MWH

January 15, 2004

Ms. Karen Garcia, Director
State of New Mexico
Mining and Minerals Division
Pinion Building
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

RE: Section 27 Closeout Plan

Dear Ms. Garcia:

On behalf of United Nuclear Corporation (UNC) enclosed are 6 copies of the Section 27 Closeout Plan.

If you have any questions please feel free to contact me at the number below or Larry Bush at UNC.

Sincerely,

MWH

Mike Ross, P.E.
Project Engineer

Enclosures

cc: Roy Blickwedel, GECE
Larry Bush, UNC
Bill Killoran, GEAE
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Prepared for:

UNITED NUCLEAR CORPORATION
P.O. Box 3077
Gallup, New Mexico 87305

SECTION 27 MINE CLOSEOUT PLAN

January 2004

Prepared by:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This Closeout Plan (Plan) for United Nuclear Corporation's (UNCs) former Section 27 Mine has been prepared in compliance with the requirements of Section 5 of the New Mexico Mining Act. The Plan is based on available site data and topographic mapping. The Section 27 Plan was prepared using the State of New Mexico Energy, Minerals and Natural Resources Department Mining Act Reclamation Program Closeout Plan Guidelines.

This Plan describes the construction tasks that will be completed to reclaim the site in accordance with the Mining Act Guidelines. The Plan is also intended to update the previously submitted Site Assessment by incorporating responses to comments on the Site Assessment that were received from various agencies.

This Plan is divided into 4 sections. Section 1 discusses the project site including soils, geology, surface and groundwater and post-mining land use. Section 2 describes components of the Closeout Plan. A general construction schedule is provided in Section 3, and references are provided in Section 4. Geotechnical stability model output is presented in Appendix A. Procedures for groundwater sampling are contained in Appendix B. Figures for the Plan follow the text.

1.1 PROJECT DESCRIPTION AND BACKGROUND

The Section 27 mine is located approximately two miles east of the Ambrosia Lake Uranium mill tailings impoundment in the Ambrosia Lake District in McKinley County as shown on Figure 1, *Cover Sheet and General Location Map*. The mine is located in Section 27, Township 14N, Range 9W of the New Mexico Principal Meridian approximately 35 miles north of Grants, New Mexico. Features at the site include two shafts, three vent holes, two small piles of non-economic mine materials containing overburden rock, sands and gravels, one small ore stockpile, two topsoil stockpiles and several small piles of ball mill reject materials. The mine site is currently inactive and encompasses approximately 14 acres. Site features are shown on Figure 2, *Section 27 Mine Existing Conditions.*

UNC produced uranium ore from the Section 27 mine during operations from 1970 to 1977. The Section 27 mineral lease covered approximately 200 acres in the south half of Section 27 and was surrendered in 1988. Surface ownership at the mine is currently held by Kent Schmitt. Ownership of the mineral estate is held by Hecla Mining Company.

1.1.1 Site Soils

Native soils on the site consist of well-drained silty, slightly clayey sands. Soils in the non-economic storage areas consist of fine to coarse-grained sands with gravels and cobble-sized sandstone and bentonitic shale fragments. The ore stockpiles are comprised of gray-colored medium to coarse-grained sands with cobbles and gravels. On the outer surfaces of all the piles the cobbles and gravels have formed a natural armoring layer, greatly reducing wind and water erosion. Currently all areas support a variety of native vegetation.

1.1.2 Site Geology

The Section 27 mine is located southwest of the San Mateo Mesa and northeast of the Mesa Montanosa. The geologic regime at the site includes the following strata in descending sequence: alluvium/weathered Mancos shale; the Tres Hermanos-C, -B, and –A sandstones; the Dakota formation; the Westwater Canyon Member and Recapture Member of the Morrison formation, and the Bluff Sandstone formation. Uranium production at the site was from the Westwater Canyon Member.

1.1.3 Surface Water and Groundwater

The site is located within the drainage basin of the Arroyo del Puerto, an ephemeral drainage located over two miles southwest of the site. Two surface water drainages lie to the east of the site, with the Mulatto Canyon drainage lying immediately east of the site and another, unnamed drainge approximately one-half mile to the east. The unnamed drainage drains into a small impoundment area known as Voght tank, primarily used as a stock watering pond. Both drainages are intermittent, with flows occurring only after the spring runoff and during heavy thunderstorms. The non-economic mine material piles and other portions of the site are not within the floodplain of the stream, and as such do not impede the natural flow. Surface water at the site has not been characterized due to the intermittent nature of the flows. As no surface water will be impounded at the site, a surface water monitoring plan will not be required.

Mining at the site took place in the Westwater Canyon Member, and as such, groundwater impacts due to mining, if any, would be limited to this formation. During operations water flowed from the Section 27 Mine to the Sandstone Mine through connecting drifts. From the Sandstone mine the water was then pumped to the Phillips Ambrosia Mill where it was treated at an ion exchange facility. There were no other groundwater discharges to the surface originating from the Section 27 Mine.

Mine water pumped to the Ambrosia Mill during operations consisted of a mixture of water originating from several different mines. Therefore, the quality of the discharge water would have been representative of the regional groundwater quality in the vicinity of the Section 27 Mine. Table 1.1 presents ground water quality data for mine water that was pumped to the Ambrosia Mill near the end of operations at the Section 27 Mine.

TABLE 1.1
UNC MINE DISCHARGE WATER QUALITY

Constituent	Units	Sample Dates		
		10/27/77	11/17/78	11/7/79
TSS	mg/l	1.1	1.0	2.0
TDS	mg/l	1852	1903	2441
Conductivity	µmhos	2657	2241	3288
pH	S.U.	8.08	--	8.12
Arsenic	mg/l	<0.005	<0.005	0.009
Barium	mg/l	0.27	0.074	<0.100
Selenium	mg/l	0.268	0.171	0.122
Molybdenum	mg/l	3.20	1.91	3.05
Ammonia	mg/l	0.01	0	0.05
Sodium	mg/l	428	421	511
Chloride	mg/l	108	97.5	188
Sulfate	mg/l	1060	1115	1280
Calcium	mg/l	--	150	194
Potassium	mg/l	--	8.19	9.75
Bicarbonate	mg/l	--	228	174.0
Cadmium	mg/l	<0.001	<0.001	--
Nitrate (as N)	mg/l	0.11	<0.01	--
Magnesium	mg/l	--	--	45.3
Vanadium	mg/l	--	<0.010	<0.010
Zinc	mg/l	--	<0.100	<0.250
Aluminum	mg/l	--	--	<0.250
Lead	mg/l	--	<0.005	<0.005
Gross Alpha	pCi/l	--	570 ± 70	360 ± 60
Radium-226	pCi/l	29 ± 1	65 ± 1	19 ± 6
Radium-228	pCi/l	0 ± 2	--	--
Lead-210	pCi/l	17 ± 6	--	--
Uranium	mg/l	0.32	2.23	1.31

If possible, current groundwater quality at the Section 27 Mine will be evaluated by obtaining a grab sample from one of the shafts or vent holes prior to implementation of the closeout plan. The shaft or vent hole from which the sample will be obtained will be checked prior to sampling to verify that blockages will not interfere with sampling. The water level and total depth of water will be measured prior to sampling. The sample will be taken from approximately the midpoint of the water column using a thief or messenger sampler, allowing for point source sampling at a specific depth. A motorized winch will likely be used to lower the sampler to the predescribed sampling depth. Field parameters consisting of pH, temperature and conductivity will be measured during sampling. Prior to sampling the NMED will be contacted to determine how many splits, if necessary, will be required. The sampling SOP and list of analytes are presented in Appendix B.

