.3		2.1	
Pile 4	Section 4-1 (global)	2.8		1.8	
	Section 4-1 (localized)	2.6		1.7	
	Section 4-2 (global)	3.0		1.9	
	Section 4-2 (localized)	2.7		1.8	
	Section 4-3 (global)	3.1		2.0	
	Section 4-3 (localized)	2.9		1.9	
	Section 4-4 (western slope)	2.9		2.0	
	Section 4-4 (eastern slope)	3.5		2.1	

6.5 SURFACE WATER HYDROLOGY

The design includes a series of surface water channels to direct upstream run on around each of the two pits and to Meyer Draw. Stormwater management structures have been designed to manage stormwater from the bench in Pit 1 and along the haul ramps in Pit 1. Additionally, the hydrologic design includes the arroyo stabilization measures for Meyer Draw.

6.5.1 Performance Objectives and Design Criteria

Table 6-8 summarizes the design criteria being applied to surface water design and management for the Site. These criteria for surface water are being applied to channel design, arroyo stabilization, and erosion protection designs for the Site features.

Table 6-8. Hydrology Design Criteria

Design Element	Design Criteria	Design Guidance
Design Storm Event	• 500-year return interval • 24-hour storm duration based on maximum peak flow generated by the 500-year storm event	Selection based on MMD request in response to NM Executive Order 2019-003 on Addressing Climate Change (Also, NMDOT for channel design and Albuquerque Dev. Process Manual for Site Development, Stormwater)

6.5.2 Design Discharge

For hydrologic evaluations, Stantec developed hydrologic models to predict flows at various points of interest around the project Site for existing and design conditions. Modeling was completed using USACE Hydrologic Engineering Center's – Hydrologic Modeling System (HEC-HMS) version 4.2.1, build 28.

Stormwater conveyance facilities in this plan were designed using the peak discharge rates with an estimated 0.2 percent annual occurrence probability (500-year storm). The study also evaluated the 2-year, 5-year, 10-year, and 100-year storm events under existing Site conditions. The peak discharge at each point of interest on the project Site was determined by simulating runoff hydrographs using a center peaking rainfall distribution that included the peak rainfall intensities for time intervals between 5-minutes and 24 hours.

The stormwater models considered rainfall losses from depression storage and infiltration. The hydrologic model used constant depression storage values consistent with values recommended for regional watersheds. Losses due to infiltration were computed using the Green and Ampt (1911) method which provides physically-based estimates of losses during different storm intensities and storm durations. Appendix F contains further discussion and justification of the methods and assumptions used to develop the peak flow rates used for design of stormwater conveyance facilities.

6.5.3 Native Arroyo

Meyer Draw is located between several mine waste rock piles, and channel stabilization measures have been designed to prevent long-term downcutting erosion in the arroyo. Stantec believes that the arroyo through the Site is vertically unstable and future channel downcutting is predicted to occur if preventative measures are not taken. Deeply incised drainages with unstable sides are common features of natural arroyos in the Site vicinity. Highly erodible, native soils in the drainage bottoms are susceptible to continued channel downcutting due to frequent, intense flooding that is characteristic of western arroyos.

The arroyo improvements are designed to mitigate erosion and destabilization (e.g., undercutting and slope oversteepening) of the re-graded and covered waste piles that will remain more than 50 feet from the centerline of the arroyo. Stabilization measures will prevent continued arroyo downcutting that could compromise the slope stability and soil cover integrity of the adjacent waste pile slopes. The stabilization strategy is to re-establish a “quasi-equilibrium” condition in the arroyo; that is, a condition in which the arroyo reach through the Site can transport flows without substantial loss or accumulation of sediments from long-term scour or sediment deposition, respectively. This condition is achieved by mirroring local, native cross-sectional channel dimensions and profile gradients so that the design reach will effectively convey sediment loads transported to the project area without disrupting the natural channel functions in the upstream and downstream reaches.

The arroyo stabilization design includes construction of four drop structures that will lower the channel thalweg, or the line connecting the lowest point of elevation along each cross section of the arroyo, by 6 feet each. The drop structures are designed to resist vertical and lateral channel migration and will be constructed using roller compacted concrete that is designed to be stable during a 500-year flood event and to resist erosive forces. The toe of the regraded piles along the arroyo banks will be lined with riprap between the drop structures where regraded waste pile materials are adjacent to the arroyo and on both banks immediately downstream of the drop structures. The channel alignments and sections are illustrated in the Closeout Plan Drainage Design Drawings and further discussion of methods used in, and justification of, the channel designs are provided in Appendix F.

Construction at the site will require temporary crossings of the arroyo be constructed in order to provide truck and equipment access to Pile 4. Stantec anticipates that one crossing will be established North and East of Pit 1 to access the North side of Pile 4 and immediately East of Pit 1 to access the central and South sides of Pile 4. The crossings will be the responsibility of the Contractor and are expected to consist of a series of temporary large diameter culverts, box culverts, and/or low-water crossings designed to be durable enough to withstand high-velocity flows in the arroyo. These structures will be temporary for construction and will be removed upon completion of the project. Temporary water management structures within Meyer Draw should be designed for 10-year 24 hour storm flows.

6.5.4 Pile 4 Bench Channels and Downdrain

The closure plan for Pile 4 is to spread the pile material to flatten and stabilize the slopes and maximize the use of available space between Meyer Draw and the East Tributary arroyo that flank the southwest and eastern edges of the pile. From the arroyo edges, Pile 4 will be sloped at a design grade of approximately 30 percent (3.5H:1V). The pile slopes will be broken by benches that capture and convey rainfall runoff from the Pile 4 interbench slopes. The maximum length of the interbench slopes will be 250 feet. Stormwater conveyance channels constructed on the regraded benches will extend from the North face of the pile at approximately 2 percent grade toward an armored downdrain channel at the Southern end of the pile. The downdrain channel will convey flow at a slope that decreases from approximately 14 percent at the upstream portion to approximately 10 percent at the downstream portion. The bench and downdrain channels will be armored with riprap to resist channel degradation. The downdrain will convey non-contact, meteoric flows off the regraded pile and will discharge near the confluence of the Meyer Draw and East Tributary arroyos. The channel alignments and sections are illustrated in the Closeout Plan Drainage Design Drawings and further discussion of methods used and justification of the channel designs is provided in Appendix F. Table 6-9 includes a summary of the channel dimensions and riprap sizing for the Pile 4 channels.