It is anticipated that at least one of the shafts or vent holes will be accessible for sampling, however the current conditions of the shafts and vent holes is unknown and sampling may not be possible. Should a sample be obtained, the results of the analysis will be discussed with the NMED prior to the start of closure work at the site.

1.1.4 Post-Mining Land Use

Reclamation of the Section 27 mine is intended to achieve a post-mining land use of livestock grazing, comparable to surrounding areas. Vegetation surveys will be conducted prior to the start of reclamation to determine the native species, corresponding plant densities and current range conditions for the site and adjacent range areas. Prior to reseeding, the topsoil stockpiles and surrounding native soils will be sampled for agronomic analysis to determine required quantities of fertilizer and amendments.

2.0 CLOSEOUT PLAN COMPONENTS

This Closeout Plan was prepared following the Guidelines that are part of the Mining Act Reclamation Program. Components of the Plan are intended to reclaim the Section 27 Mine to post-mining land use of livestock grazing. Plan components include regrading of non-economic storage areas, removal and disposal of the remaining foundations on site, abandoning shafts and vent holes and revegetating all disturbed areas. Closeout plan components are discussed in the following sections.

2.1 EROSION CONTROL

Erosion from the site will be controlled by regrading surfaces to promote non-erosive runoff and to reduce run-on from the adjacent hillside. Temporary sediment control structures such as sediment control basins, straw bales, and silt fences will be installed prior to reclamation. The structures will be maintained for the duration of reclamation activities and will be removed once reclamation is complete. Typical placement locations for these structures are shown on Figure 2, *Section 27 Mine Existing Conditions*.

2.2 REGRADING

Regrading at the non-economic storage areas will consist of flattening the existing embankment slopes to promote sheet flow runoff and revegetating the surfaces to reduce erosion. As shown on Figure 3, side slopes of the piles will be recontoured to slopes ranging from approximately 3H:1V to 4H:1V. Regrading will be performed to balance cuts and fills.

2.2.1 Non-economic Storage Area 1

Non-economic Storage Area 1 will be regraded to have side slopes 3H:1V or flatter. The top of the pile will be regraded to slope slightly toward the regraded embankment at a slope less than 2 percent. Prior to regrading, concrete foundations for the entire site will be demolished and placed in the designated disposal areas adjacent to the pile as shown on Figure 3. During regrading, material in the pile will be used as cover for the buried debris. Once the final contouring has been completed, approximately 8 to 10 inches of topsoil will be placed uniformly over the regraded surface.

The reclaimed configuration of the pile was analyzed for geotechnical slope stability using the Slope/W model. Circular failures were analyzed by the model at one cross section location using Bishop's method. Input parameters for the model were estimated using typical properties for waste rock, and included a unit weight of 110 pounds per cubic foot, an internal friction angle of 33 degrees and a cohesion of zero. Typically acceptable factors of safety for long-term stability range from 1.3 to 1.5, and flattening of the side slopes through regrading will result in a factor of safety greater than 2.5. The location of the analyzed cross section and output from the Slope/W model are contained in Appendix A.

2.2.2 Non-economic Material Storage Area 2

Non-economic Storage Area 2 will be regraded in place, balancing cut and fill quantities. The sides of the pile will be regraded to slopes of 4H:1V or flatter. To the extent possible the salt brush at the toe of the south end of the pile will be left in place to provide erosional stability. At the north end of the pile the small material piles will be regraded to blend them into the surrounding topography. Approximately 8 to 10 inches of topsoil will be placed on the regraded areas prior to the placement of fertilizer and seed for revegetation.

A geotechnical stability analysis was performed for the regraded configuration using the same approach, methods and material properties that were used for Non-economic Storage Area 1. Regrading of the pile will result in a long-term stability of greater than 2.5. Stability modeling output is contained in Appendix A.

2.2.3 Topsoil Stockpiles 1 and 2

Soil from the topsoil stockpiles will be placed over the regraded non-economic storage areas prior to placement of fertilizer and seed. The stockpiles currently contain approximately 11,000 cubic yards of soil, sufficient to cover the regraded piles and other disturbed areas with a topsoil thickness of approximately 8 to 10 inches.

2.2.4 Ball Mill Reject Pile

The material in the Ball Mill Reject Pile consists of coarse sands, gravels, cobbles and mill ball debris. The pile will be removed and placed down either Shaft #1 or Vent Hole #2 and the removal area will be revegetated. The Ball Mill Reject Pile is shown on Figure 2.

2.2.5 Ore Stockpiles

Several stockpiles of ore are currently located to the southwest of Non-economic Storage Area 2. The stockpiles consist of gray-colored medium to coarse-grained sands with cobbles and gravels. The stockpiles will be removed and placed down the vent holes and shafts.

2.3 FOUNDATION DEMOLITION AND REMOVAL

Closure of the mine was completed in 1988, leaving several foundations in place as shown on Figure 2. With the exception of the ore loading pull-through at Shaft #2, all structures will be demolished and placed in the designated disposal area shown on Figure 3. At the request of the landowner, the Shaft #2 pull-through will remain on site for use as a livestock watering trough. The remaining power poles and power lines on site will be removed and salvaged.

2.4 SHAFT AND VENT HOLE RECLAMATION

The two shafts and three vent holes on site will be reclaimed by filling them with on-site materials. Once the shafts and vent holes are filled, concrete caps will be placed over the filled areas to prevent infiltration and settlement of the fill.

Shaft #1 has a diameter of approximately 5 feet and will be reclaimed by filling it with materials from the ball mill reject pile and non-economical storage areas. Shaft #2 has a diameter of approximately 12 feet and will be reclaimed by filling it with the ore stockpile materials. If additional material is needed to finish filling Shaft #2, non-economic materials will be used. Once the shaft is completely filled, a concrete cap will be placed on the fill to prevent infiltration and settlement.

Vent Holes #1, #2 and #3 all have diameters of approximately 5 feet and extend down to the Westwater Canyon ore body at a depth of approximately 850 feet below ground surface. As shown on Figure 2, Vent hole #1 lies approximately 750 feet west-northwest of Non-economic Storage Area 1, Vent Hole #2 is located approximately 150 feet southeast of Non-economic Storage Area 2, and Vent Hole #3 is located approximately 500 feet southwest of Shaft #2. All vent holes will be filled with non-economic mine materials. Concrete plugs will be placed over the filled vent holes.