Table 6-9. Pile 4 Channel Design Summary

Channel	Dimensions*		Median (D_{50}) Riprap Size (inches)
	Bottom Width (ft)	Channel Depth (ft)	
Pile 4 Bench Channels	4	2.25	3
Pile 4 Downdrain Channel	12	2 to 2.5	6 to 12
Pile 4 North Diversion	5	3 to 3.5	9

*Channels have 3:1 side slopes

6.5.5 Pile 4 Sediment Berms

Sediment berms have been designed to capture eroded sediment flowing toward the arroyo from Pile 4. The sediment berms have a trapezoidal berm geometry with a height of 3 feet to capture soil erosion volume for a 2-year period, after which, the rate of erosion of newly constructed cover material should reduce as self-armoring and vegetation become established. The sediment berms will have 2-foot-wide gaps spaced every 1,000 feet to allow water to drain off the Pile 4 slopes. The sediment berm gaps will be armored with the same riprap as the arroyo side-slopes. The sediment berm sizing methods are provided in Appendix F. Table 6-10 summarizes the berm dimensions and riprap sizing for the sediment berms. The berms are intended to be permanent and will remain in place following construction of the site improvements.

Table 6-10. Sediment Berm Design Summary

Dimension	Value
Upstream Side Slope (xH:1V)	3
Height (ft)	3
Gap Spacing (ft)	1000
Gap Width (ft)	2
Median (D_{50}) Riprap Size (inches)	15

6.5.6 Diversion Channels

Upstream diversion channels have been designed to capture surface run-on water to minimize drainage flowing back into Pits 1 and 2, and to capture and convey drainage around the covered waste rock material. The diversion plan uses a combination of trapezoidal channels and armored, flow diversion berms. The diversions will direct the flow of meteoric water (originating from the catchment area surrounding the pits) around the pit areas and into the Meyer Draw channel. Median riprap diameters ranging in size between 3 inches and 18 inches will be installed to prevent scour/erosion along the diversion channel alignments.

Within Pit 1, drainage channels will be incorporated into the access ramps. The channels will be located on the outside edge of each access ramp (where the ramp meets the pit wall above) and the ramps will be cross-sloped at a 3 percent grade for surface water to drain into the channel. At the bottom of the ramps, the channels will continue to the center of the covered Pit 1 area and converge at a riprap-lined dissipation structure designed to mitigate erosion of the cover material. The bench area on the north side of Pit 1 will also be graded to drain into the Pit 1 Ramp Channel North. Water collected on this bench will be conveyed in a controlled manner to the bottom of the pit.

The channel alignments and sections are illustrated in the Closeout Plan Design Drawings and further discussion of methods used in, and justification of, the channel designs are provided in Appendix F. Table Table 6-11 includes a summary of the channel dimensions and riprap sizing for the Site diversion channels.

Table 6-11. Diversion Channels Design Summary

Channel	Dimensions*		Median (D_{50}) Riprap Size (inches)
	Bottom Width (ft)	Channel Depth (ft)	
Pit 1 Diversion North	5	3 to 3.5	6 to 9
Pit 1 Diversion South	0-10	2.25 to 4.75	6 to 15
Pit 1 Ramp Channel North	3	2.5 to 2.75	6 to 9
Pit 1 Ramp Channel South	3	2.0 to 2.5	3 to 9
Pit 1 Diversion South Bench	0 to 4	2.5 to 3.25	3 to 6
Pit 2 Diversion	0 to 20	3 to 4.25	6 to 18
Pile 3 Channel	5 to 7	3 to 3.5	6 to 9
Pile 1 Bench Channel	4	2	3 to 6

*Channels have 3H:1V side slopes

6.6 SOIL COVERS

Both the finished surfaces of the pits and the waste piles to be regraded in place will be covered with non-impacted soils and stabilized during Site reclamation.

6.6.1 Performance Objectives and Design Criteria

Table 6-12 summarizes the design criteria being applied to soil cover design both for the pit backfill and the covers to be placed over the regraded waste piles.

Table 6-12. Cover System Design Criteria

Design Element	Design Criteria	Design Guidance
Cover System	• Maintain erosional stability of pit and pile covers under the design storm event • Cover material to be of sufficient thickness and texture to remain in place and not allow for re-exposure of buried material • Use suitable materials described by soil and topsoil suitability ratings • Model cover slopes with Revised Universal Soil Loss Equations (RUSLE) • Cover materials must achieve radon flux equal to, or less than, 20 picocuries per square meter per second ($pCi/m^2/s$)	• MARP Closeout Plan Guidelines and Attachment #1 • Joint Guidance for the Cleanup and Reclamation of Existing Uranium Mining Operations in NM (2016)
Surface Re-grading	• Stable configuration that minimizes ponding and promotes conveyance of surface water • Slopes to be revegetated should be graded to no steeper than 3H:1V • Erosional stability for design slope lengths	• MARP Closeout Plan Guidelines

6.6.2 Cover Materials

Soil will be sourced from the West Borrow and Lobo Tract borrow areas and be used as cover soils for the backfilled pits and regraded piles. Additional cover soil will be excavated from the North Topsoil pile located north of Pit 1. Material from the T/O Pile and South Topsoil Pile will be excavated and placed as radon barrier layers in the Pit 1 and Pit 2 cover systems, respectively. Gravel will be incorporated into a soil and rock mixture (Soil Cover with Gravel) that will be used as cover material on the lower pile slopes of Pile 3 and the slope downslope from the lower bench on Pile 4 immediately upslope from the arroyo, where slopes are 3.5:1 or steeper, generally between about 150 to 250 feet upslope from the arroyo, in select areas along Meyer Draw.

The borrow areas are described in the following sections and Appendix C describes the soils encountered in each area during the geotechnical investigation and summarizes material properties and classifications. Table 6-13 details the Ra-226 concentrations, available borrow volume, topsoil suitability, and Cedar Creek preference ranking for each potential borrow area. Each of the material in the sections below is considered suitable for cover borrow. The T/O Pile footprint (following excavation) will be incorporated into the regraded Pile 4 and will not require additional surface reclamation measures. All other borrow area excavations, as well as any excavation area in the Lobo Tract, will be reclaimed using the same revegetation approach as the other disturbed mine areas.