2.5 ROAD RECLAMATION

Currently the only road remaining on site is the main access road that connects Shafts #1 and #2. This road will be left in place for landowner access. Any other temporary haul roads will be reclaimed by ripping and regrading the surface at the completion of reclamation activities and seeding with the native seed mix used in other revegetated areas.

2.6 REVEGETATION

Areas impacted by regrading, material removal, shaft and vent hole reclamation and foundation removal will be revegetated. Revegetation is intended to provide stability against wind and water erosion by establishing a self-sustaining plant community. Soils in the revegetated areas will be sampled for agronomic analysis to determine amendment requirements on a site-specific basis. Inorganic fertilizer may be added to increase the nitrogen, phosphate, and potassium available to the plants as required by analytical analysis. A crimped mulch with prescribed seed mixture will be applied to conserve soil moisture and protect the soil from erosion. Revegetation will take place between June and September. Approximately 8 acres will be revegetated as part of this Plan.

Revegetated areas will be seeded with a mixture that contains native grasses and forbs and will produce a self-sustaining plant community that does not depend on external inputs of water or fertilizer. Specific species, composition percentages and seeding rates will be determined based on results from a site-specific vegetation survey that will be conducted during the height of the growing season prior to the start of reclamation activities. It is anticipated that the survey will be performed in an area that currently has a similar land use of cattle grazing, consistent with the planned land use for the Section 27 site. A wildlife survey for the site will be performed concurrently with the vegetation survey. Based on the vegetation surveys and revegetation activities previously performed at the adjacent Ambrosia Lake Site, it is anticipated that the species listed in Table 2.1 will also be used in the seed mix for the Section 27 site.

TABLE 2.1
AMBROSIA LAKE SITE
REVEGETATION SPECIES AND PERCENT COMPOSITION

Species	Seeding Rate (lbs PLS/ac)
Western Wheatgrass	6
Indian Ricegrass	6
Sand Dropseed	2
Alkali Sacation	2
Four-wing Saltbush	2
Rocky Mountain Penstemon	1

Quantities of amendments and seeding rates will be applied based on a revegetation plan developed based on a vegetation survey and agronomic analyses. Revegetation success will be dependent on landowner activities and livestock use at the site. Therefore, revegetation will be considered to be complete based on documentation that the quantities of fertilizer and seed applied to revegetated areas met or exceeded the requirements in the Revegetation Plan developed for the Section 27 Mine.

2.7 REGULATORY COMPLIANCE

A stormwater discharge (NPDES) permit for construction activities will be obtained as required prior to implementation of the Closeout Plan. Temporary erosion control measures such as straw bales, silt fences and sediment basins will be placed as needed prior to the start of construction and will be removed once construction has been completed. Erosion control measures will be maintained for the

duration of construction. Dust will be controlled by periodically watering haul roads and any disturbed areas producing dust.

Comments on the Section 27 Site Assessment were received from the Historic Preservation Division (HPD) of the New Mexico Department of Cultural Affairs pertaining to two archeological sites that are located to the north of Non-economical Storage Area #1. Prior to the start of construction, UNC will consult with the HBD regarding these two sites.

2.8 SITE ACCESS CONTROL

The Section 27 Mine is located entirely on privately-owned land. Access gates are currently in place and prevent public access to the site. The gates will remain in place as part of the final reclamation of the site. Fences that are currently in place will remain after construction, and those that are damaged or removed to facilitate construction will be replaced as necessary. UNC executed an Access Agreement with the property owner on December 16, 2003 to perform the activities described in this report.

3.0 CLOSEOUT PLAN SCHEDULE

Implementation of the Section 27 Closeout Plan will begin after it has been approved by the MMD. Prior to the start of construction the following items will be performed:

- Completion of an NPDES permit
- Completion of vegetation and wildlife surveys (to be performed during the peak of the growing season prior to the start of construction)
- Collection and analysis of a groundwater grab sample from one of the shafts or vent holes (if possible)

A specific reclamation schedule will be developed by the contractor during the construction bidding process. The general schedule for construction is as follows:

Weeks 1-2:

- Mobilization
- Installation of sediment controls
- Demolition and removal of foundations, buildings and miscellaneous structures

Weeks 2-3:

- Removal of the ore stockpile and ball mill reject pile and placement into the shafts and vent holes
- Regrading of the Non-economic Storage Areas

Weeks 3-5:

- Final contouring
- Topsoil placement
- Fence repair/replacement
- Revegetation

4.0 REFERENCES

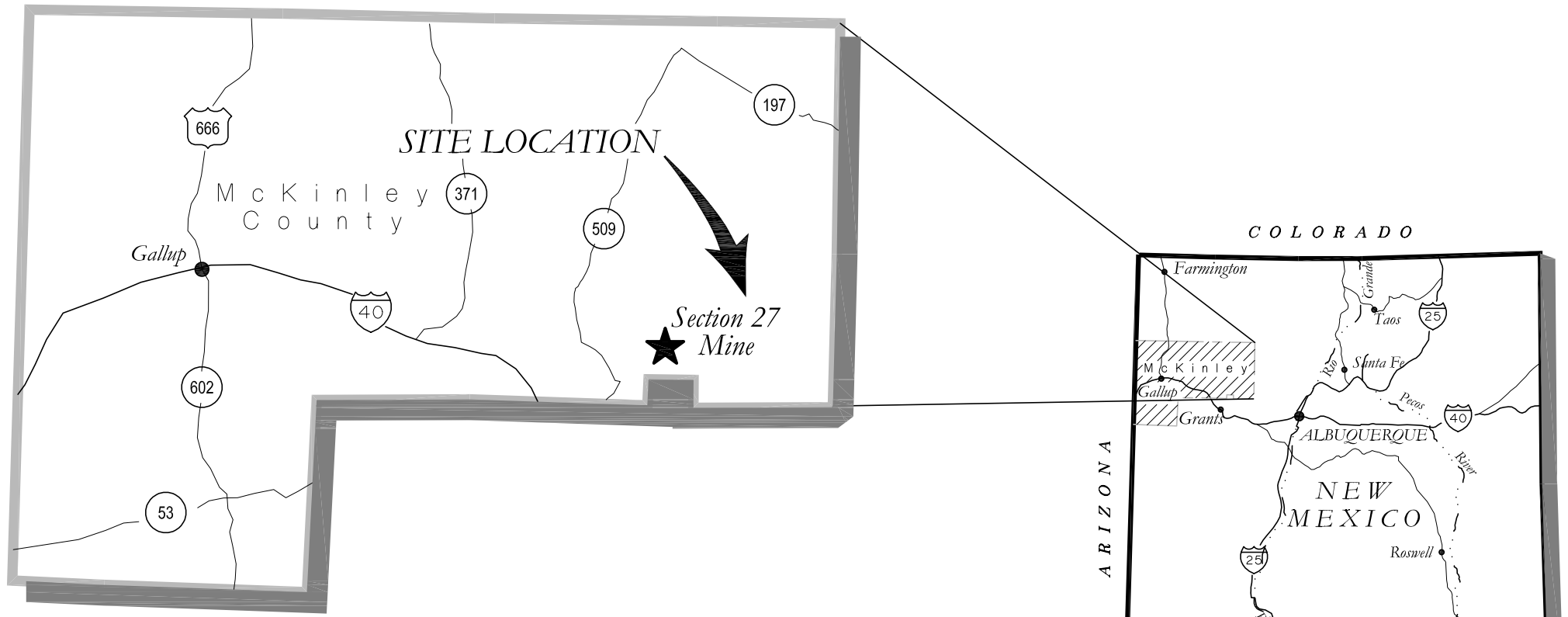
MWH, 2003, Section 27 Site Assessment, Gallup, New Mexico.

U.S. Department of Energy, 1987, Environmental Assessment of Remedial Action at the Ambrosia Lake Uranium Mill Tailings Impoundment, UMTRA Project Office, Albuquerque, New Mexico, DOE/EA-0322.

FIGURES

UNITED NUCLEAR CORPORATION
SECTION 27 MINE
CLOSEOUT PLAN

JANUARY 2004



LIST OF FIGURES

PREPARED FOR:

P.O. BOX 3077
Gallup, New Mexico 87305-3077

PREPARED BY:

MWH

AutoCAD FILE: BV-COV-10-02 PROJECT NUMBER: 2450326.01160400

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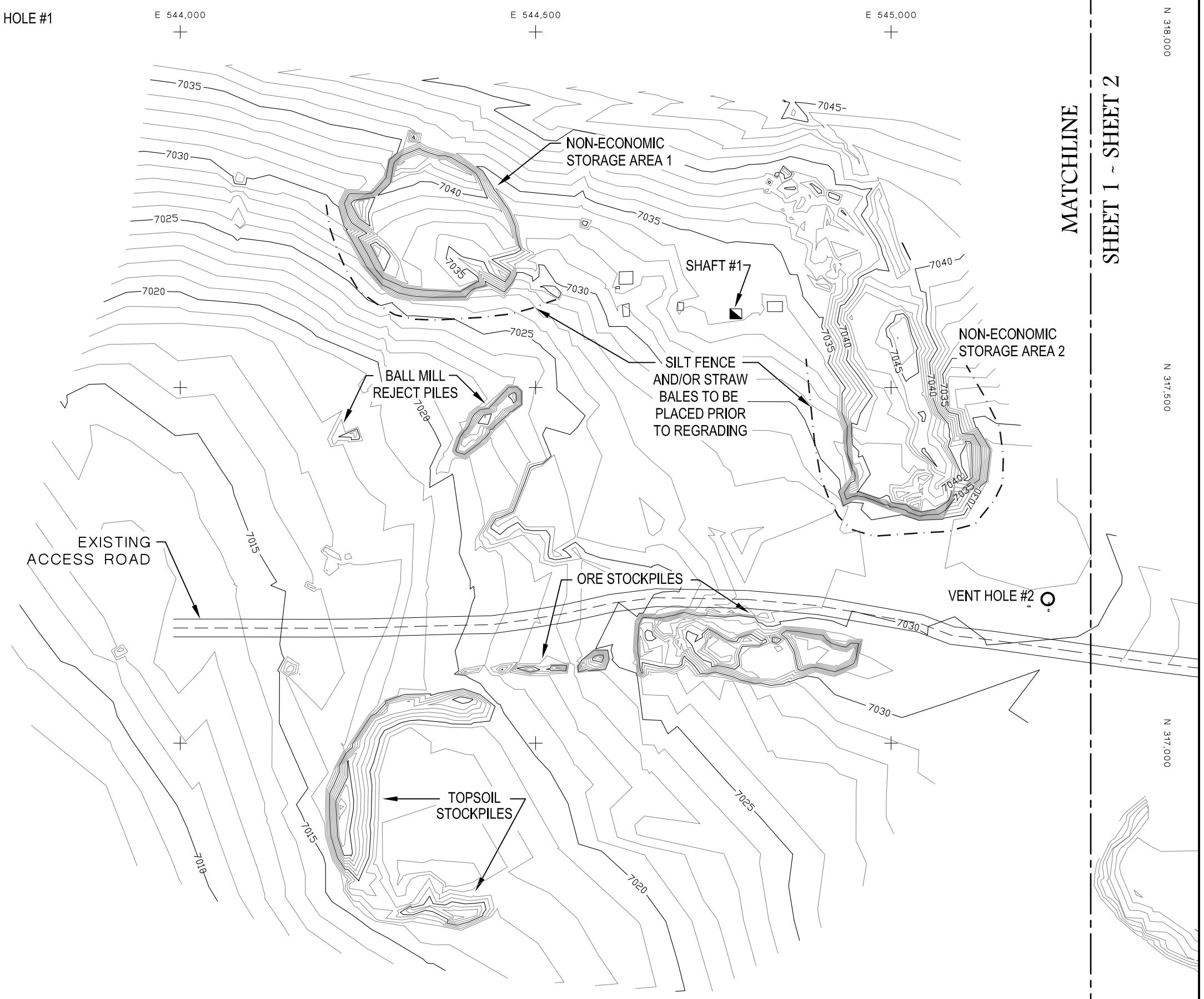

LEGEND

- CONCRETE FOUNDATION
- VENT HOLE (Not to Scale)
- ACCESS ROAD
- MINE SHAFT

N

SCALE
75' 0 75' 150'
CONTOUR INTERVAL 1 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
0	Issued for Preliminary Draft	01/04	M.Ross	K.Conrath	M.Ross

UNC
P.O. BOX 3077
Gallup, New Mexico 87305-3077

PROJECT:
SECTION 27 CLOSEOUT PLAN

DRAWING TITLE:
SECTION 27 MINE EXISTING CONDITIONS

MWH

Sheet 1 Of 2 Sheets
SCALE: As Shown
FIGURE No. 2

AutoCAD FILE: Sec27 Existcond PROJECT NUMBER: 1003900.011801

E 545,500 E 546,000 E 546,500

N 317,500

N 317,000

N 316,500

MATCHLINE

SHEET 1 ~ SHEET 2

NON-ECONOMIC STORAGE AREA 2

7040

7035

7030

VENT HOLE #2

7050

7045

7040

SHAFT #2

VENT HOLE #3

TOPSOIL STOCKPILE

LEGEND

- CONCRETE FOUNDATION
- VENT HOLE (Not to Scale)
- ACCESS ROAD
- MINE SHAFT

N

SCALE

75' 0 75' 150'

CONTOUR INTERVAL 1 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
0	Issued for Preliminary Draft	01/04	M.Ross	K.Conrath	J.Redmond

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Gallup, New Mexico 87305-3077

PROJECT:

SECTION 27 CLOSEOUT

DRAWING TITLE:

SECTION 27 MINE EXISTING CONDITIONS

MWH

Sheet 2 Of 2 Sheets

SCALE: As Shown

FIGURE No. 2

AutoCAD FILE: Sec27 Existcond PROJECT NUMBER: 1003900.