Table 6-13. Borrow Area Characteristics Borrow Area Characteristics

Borrow Area	Ra-226 Concentration (pCi/g)	Available Borrow Volume (cy)	Texture Suitability[1]	Cedar Creek Recommendation Ranking[2]
East Lobo Tract	≤1 (from 2007)	780,000+ up to 286,000 contingency from West Lobo Tract	Unsuitable to Good (unsuitable areas due to high clay content)	3
West Borrow Area	<1.2 to >6.6 (from 2022)[3]	729,000	Good	2
North Topsoil Pile	<1 (from 2007)	43,500	Good	1 (best)
South Topsoil Pile	<1 (from 2007)	368,500	Good	6
Topsoil/Overburden Pile	<1 (from 2007)	658,700	Marginal to good	5

Notes:

1. Topsoil suitability categories were evaluated based on soil texture, using Appendix #1 (MMD, 2022).
2. Cedar Creek Site Revegetation Plan (Cedar Creek, 2023b) (see Section 6.8).
3. Analytical results of the supplemental 2022 surface investigation indicates that some soil within the West Borrow Area exceeds 6.6 pCi/g (Stantec, 2023b).

6.6.2.1 Lobo Tract Borrow Area

The Lobo Tract is owned by UNC and will provide a soil borrow source for the project. Other than providing soil borrow for the reclamation, the Lobo Tract Borrow area is not part of the Site. The borrow area is on adjacent property to the north of the approximate mine permit boundary, generally east of the access road to the Site, and within a wide valley-bottom floodplain. Meyer Draw forms the base of the valley prior to moving south through the Site. Soil samples were collected from potential borrow sources on both sides of the arroyo during the 2018 geotechnical investigation. Analytical testing results from the 2007 materials characterization indicated Ra-226 concentrations of approximately 1 pCi/g or less, confirming the potential use of the area as a source of borrow material. Soil textures present within the Lobo Tract Borrow include sandy loam, sandy clay loam, clay loam, and clay (Cedar Creek, 2018). Some soil samples within the Lobo tract fall into the marginal to unsuitable category based on higher clay contents, on the order of 44 to 64% clay, which are considered more erosive.

Approximately 780,000 cy of borrow material is available within the Lobo Tract Borrow East area, to the east of the arroyo. The outlined area (shown on Drawing 5) contains the best quality borrow material for use as soil cover compared to areas closer to the rock outcroppings along the eastern edge of the valley. Approximately 286,000 cy of additional borrow material is available, if necessary, from the Lobo Tract Borrow West area, to the west of the arroyo. The Lobo Tract West area is not expected to be used for borrow material, and will remain a contingency borrow area, since the east area contains sufficient borrow volume for the Pile 4 cover requirements. The east area is also closer to Pile 4 and will allow for reduced haulage distances compared to using the west area. The Lobo Tract Borrow east area may be expanded further north within the boundaries of the Lobo Tract for contingency volume, although this will increase haulage distances and ground disturbance.

6.6.2.2 West Borrow Area

The West Borrow Area is outside of the approximate mine permit boundary to the south of Pit 1 and contains alluvial deposits with depths as great as 30 to 40 ft. The proximity of this area to Site facilities, especially Pit 1, makes it desirable as a potential borrow source. Stantec included gamma radiologic survey measurements, ex-situ and in-situ gamma radiation soil screening, soil sampling and laboratory analysis in the scope of the supplemental 2022 site investigation to collect additional analytical data in this area. As described in Section 4.1.4, measured Ra-226 concentrations were above 6.6 pCi/g (Stantec, 2023b), indicating the area contains materials excluded from use as soil cover. These areas will be excavated as part of the removal excavation prior to borrow operations. The West Borrow Area soil textures are sandy clay loam and clay loam (Cedar Creek, 2018), which are considered good to marginal. Approximately 729,000 cy of soil is available for excavation in this area, all of which is expected to be used for soil covers. Use of this material would likely require permission from the CLG since this area is part of the mining lease area but not within the approximate mine permit boundary. If used, the area would be revegetated similarly to the other areas of the mine.

6.6.2.3 North Topsoil Pile

The North Topsoil pile is immediately north of the northern Pit 1 highwall and is presumed to contain topsoil excavated from the Pit 1 overburden during initial development of the pit. The soil contained Ra-226 concentrations less than 1 pCi/g during the 2007 materials characterization and this is another potential non-impacted source of borrow material. The north borrow area soil is classified as a sandy loam (Cedar Creek, 2018) which is considered good for plant establishment. Of the available borrow sources, Cedar Creek listed the North Topsoil pile as the preferred material for cover or planting media based on a comparison of soil textures. Approximately 43,500 cy of material is available for borrow excavation from the North Topsoil pile. Stantec considers the North Topsoil pile a mine feature to be reclaimed, however use of this material will require the consent of the CLG since this area is located on CLG property.

6.6.2.4 South Topsoil Pile

The South Topsoil Pile is located south of Pit 2 and west of Shale Pile 1. The South Topsoil Pile is classified as a sandy loam and sandy clay loam (Cedar Creek, 2018) which is considered good for plant establishment. Approximately 368,500 cy of material is available for excavation from this pile, with measured Ra-226 concentrations less than 1.1 pCi/g for samples collected during the 2018 field investigation. Due to its proximity to Pit 2, in which the waste materials with the highest activity levels will be placed, this pile is a desirable source of non-impacted material for use as a radon barrier in the Pit 2 cover system. The available volume translates to an 8-foot-thick (compacted) intermediate cover layer over the backfilled waste (with additional cover placed above the South Topsoil material for revegetation), as discussed in Section 6.6.3.

6.6.2.5 Topsoil/Overburden Pile

The T/O Pile is located east of Meyer Draw and north of Pile 5. The T/O Pile samples are classified as clay loam, sandy clay loam, and clay (Cedar Creek, 2018) which are considered marginal to good for plant establishment. The clay samples from this source contained 40 to 50% clay particles which is still generally considered to be marginal (MMD, 2022). The pile contains approximately 658,700 cy of material with measured Ra-226 concentrations less than 1 pCi/g for samples collected during the 2018 field investigation. Similar to the South Topsoil pile material, the T/O material is not the most preferred borrow material for use as growth media; however, the pile provides a useful source of non-impacted material for use as either a radon barrier or as fill soil for other Site reclamation purposes. A portion of the pile material will be placed in the Pit 1 cover system to contribute to mitigation of radon emanation and the remaining volume will be moved and graded into Pile 4.