VENT HOLE #1
(FILLED AND CAPPED)

E 544,000 | E 544,500 | E 545,000 | E 545,500

N 318,000

N 317,500

N 317,000

DISPOSAL AREAS FOR
DEMOLISHED FOUNDATIONS

NON-ECONOMIC
STORAGE AREA 1

SHAFT #1
(FILLED AND CAPPED)

NON-ECONOMIC
STORAGE AREA 2

APPROXIMATE LOCATION
OF ACCESS ROAD

VENT HOLE #2
(FILLED AND CAPPED)

MATCHLINE

SHEET 1 ~ SHEET 2

LEGEND

- CONCRETE FOUNDATION
- ACCESS ROAD
- MINE SHAFT

N

SCALE
75' 0 75' 150'
CONTOUR INTERVAL 1 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
0	Issued for Preliminary Draft	01/04	M.Ross	K.Conrath	J.Redmond

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PROJECT:
SECTION 27 CLOSEOUT PLAN

DRAWING TITLE:
SECTION 27 MINE RECLAMATION TOPOGRAPHY

MWH

Sheet 1 Of 2 Sheets

SCALE: As Shown

FIGURE No. 3

AutoCAD FILE: Sec27 Rec Plan PROJECT NUMBER: 1003900

MATCHLINE

SHEET 1 ~ SHEET 2

E 545,500 E 546,000 E 546,500

N 317,500

N 317,000

N 316,500

VENT HOLE #2
(FILLED AND CAPPED)

ACCESS ROAD

SHAFT #2 - PULL-THROUGH
TO REMAIN FOR USE AS
LIVESTOCK WATERING
TROUGH

SHAFT #2
(FILLED AND CAPPED)

VENT HOLE #3
(FILLED AND CAPPED)

7040

7035

7030

7045

7050

LEGEND

- CONCRETE FOUNDATION
- ACCESS ROAD
- MINE SHAFT

SCALE
75' 0 75' 150'
CONTOUR INTERVAL 1 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
	Issued for Preliminary Draft	01/04	M.Ross	K.Conrath	J.Redmond

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PROJECT:
SECTION 27 CLOSEOUT PLAN

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SECTION 27 MINE RECLAMATION TOPOGRAPHY

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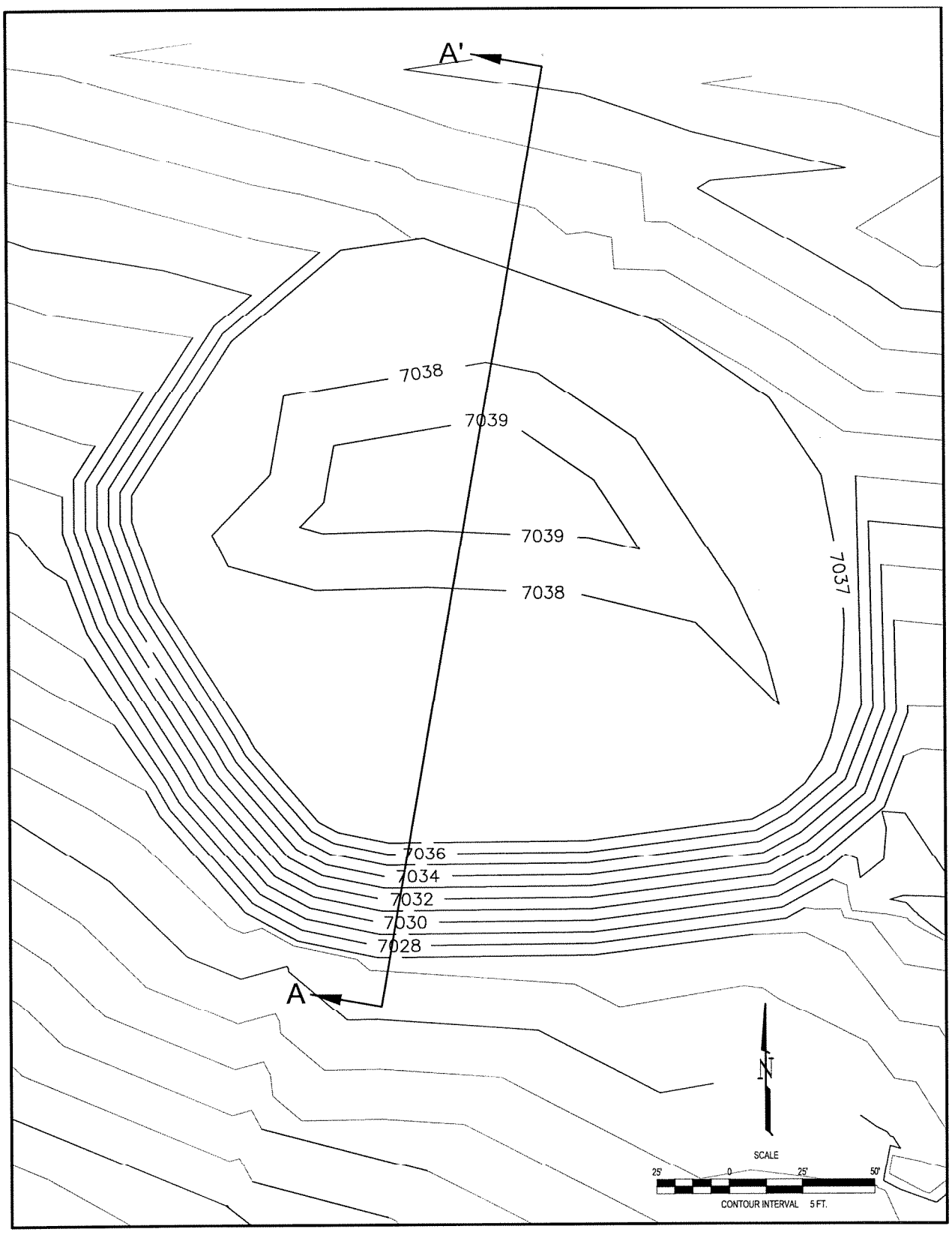
Sheet 2 Of 2 Sheets
SCALE: As Shown
FIGURE No. 3

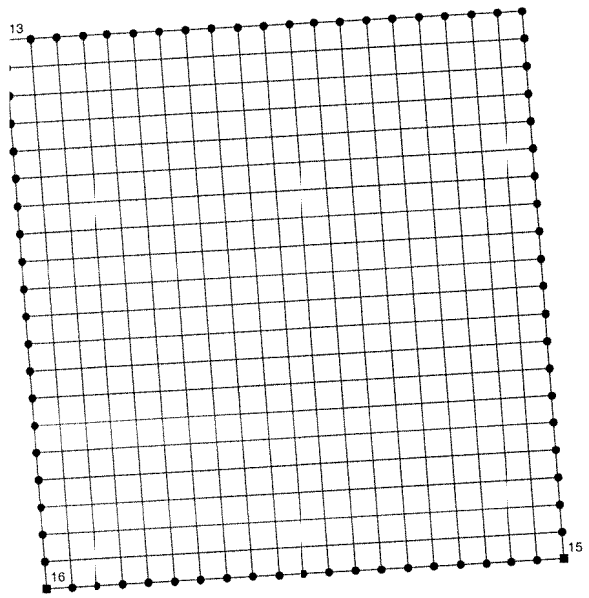
AutoCAD FILE: Sec27 Reclam PROJECT NUMBER: 1003900

APPENDIX A

GEOTECHNICAL STABILITY MODEL OUTPUT

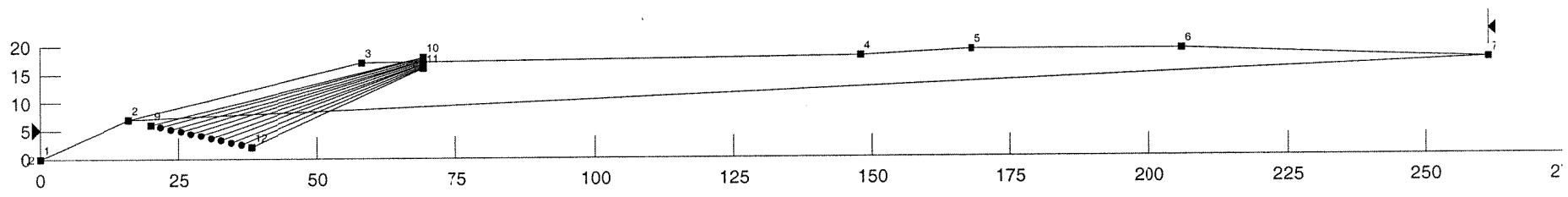


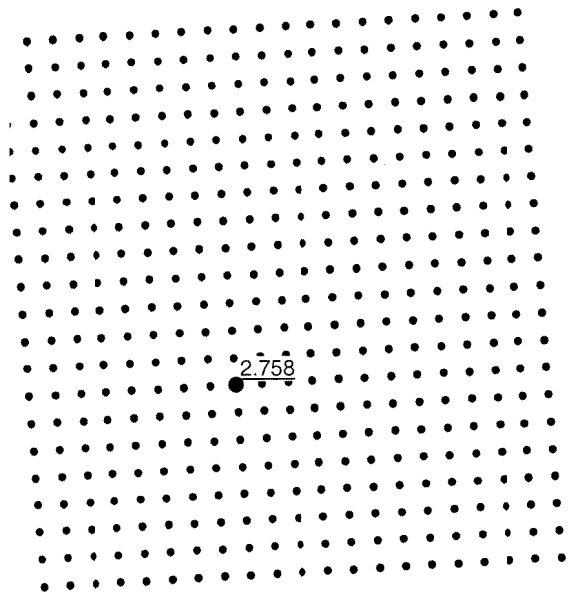
NON-ECONOMIC STORAGE AREA 1



Description: WRP-1 Section A-A'
Analysis Method: Morgenstern-Price
Slip Surface Option: Grid and Radius

Description: Waste Rock
Soil Model: Mohr-Coulomb
Unit Weight: 110
Cohesion: 0
Phi: 33





Description: WRP-1 Section A-A'
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Slip Surface Option: Grid and Radius

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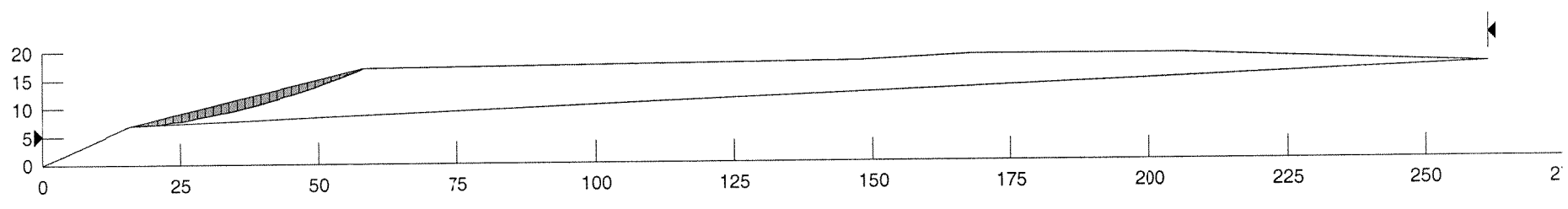
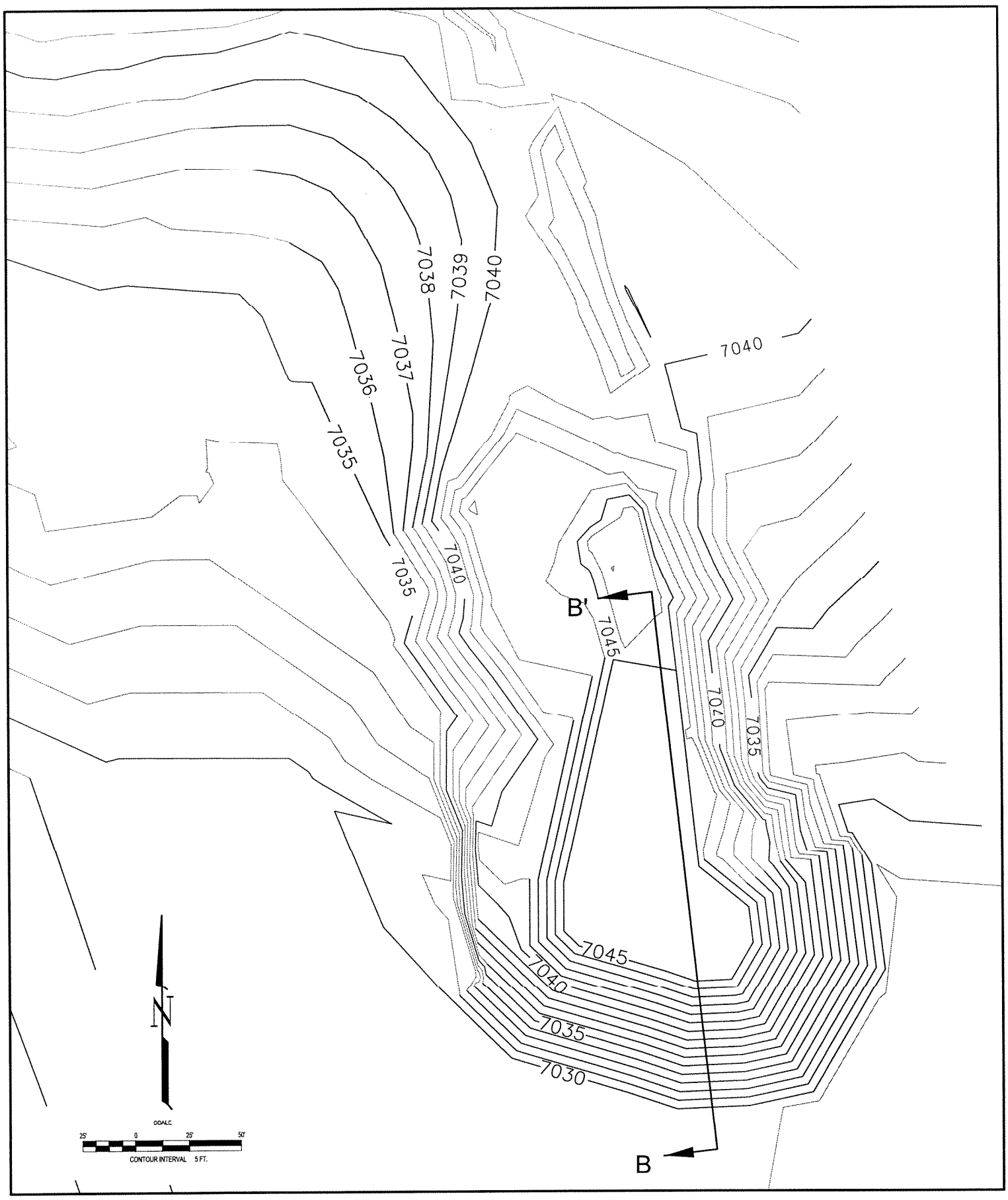
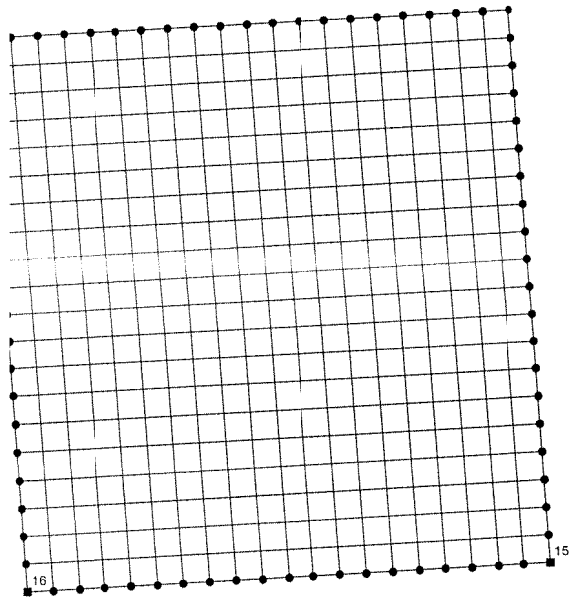