6.6.2.6 Highwall Materials

Materials to be excavated from the Pit 1 highwall as part of the highwall stabilization include loose rock and eroded soils currently located on the pit walls and benches, generally consisting of material originating from the upper Mancos shale and Dakota formations as well as the overlying alluvial/topsoil deposits. Since the highwall materials were not specifically characterized during prior field investigations, Stantec estimated material properties (including Ra-226 concentration) using a weighted average of the measured properties for topsoil/alluvium (e.g., West Borrow material) and Shale Piles 1 and 2, based on a visual approximation of the proportion of each material type in the loose highwall materials (estimated to be 40% topsoil/alluvium and 60% eroded shale). The resulting Ra-226 concentration used for cover system design was 5 pCi/g, which is less than the SAL for the Site. Thus, the highwall provides a source of non-impacted material in close proximity to the Pit 1 backfill, with minimal transport required for use as the initial cover material in the pit bottom.

Stantec estimated that the pit walls and benches contain approximately 50,000 cy of loose material to be removed as part of the highwall stabilization. This volume translates to an approximate one-foot-thick (compacted) radon barrier layer when placed as backfill in the pit, serving as the lower layer of the Pit 1 cover system placed over the infill waste material.

6.6.3 Cover Designs

A primary objective of placing a soil cover over the backfilled pits is to reduce radon flux from the waste to less than 20 pCi/m^2/s. Radon attenuation was analyzed using the US Nuclear Regulatory Commission (NRC) RADON model (NRC, 1989), which uses the physical and radiological characteristics of the waste and overlying materials to calculate the rate of radon emanation through the cover. Appendix G describes the methods used to develop the model input parameters and summarizes the model results.

Geotechnical properties for the materials are based on the laboratory data from the Site samples. Stantec has assumed a placed density of 90% of the standard Proctor density for the borrow and the waste. Moisture contents for the materials were either based on laboratory data or the NRC-recommended long-term moisture content of 6 percent was used for cover soils if the lab results were greater than 6 percent. Ra-226 activity concentration input values are estimated based on the results of the 2007, 2018, and 2019 analytical testing.

Erosional stability was analyzed for a vegetated cover surface using the Temple Method as recommended in “Design of Erosion Protection for Long-Term Stabilization” published by the NRC (Johnson, 2002). This method uses physical characteristics of the cover material and expected vegetation properties to calculate the factor of safety against erosion due to the peak runoff from the 500-year design storm event. Appendix G.2 describes the methods used to develop the model input parameters and summarizes the results. Stantec used a reference factor of safety of greater than or equal to 1.5 for acceptable erosional stability with vegetation established. The factor of safety represents the ratio of the allowable stresses (the resisting strength of the cover vegetation and soils) to the effective stresses (the stresses imparted by the runoff flowing over the cover). The surfaces were evaluated for two conditions: (1) resistance of poor vegetation, and (2) resistance of fair vegetation, which represent varying degrees of vegetation establishment on the cover.

Soil loss as a result of surficial erosion was estimated using the revised universal soil loss equation (RUSLE) for the cover designs. Stantec performed calculations for each of the covered areas (Pits 1 and 2 and Piles 1 through 4). The RUSLE calculations account for the effects of rainfall, soil erodibility, slope length and steepness, cover management practices, and conservation support practices on cover surface erosion. The resulting amount of soil loss (in tons per acre per year) can be used to evaluate the need for temporary or permanent erosion control measures on the reclaimed slopes. Calculated soil loss values account for changes in cover conditions as vegetation becomes established and residue cover increases over the first 10 years following construction. Accordingly, the resulting values presented herein for each covered facility represent the average soil loss per year over this timespan. The 10-year average annual soil loss is thus impacted by the effects of bare soil conditions during the first year, with reduced soil loss expected in years 2-10 as residue cover improves each year. Appendix G.2 describes the methods used to develop input parameters for the RUSLE calculations and summarizes the results.

6.6.3.1 Pit 1

The Pit 1 cover will be contoured to slope gently from the outer edges of the pit towards the center at slopes ranging from 0.5 percent to 2.0 percent. Per Cedar Creek's recommendations, the thickness of the topmost cover layer will be 24 inches to create more favorable growth conditions for successful revegetation. The uppermost portion of the cover will come from the North Topsoil pile and the West Borrow area. This upper layer of cover will be placed over a 2.5-foot-thick layer of material from the T/O Pile and an approximately one-foot-thick layer of cover material removed from the pit highwall, the combination of which will increase the ability of the cover to attenuate radon emanation from the underlying Pit 1 Infill waste. Figure 6-3 shows an example of the cover detail for the Pit 1 cover.

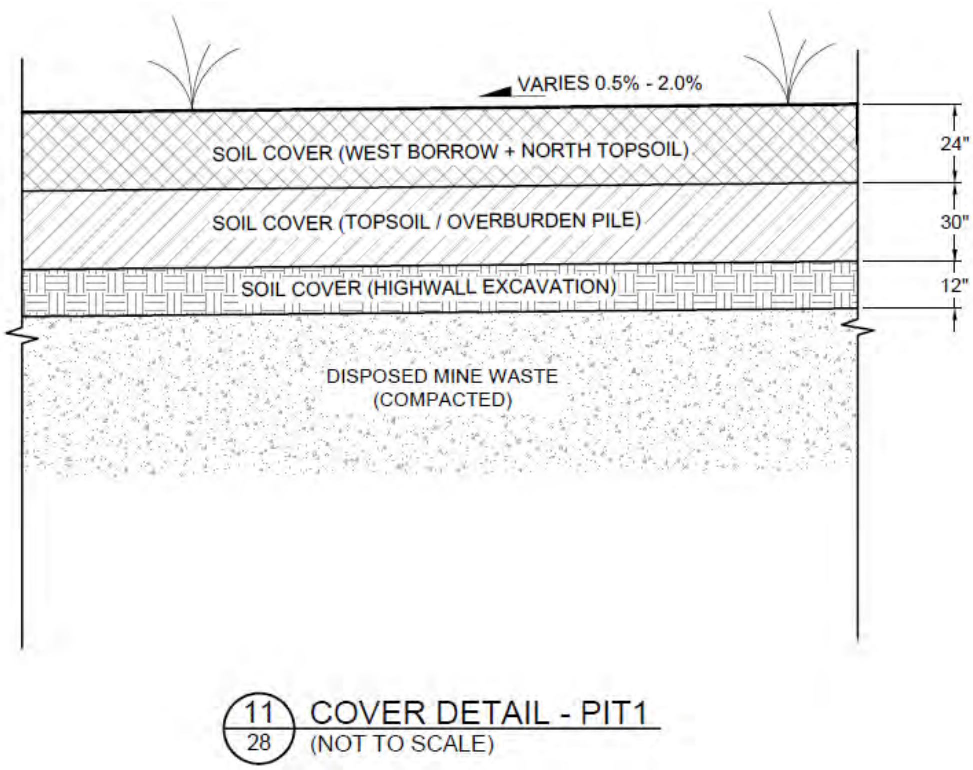


Figure 6-3. Pit 1 Cover Detail

Radon Emanation

Input values for the Pit 1 infill piles were estimated as the 75th percentile of the values measured during analytical testing for samples collected from the piles. The activity of the Pit 1 Highwall Excavation materials was estimated using a weighted average of the activities for clean topsoil/alluvium and Shale Piles 1 and 2 materials based on material similarities and the expected proportion of each material in the design profile (60% shale, 40% topsoil/alluvium). The estimated Ra-226 activity of the highwall materials (5 pCi/g) is less than the SAL. The T/O Pile material cover layer was optimized in the RADON model to determine the required layer thickness (with the highwall excavation and upper revegetation cover layer thicknesses kept constant) to limit radon flux from the top of cover to no more than the target threshold value of 20 pCi/m^2/s. The resulting T/O layer thickness corresponding to a total flux for the Pit 1 cover design of 20 pCi/m^2/s was 2.2 ft. For constructability purposes, Stantec selected a T/O layer thickness of 2.5 ft (corresponding to a total cover system thickness of 5.5 ft) for the cover design. The increased design cover thickness compared to the model result is expected to further reduce radon emanation below the target threshold value of 20 pCi/m^2/s. Appendix G.1 further describes the development of model input parameters and the results.

Erosional Stability and Soil Loss

The resulting factors of safety against soil erosion for the maximum length (1,020 feet) of an approximate 1.4 percent (100H:1.4V) cover slope included for the Pit 1 design are 5.1 for poor vegetation conditions and 15.1 for fair vegetation conditions which is considered to be acceptable. Using the RUSLE, an average annual soil loss of 0.3 tons/acre/year was calculated for the Pit 1 cover surface based on the design. Appendix G.2 describes the methods used to develop the model input parameters and summarizes the results. Less than 2 tons/acre/year is considered tolerable for this environment without active erosion control management. Due to the gentle slopes and contouring on the Pit 1 cover, additional erosion control measures are not expected to be necessary as the vegetation is establishing.

Evapotranspiration

The combination of climate conditions and cover material properties is expected to restrict rainfall infiltration below the cover to small fluxes. These fluxes are expected to become negligible following revegetation of the cover. Variably saturated modeling of infiltration using historical climate data for the Site, and a range of hydraulic properties based on the particle-size distributions for the cover material, indicated that fluxes into the underlying material would be small under current conditions with little to no vegetative cover. Based on transpiration data for different vegetation communities found at nearby or similar New Mexico mine sites, transpiration from the revegetated cover will greatly increase loss from the vadose zone and significantly reduce the likelihood of recharge to pit groundwater.

6.6.3.2 Pit 2

The surface of Pit 2 will be sloped to drain out of the partially backfilled pit to the east-southeast at a slope of approximately 1.5 percent. Per Cedar Creek’s recommendations, the thickness of the topmost cover layer, sourced from the West Borrow Area, will be 24 inches to create favorable growth conditions for successful revegetation. This layer will be placed on a cover layer of non-impacted material from the South Topsoil pile that will act as a barrier to attenuate radon emanation from the underlying compacted waste material. The full volume of available material in the South Topsoil pile will be excavated and placed on the surface of the compacted mine waste to provide radon emanation protection and establish surface drainage to the southeast and out of the pit, resulting in an estimated cover layer thickness of eight feet (96 inches). Thus, including the upper 2-ft layer of West Borrow material, the total Pit 2 cover thickness is 10 feet. Stantec anticipates that the estimated thickness of material from the South Topsoil pile will be adjusted to be less, based on additional mine materials to be added to Pit 2 from the Old St. Anthony Mine and other site materials. Figure 6-4 shows the cover detail for the Pit 2 cover.

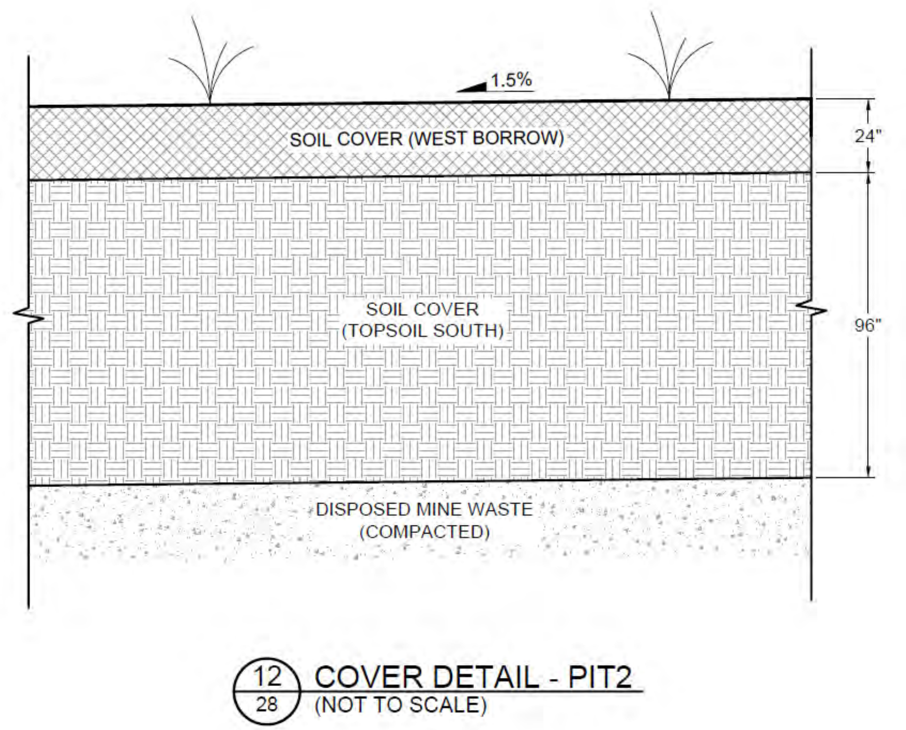


Figure 6-4. Pit 2 Cover Detail

Radon Emanation

Input values for the waste to be used as backfill in Pit 2 were estimated as the 75th percentile of the values measured during analytical testing for samples collected from the piles. The higher activity materials from the Site surface materials and waste piles will be placed in Pit 2 and, as a result, Pit 2 likely will require a thicker cover. As with the Pit 1 cover, the NRC RADON model was used to calculate radon attenuation for the Pit 2 cover design. Appendix G.1 describes the development of model input parameters and the results. The cover configuration resulted in a calculated rate of emanation of 11.4 pCi/m^2/s, which is below the threshold value of 20 pCi/m^2/s.