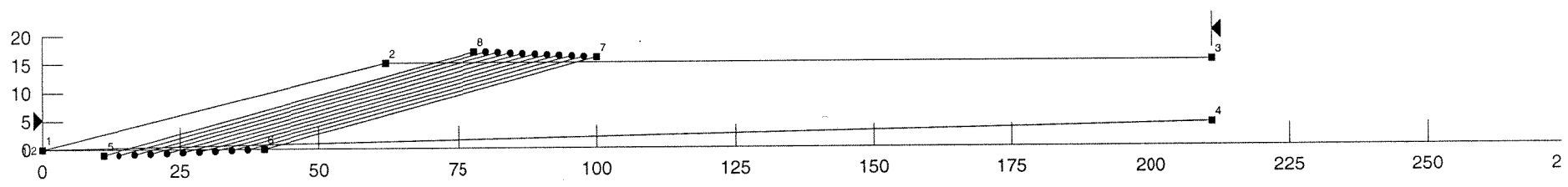


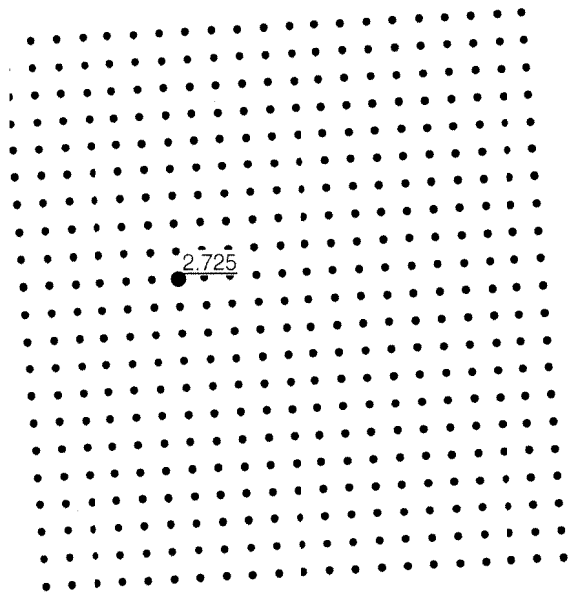
NON-ECONOMIC STORAGE AREA 2



Description: WRP-2 Section B-B'
Analysis Method: Morgenstern-Price
Slip Surface Option: Grid and Radius

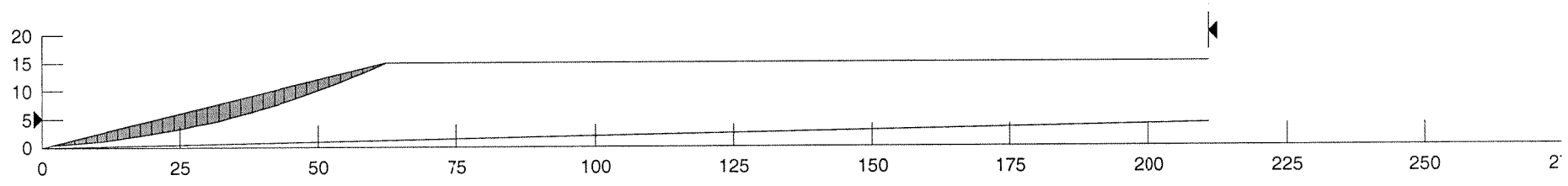
Description: Waste Rock
Soil Model: Mohr-Coulomb
Unit Weight: 110
Cohesion: 0
Phi: 33





Description: WRP-2 Section B-B'
Analysis Method: Morgenstern-Price
Slip Surface Option: Grid and Radius

Description: Waste Rock
Soil Model: Mohr-Coulomb
Unit Weight: 110
Cohesion: 0
Phi: 33



APPENDIX B

GROUNDWATER SAMPLING SOP AND LIST OF ANALYTES

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes methods and equipment used for collecting groundwater samples from mine shafts or vent holes at the Section 27 Mine site for the determination of field parameters and laboratory analysis. It also describes procedures for sample handling, labeling and documentation.

2.0 SAMPLING PROCEDURES

2.1 WATER LEVEL MEASUREMENT

An electronic water-level sounder (EWS) will be used to determine the water level in the shaft or vent hole from which the groundwater sample will be obtained. After the static water surface elevation has been determined the EWS will be used to determine the total depth of water in the shaft.

2.2 SAMPLE COLLECTION

A groundwater sample at the Section 27 Mine will be obtained using a thief or messenger-type sampler to collect a sample from either a shaft or vent hole. For this method, a decontaminated sampler such as a Camera sampler will be lowered to the surface of the water in the shaft and will be allowed to sink under its own weight to the desired depth. A nylon rope or steel cable will be used to lower the sampler to the desired depth at approximately the midpoint of the water column in the shaft. It is anticipated that a motorized winch will be used to lower the sampler. A weighted messenger will be sent down the tether line to release a spring mechanism to close the sampler. The sampler will then be raised slowly to the surface, will be split, if necessary and transferred to the sample bottles. Filtration of the samples is not anticipated.

2.3 FIELD MEASUREMENTS

Specific conductivity, pH and temperature will be measured in the field using hand-held portable meters. Measurements will be made by placing the probe of the meter directly into a beaker containing the sample. Field meters will be calibrated prior to sampling using instructions provided by the equipment manufacturer

2.4 DECONTAMINATION OF FIELD EQUIPMENT

Water sampling equipment will be decontaminated prior to sampling. Equipment will be washed with Alconox (or comparable) non-phosphate biodegradable detergent and triple rinsed with potable water followed by a triple distilled or de-ionized water rinse. Following decontamination, equipment will be placed in a clean area or in clean plastic bags to prevent contact with soils/sediments and airborne material.

3.0 SAMPLE HANDLING AND FIELD DOCUMENTATION

3.1 SAMPLE HANDLING

Proper sample preparation practices will be observed to minimize sample contamination. Prior to sampling, sample bottles will be obtained directly from the analytical laboratory or from a laboratory supply company. The bottles will be labeled to indicate the type of sample and sample matrix to be collected. A sample tag or label will be completed and attached to each laboratory sample container just before it is filled. The labels will be filled out with a permanent marker and will include the following information:

- Sample identification
- Sample date
- Sample time
- Sample preservative (if any)
- Sample type (including if raw or field filtered)

Because a variety of preservatives and analytical methods will be employed, care must be taken to avoid mislabeling the containers. If possible, labels should be covered with plastic tape to minimize smudging and ink runs.

Sample bottles can be either pre-preserved from the laboratory or preservatives can be added in the field during sample collection. In general, 0.5-liter or 1-liter polyethylene or glass bottles will be used for the sample bottles that will be submitted for analysis of general chemical constituents, major inorganic constituents and metals.

3.2 SAMPLE PREPARATION, PRESERVATION AND SHIPPING

Laboratory sample containers will be filled one by one at the monitoring location, secured with the container lid, and any excess water wiped off the exterior. Immediately after collection, the containers will be placed in field coolers with ice. Glass containers will be wrapped with bubble wrap or other appropriate shipping material to prevent breakage.

After collection, samples will be labeled and prepared as described above. The sample containers will be placed in re-sealable plastic storage bags and stored in an upright position in the cooler. The cooler will be taped shut and a chain-of-custody seal will be attached to the outside to assure that it cannot be opened without breaking the seal.

Samples are preserved in order to prevent or minimize chemical changes that could occur during transit and storage. Sample preservation will be performed immediately upon sample collection to assure that laboratory results are not compromised by improper coordination of preservation requirements and holding times. To meet recommended holding times, samples will be shipped to the analytical laboratory as soon as possible or within 48 hours of collection. It is anticipated that Energy Laboratories in Casper, Wyoming will analyze the sample(s).

3.3 CHAIN-OF-CUSTODY

A chain-of-custody form will accompany the sample cooler and will include the following information.

- Project name or number
- Sampler's name and signature
- Sample identification number(s)
- Date and time of sample collection
- Sample matrix
- Number of sample containers
- Analyses requested
- Method of shipment (with airbill number if applicable)
- Any additional instructions for the laboratory

Upon receipt, laboratory personnel will inspect the samples and record their condition and temperature on the chain-of-custody form. The laboratory will immediately report the presence of broken custody seals to UNC's project laboratory liaison. The laboratory liaison, after consulting with

the Project Manager and the laboratory's project manager, will decide whether or not to analyze the samples.

3.4 FIELD DOCUMENTATION

All aspects of sample collection and handling as well as visual observations will be documented in the field logbooks. Field logbooks will note the following information:

- Site location
- Sampler name(s)
- Date and time of sample collection
- Sample identification number(s)
- Field water quality measurements (pH, conductivity, temperature)
- Sample handling (including preservation, as appropriate)
- How sample collected (e.g. grab, composite, bailer)
- Number and type of any QA/QC or split samples collected
- Field observations, including any unusual conditions or activities in the area

4.0 WATER QUALITY PARAMETERS

Water quality parameters to be analyzed for the collected sample are presented in Table 4.1 below.

TABLE 4.1
WATER QUALITY MONITORING PARAMETERS

Parameter	Fraction	Method	Detection Limit	UNITS
GENERAL CHEMISTRY AND ANIONS				
pH		EPA 150.1	0.1	mg/l
Electrical Conductivity		EPA 120.1	1	umhos/cm
Total Dissolved Solids		EPA 160.1	10	mg/l
Total Suspended Solids		EPA 160.2	5	mg/l
Alkalinity		EPA 310.1	2.0	mg/l (as $CaCO_3$)
Chloride		EPA 325.2	1.0	mg/l
Fluoride		EPA 340.2	0.1	mg/l
Nitrate (NO3+NO2 as N)		EPA 353.2	0.02	mg/l
Sulfate		EPA 375.3	10.0	mg/l
CATIONS AND TRACE METALS				
Barium	Dissolved	EPA 200.7, ICP	0.003	mg/l
Boron	Dissolved	EPA 200.7, ICP	0.001	mg/l
Calcium	Dissolved	EPA 200.7, ICP	0.2	mg/l
Iron	Dissolved	EPA 200.7, ICP	0.01	mg/l
Lead	Dissolved	EPA 200.7, ICP	0.04	mg/l
Magnesium	Dissolved	EPA 200.7, ICP	0.2	mg/l
Potassium	Dissolved	EPA 200.7, ICP	0.30	mg/l
Sodium	Dissolved	EPA 200.7, ICP	0.30	mg/l
Uranium	Dissolved	EPA 200.8, ICP-MS	0.0001	mg/l
Vanadium	Dissolved	EPA 200.7, ICP	0.005	mg/l
RADIONUCLIDES				
Radium 226	Dissolved	EPA 903.0	1	pCi/l
Radium 228	Dissolved	EPA 904.0	1	pCi/l
Gross Alpha	Dissolved	EPA 900.0	1	pCi/l