Erosional Stability and Soil Loss

The resulting factors of safety against erosion for the 1,440-foot-long 1.5 percent (100H:1.5V) cover slope included in the Pit 2 design is 3.8 for poor vegetation conditions and 10.8 for fair vegetation conditions which is considered acceptable. Using the RUSLE, an average annual soil loss of 0.3 tons/acre/year was calculated for the Pit 2 cover surface based on the design. Appendix G.2 describes the methods used to develop the model input parameters and summarizes the results. Less than 2 tons/acre/year is considered tolerable for this environment without active erosion control management. Due to the gentle slopes and contouring on the Pit 2 cover, additional erosion control measures are not expected to be necessary as the vegetation is establishing.

6.6.3.3 Regraded In-Place Piles

A soil cover is required for radon attenuation and revegetation of the regraded-in-place pile surfaces. Covers for Piles 1 and 2 (combined) and Pile 3 will comprise borrow material from the West Borrow area and will be placed directly over the regraded waste materials in each pile. A combination of borrow soil from the West Borrow and Lobo Tract borrow areas will be placed directly over the Pile 4 waste either as a single layer, a mixed layer of the two materials, or as separate lifts. The cover material placed on the lower 150 to 250 feet of slope along Meyer Draw will include gravel (D_{50}=1”, 25% by volume) to enhance erosion protection.

Radon Emanation

RADON calculations were performed for each pile cover assuming a 3-ft cover thicknesses. Based on the parameter inputs described in Appendix G.1 for the cover and waste materials at each pile, the corresponding radon fluxes for Piles 1 and 2 (combined), Pile 3 and Pile 4 were 5.3, 13.2, and 11.6 pCi/m^2/s, respectively. The results indicate that 2-ft cover thicknesses are sufficient to meet the threshold flux of 20 pCi/m^2/s.

Erosional Stability and Soil Loss

The resulting factors of safety against erosion for the critical slopes of the Pile 4 regrade design, an inter-bench slope 250-feet-long at 3.5H:1V, is 2.2 for poor vegetation conditions and 8.3 for fair vegetation conditions. The resulting factors of safety against erosion for the critical slopes of the Piles 1, 2, and 3 regrade designs, also with slopes from 280 to 370-feet-long at 4H:1V, range from 1.5 for poor vegetation conditions and 8.0 for fair vegetation conditions. Because the factor of safety for Piles 2, 3, and 4 is less than 2 for the poor vegetation conditions, active maintenance following large storm events may be required for repairs on the pile slopes until stable vegetation is established.

Using the RUSLE, an average annual soil loss of 8.1 tons/acre/year was calculated for the Piles 1 and 2 (combined), Pile 3, and Pile 4 cover surfaces based on the designs. Appendix G.2 describes methods used to develop the model input parameters and summarizes the results. Less than 2 tons/acre/year is considered tolerable for this environment without active erosion control management. Results from the RUSLE calculations for the piles indicate that additional temporary erosion control measures will likely be necessary to reduce soil loss and maintain stability of the soil covers. Revegetation plans will include tilling and seeding along the contours, however additional breaks in the slopes may be required to reduce overall slope lengths. Active management and repairs of erosion and installation of post-construction erosion control measures on the slopes, such as rock check dams or straw bales to disperse concentrating flows, will be required prior to establishment of vegetation on the slopes. UNC has assumed annual maintenance of the Site, post-construction, is expected to continue for 5 years. A summary of erosional stability calculation results for the regraded piles is included in Table 6-14.

To enhance erosion protection performance along the lower portion of the regraded piles, gravel will be incorporated into the cover design. As briefly described in Section 6.6.2 and indicated on the drawings, 1-inch D_{50} gravel will be imported from offsite and incorporated into the upper 1-foot of the cover soil at a 75% soil/25% rock mulch material (rock mulch) that will cover the surface on the lower 150 to 250 feet of slopes that are adjacent to Meyer Draw, where the regraded slopes will be 3.5:1 or steeper. Calculations indicate a soil loss reduction to 5.7 tons/acre/year for slopes with added gravel.

Table 6-14. Erosional Stability Results for Regraded Piles

	Design Configuration		Factors of Safety for Reclaimed Slopes	Erosional Soil Loss Estimates
Pile	**Maximum Slope**	**Maximum Corresponding Slope Length (ft)**	**Vegetation Establishment (poor / fair)**	**(tons/acre/year)**
Piles 1	4H:1V	280	2.1 / 8.0	9.8
Pile 2	4H:1V	370	1.5 / 5.2	8.1
Pile 3	4H:1V	350	2.2 / 7.9	
Pile 4	3.5H:1V	250	1.9 / 6.7	9.3

Reclaimed Grading Plan

Once the surface impacted materials are excavated and placed into Pit 2 or regraded and covered in-place, the ground surface of Pit 2 and the covered-in-place piles will be graded to establish surface water drainage off the Pit 2 cover to the diversion channel and out to the arroyo. Drawings 9 through 29 show the grading plans, including the grading of the two pits and Pile 4. Shallow excavations in the vicinity of the existing piles will be shaped to allow positive drainage. Deeper excavations may require clean borrow to establish positive drainage following completion, up to 80,000 cy of unimpacted materials will be available for use as fill from the diversion channels to be excavated around Pits 1 and 2. Disturbed areas will be reseeded with the approved reclamation seed mix following verification surveys. Temporary erosion controls methods, such as rock check dams or biodegradable erosion control netting, may be installed to stabilize the disturbed areas where erosion is expected prior to establishment of vegetation.

6.6.4 Radon Flux Measurements

The pit and waste pile covers are designed and constructed to limit the release of radon-222 (radon) to the atmosphere, not exceeding an average release rate of 20 picocuries per square meter per second (pCi/m^2s). Appendix G.1 includes radon emanation calculations for the covers. Following completion of cover placement, radon emission testing will be conducted to verify that the design and construction of the covers is effective at limiting radon flux using the method described in 40 Code of Federal Regulations (CFR) part 61, Appendix B, Method 115. Section 2 of Method 115 describes the radon flux measurements.

Consistent with Method 115, a single set of radon flux measurements will be made over the combined areas of the mine waste covers. The combined covers for Pit 1, Pit 2, Piles 1-3, and Pile 4 will be considered a test region. Method 115 specifies a minimum of 100 measurements for a region. Radon flux measurements over the covers will be made on equally spaced locations (grid nodes of a square grid at 375-foot square cast over the total cover surface area) which results in approximately 107 measurements.

A radon measurement procedure, similar to the detailed measurement procedure provided in Appendix A of EPA 520/5-85-0029 will be used to measure the radon flux on the covers. This radon flux measurement procedure involves adsorption of radon on activated charcoal in large-area canisters. The radon canisters will be placed on the surface of the pile and allowed to collect radon for 24-hour period. The radon flux measurements will not be initiated within 24 hours of a rainfall event and will not be performed if the ambient temperature is below 35°F, or if the ground is frozen. The radon collected on the charcoal will then be measured by gamma-ray spectroscopy. The mean of the radon flux measurements will be calculated for verification of the 20 pCi/m^{2}s radon emission performance standard for the cover regions. Results of the individual radon flux measurements with locations will be included in the construction completion report for the project.

6.7 ACCESS ROADS

The haul road plan for material excavation and placement is shown on Drawings 7 and 8 (Haul Road Plan). Typical haul road sections are shown on Drawing 35. Both the North and South access roads into Pit 1 will be regraded to provide construction access and temporary stormwater management during construction. As part of the reclamation, the Pit 1 access roads will be surfaced with non-impacted soil and/or rock. Following construction, only select roads will remain for site access and maintenance as shown on Drawings 30 and 31.

The main access road provides Site access from the north and will extend through the Site as the main arterial. From this road, the Contractor will access the Mine area, Pit 1, the Pile 4 area, the West Borrow Area, and Pit 2. Road improvements will be required along all of the roads shown on the Haul Road Plan. The main access road will be developed for 2-way traffic while all others are expected to be 1-way unless modified by the Contractor during development of their project-specific traffic safety plan. The Contractor will be required to develop low-water crossings or temporary culverts, if necessary, for the Pile 4 Road and the Arroyo Crossing to Pile 4 east of Pit 1. In addition, prior to construction, improvements will be required to the main access Road north of the Site in order to allow for 2-way traffic and heavy equipment. There are several areas where erosion has occurred over time and reduced the road width along the east side of the road near the arroyo.

Following completion of construction, the main access road will remain in place to the Site access gate and the Pit 1 gates and the mine road will remain in place for access during the active maintenance period. Other roads developed during construction will be scarified and reseeded during revegetation.

6.8 REVEGETATION

The Site Revegetation Plan was updated in 2022 and 2023 by Cedar Creek and was informed by previous vegetation sampling conducted in 2005; a growth media characterization effort and general Site survey conducted in 2018 (included in Appendix H with the Site Revegetation Plan); and local and regional experience successfully reclaiming uranium sites with similar conditions and challenges. In general, the Site Revegetation Plan applies to lands within the project area that are subject to revegetation, including the waste piles, soil borrow areas, and revegetated portions of backfilled pits. Revegetation protocols and performance criteria presented in the plan abide by the rules, regulations, and guidelines of the MMD. The revegetation design criteria are shown in Table 6-15.

Revegetation planning considers: 1) local vegetation communities (see Section 3.6); 2) post-mining (or post-disturbance) land use (PMLU); 3) specific considerations pursuant to desired post-disturbance management of private lands; and 4) industry-standard methods and techniques related to revegetation, soil amendments, seedbed preparation, seeding, mulching, and general reclamation science. In addition, quality assurance and quality control procedures in the form of monitoring surveys will be undertaken to confirm that revegetation efforts are implemented correctly and that the results of the process meet design criteria. This process of monitoring and evaluation will also allow for an adaptive management approach to reclamation, further assuring a positive project outcome at the St. Anthony Mine Site.

Table 6-15. Revegetation Design Criteria

Design Element	Design Criteria	Design Guidance
Revegetation	• Revegetation monitoring period of 12 years with monitoring every 3 years • Meet success criteria defined in MMD framework of 70% ground cover and 60% woody plant density	MARP Closeout Plan Guidelines and Attachment #2 (MMD, 2006) Self-Sustaining Ecosystem Guidelines (MMD, 2022) Soil and Cover Material Handling and Suitability for Part 5 Existing Mines (MMD, 2022) Revegetation Guidelines (MMD, 2022)

6.8.1 Self-Sustaining Vegetation Ecosystem

The Site Revegetation Plan specifies the use of suitable growth media which supports native seeded communities expected to occupy all niches in the reclaimed areas which are also found in the life zone of the project. When seeding native species of reclaimed areas, early to mid-seral species typically inhabit the Site and set the stage for a successional trajectory to occur. Initiating succession on reclaimed areas generates a self-sustaining ecosystem. Appendix H includes the Cedar Creek growth media characterization report with the Site Revegetation Plan. Drawing 31 shows the areas of the Site that will be revegetated following soil excavation and regrading.

6.9 ENGINEERING CONTROLS

Access to the St. Anthony Mine is gained via lands owned by Lubo Land, LLC. A locked gate currently stands at the entrance to the Site to prevent public access. Fences that are currently onsite will remain in place and will be repaired and photographically documented.

Temporary range fencing is to protect the revegetation areas from cattle grazing, or traffic, while the vegetation is establishing. Temporary fencing will be added around the perimeter of the mine Site to fill gaps in the existing fence and prevent cattle access. The temporary fence will consist of 4 strands of class 2 galvanized 9-gauge wire spaced at 16, 22, 28, and 40 inches above the ground surface. The top and bottom wires will be smooth, while the middle two wires will have 2 to 4 barbs placed every 4 to 5 inches. A temporary gate and fence will be added across the road up to the underground area to prevent grazing access in that area. The temporary fences will be removed following establishment of the Site revegetation and approval by MMD.

Permanent range fencing will be added to prevent access by cattle, deer, elk, and other wildlife species as well as unauthorized vehicles into Pit 1. The permanent fencing will include access gates at the top of Pit 1 on the east side, at the vehicle access ramps. Permanent chain link fencing will be added in the bottom of Pit 1to prevent wildlife from accessing the vegetated water management structure and have a minimum height of 8 feet. A sheet metal barrier will cover the lower 2 feet of the fencing and will extend an additional 2 feet below ground surface (bgs) to restrict burrowing. Drawing 31 shows the fencing locations, permanent and temporary, for the reclaimed Site and fencing details are shown on Drawing 36.

The grading design for the reclaimed Lobo Tract East Borrow area includes a low-lying area designed to naturally collect surface water and serve as a wildlife watering pond. The low graded area will naturally collect water, providing wildlife with an alternate water source from the Pit 1 area following completion of the partial pit backfill and temporary and permanent fencing controls. The wildlife pond will be graded to have a maximum depth of four feet in the center with side slopes of 5H:1V as seen in Drawing 27. A detail is included on Sheet 37.

6.10 TEMPORARY EROSION PROTECTIONS

Site-specific temporary erosion control measures are shown on Drawing 30 and the BMP catalog for interim stormwater controls is included in Appendix F.5. The Contractor will be responsible for developing a site-specific construction stormwater pollution protection plan (CSWPPP) for approval by the Engineer. The CSWPPP will outline the temporary measures that the Contractor will put in place to prevent erosion and sediment from leaving the site via the arroyo and other drainages during construction.

7.0 SCHEDULE AND PERMITS

7.1 SCHEDULE

Table 7-1 is an anticipated list of project items to be completed for implementation of the St. Anthony Mine reclamation and the estimated durations, following approval of the final Stage 2 Abatement Plan Modification and 90% CCOP. Once the 90% CCOP is approved, the 100% CCOP will be the issued for bid version of the design documents following incorporation of any other changes based on comments received on the current version of the design. Each item is subject to change.

Table 7-1. Implementation Schedule Durations

Schedule Item	Estimated Duration (days)
MMD deems the 90% CCOP technically complete, NMED issues approval of final Stage 2 Abatement Plan Modification and the WQCC approves the AAS petition.	-
UNC prepares updated surety cost estimate for financial assurance and Issued for Bid (IFB) drawings and specifications	120
Pre-bid meeting and Contractor bid preparation	90
Contract procurement	90
Construction duration, assumes no winter shutdowns; some tasks concurrent	1,095 (3 years)
-Mobilization	15
-Site access improvements	21
-Pit 1 Stabilization (STPP, high wall, Pit 1 Piles, and cover)	75
-Mine-impacted soils excavation, move to Pit 2	375
-Pile regrading	250
-Borrow soil hauling and cover construction	350
-Stormwater channel construction	175
-Reclaim borrow areas, site revegetation and erosion controls	45
-Demobilization	15
Monitoring (engineering inspections) and Maintenance, beginning post-construction	Twice in year 1 following construction, then annual for 3 years, and then once every 5 years until MMD approval of revegetation.
Revegetation monitoring, beginning post-construction until MMD approves vegetation establishment	Years 1, 3, 6, 9, 11, and 12 following construction; up to 12 years
Groundwater monitoring, per the Stage 2 Abatement Plan Modification	Water levels quarterly, water quality samples annually; until completion of Abatement

7.2 FUTURE CONSIDERATIONS

The final CCOP will be implemented following approval by MMD. Stantec will prepare an updated financial assurance cost estimate once MMD provides feedback on the final CCOP and indicates that the plan is approvable. Upon MMD approval of both the final CCOP and the financial assurance cost estimate, UNC will prepare construction permit applications and select a construction contractor. In conjunction with preparing the updated financial assurance estimate and construction planning, Stantec plans to complete the following additional details:

- Identify a quarry capable of supplying the channel armoring materials (aggregates and cement for roller compacted concrete, riprap, granular filter material) outlined for use in the design drawings.

7.3 CONSTRUCTION PERMITS

If required, a National Pollutant Discharge Elimination System (NPDES) construction permit for storm water discharge will be obtained prior to implementation of the final CCOP. A SWPPP will be prepared prior to construction. The SWPPP will present erosion control measures that will be implemented, inspected, and maintained for the duration of construction. Dust will be controlled by periodically watering haul roads and other dust generating areas, as necessary. Permitting criteria for construction are summarized on Table 7-2.

Table 7-2. Project Permitting Criteria

Design Element	Design Criteria	Design Guidance
Permitting	1. Evaluate Air Quality Standards, if applicable 2. SWPPP updated to incorporate reclamation work	- 20.2.72.200 NMAC - Section 402 (NPDES) of Clean Water Act

7.4 POST-CLOSURE REQUIREMENTS

Post-closure engineering and vegetation inspections will be conducted at the intervals listed in Table 7-1. Maintenance and repairs will be completed on an as-needed basis as the Site vegetation is established. A monitoring and maintenance plan is included in Appendix I that describes anticipated post-construction inspections and potential maintenance requirements for the Site.

7.4.1 Water Quality Monitoring and Reporting

Groundwater quality and/or water level monitoring will be ongoing through completion of the Site reclamation activities. Annual reports will be provided which will summarize the results. A post-closure monitoring program will be included in the Final Stage 2 Abatement Plan Modification.

7.4.2 Reclamation Monitoring and Maintenance

Appropriate reference areas to determine revegetation success will be selected in accordance with New Mexico Mining and Minerals Division guidelines. Each reference area will be selected from ecological communities in the life zone of the project and represent logical targets for revegetation communities expected to inhabit the reclaimed facilities, including vegetation communities on the regraded piles, the pit covers, and other reclaimed areas of the Site. The reference areas will be selected and documented by Cedar Creek, prior to initiation of construction.

7.4.3 Inspections

Engineering inspections will be conducted following completion of construction to evaluate ongoing performance of the Site improvements. Stantec anticipates that two inspections (Spring and Fall) will be conducted during the first year following completion of construction and inspections will be conducted thereafter on an annual basis until bond release.

Revegetation inspections will be conducted in the Fall at a minimum of once every 3 years beginning in the first year after revegetation, with an inspection in years 11 and 12. Revegetation inspections will continue until bond release.

7.5 REPORTING

Stantec will prepare a construction completion report to document the construction onsite following completion of the Site work. Inspection reports will also be prepared to document annual engineering inspections until bond release. Inspection reporting will be combined with vegetation progress evaluation reports.

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APPENDICES